Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

January 18, 2023
File: 195602317

**Attention: Tim Carr**
Land Use Planning Commission
Department of Agriculture, Conservation, and Forestry
Harlow Building
18 Elkins Lane
Augusta, ME 04333

Dear Mr. Carr,

**Reference: Wolfden Mount Chase LLC Application for Zone Change**

On behalf of Wolfden Mount Chase LLC., Stantec Consulting Services is pleased to submit the attached Application for Zone Change for consideration of rezoning of approximately 374 acres in T6R6 WELS from General Management (M-GN) to Planned Development (D-PD). If rezoned and then ultimately approved by the Department of Environmental Protection under Maine's *Metallic Mineral Exploration, Advanced Exploration and Mining* regulations the rezone area would be used for development of an underground mining operation and associated structures. The purpose of the operation is to extract metallic ore that is rich in copper, lead, zinc, silver and gold. The proposed rezone area does not include facilities for ore concentration or tailings.

The document has been produced in a format that addresses the Land Use Planning Commission (LUPC) Chapter 10 and Chapter 12 regulations, including 27 Exhibits designed to provide the information that is required to support the proposed rezoning. In Table 2-2 of the Application, we have provided a matrix linking the applicable regulatory requirements to the relevant Application Exhibits.

Three hard copies are being submitted by hand delivery to your attention at Elkins Lane in Augusta. Please advise on how best to transmit an electronic copy compatible with State security and file size restrictions. In addition, hard copies are being posted via FedEx as follows:

- LUPC East Millinocket office – 1 copy;
- LUPC Ashland office – 2 copies; and
- Aroostook and Penobscot County Commissioners offices – 1 copy to each.

By separate transmittal Wolfden Mount Chase LLC is today submitting the Application fee ($14,350) and the Extraordinary Project Processing fee ($79,387.28).

Thank you for your attention to this submission. We look forward to working with the LUPC staff and Commission as you all undertake your review of these materials.

**Reference:** **Wolfden Mount Chase LLC Application for Zone Change**

Respectfully yours,

**Stantec Consulting Services Inc.**

**Brooke Barnes**
Principal
Phone: 207 406 5461
Fax: 207 729 2715
brooke.barnes@stantec.com

Attachment: Application for Zone Change
c. Jeremy Ouellette, Wolfden Mount Chase LLC

*For office use:*

| Tracking No. | ZP Permit No. | $ Fee Received |
|---|---|---|
| | | |

# Applicant & Agent Information - LUPC Application for Zone Change

## APPLICANT INFORMATION

**Please Print Legibly**

| | | |
|---|---|---|
| Applicant Name(s)<br>Wolfden Mount Chase LLC.<br>Jeremy Ouellette | Title *(if representing a corporation)*<br>Vice President of Project Development | |
| | Phone<br>807-624-1134 | |
| Mailing Address<br>20 Main St | Email<br>jouellette@wolfdenresources.com | |
| Town<br>Patten | State<br>ME | Zip Code<br>04765 |

## AGENT INFORMATION (If applicable)

| | | |
|---|---|---|
| Agent Name(s) | Phone | |
| Business Name | | |
| Mailing Address | Email | |
| Town | State | Zip Code |

## APPLICANT AND AGENT SIGNATURES

I have personally examined and am familiar with all information submitted in this application, and to the best of my knowledge, it is true, accurate, and complete. I am aware that there may be significant penalties for submitting false information. I understand that the applicant is responsible for complying with all conditions of any permits issued by the Land Use Planning Commission.

If signing this document on behalf of a corporation, partnership, trust, or other legal entity, I affirm that I am authorized to bind the entity and execute legal agreements on its behalf.

Please check **one** of the boxes below:

☐ I authorize staff of the Land Use Planning Commission to access the project site as necessary between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday.

☑ I request that staff of the Land Use Planning Commission make reasonable efforts to contact me in advance to coordinate access to the project site.

**Authorization of Agent by Applicant:** *By signing below, I authorize the individual or business listed above to act as my legal agent in all matters relating to this application.*

**Applicant Signature:** Jeremy Ouellette **Date:** January 18/2023

**Agent Signature:** _____ **Date:** _____

*If not providing digital signatures (see page 2), you must submit a paper copy of this form with original manual signatures.*

*For office use:*

| Tracking No. | ZP Permit No. | $ Fee Received |
|---|---|---|
| | | |

# Property Information - LUPC Application for Zone Change

**PROPERTY INFORMATION.** Provide the following details about your property location. Tax map, plan, and lot numbers are listed on your property tax bill. If you lease your property, check your lease to find out whether any unique lease lot numbers have been assigned to the property.

| Applicant | Township, Town or Plantation | County |
|---|---|---|
| Wolfden Mount Chase LLC. | T6R6 WELS, Maine | Penobscot |

Tax Map, Plan, and Lot Numbers *[list all applicable; check tax bill(s)]*

Map 1 Lot 2

| Lot size *(in acres, or in square feet if less than 1 acre)* | Deed Book and Page #'s, and lease information if applicable *(include any lessor or lease lot numbers assigned by a property owner)* |
|---|---|
| 7,145 acres | Book: 14672, Page: 27 |
| All Zoning on Property *(check the LUPC Land Use Guidance Map)*<br>M-Gn, P-GP, P-WL1, P-WL2, P-WL3, P-SG, P- | Zoning at Development Site<br>M-GN, P-SL2 |
| **Road Frontage:** List the name(s) and frontage(s) (in feet) for any public or private roads, or other rights-of-way adjacent to your lot:<br>Road #1 NA Frontage_____ft.<br>Road #2_____ Frontage _____ft. | **Water Frontage:** List the name(s) and frontage(s) (in feet) for any lakes, ponds, rivers, streams (named and unnamed), or coastal wetlands on or adjacent to your lot:<br>Waterbody #1 Pickett Mountain Pond Frontage 17,300 ft.<br>Waterbody #2 Pleasant and Mud Lakes Frontage 48,860 ft. |

If there is no road frontage, describe the access for the property.

Access to the property is via route 11 then into the property via a series of maintained gravel logging roads. Details are discussed in Exhibits 21 and 22 of this petition.

**LUPC Approved Subdivision:** If the lot is part of an LUPC approved subdivision, provide the subdivision permit and lot numbers:

Subdivision Permit # NA and Lot # NA *(usually included in deed description)*

**BRIEF PROJECT SUMMARY** *(include proposed zoning if submitting an application for zone change; include proposed project name, if applicable)*

Wolfden Mount Chase LLC is requesting rezoning of a 374 acre parcel of land from M-GN to D-PD for a proposed small underground mining project located in T6R6 WELS, Maine. Details of the proposal are submitted to the LUPC for review and consideration in the following series of Exhibits.

**APPLICATION FEE** *(see the Application Fee exhibit for more information, including surcharges if paying online)*

Please check **one** of the boxes below:

- ☒ I have enclosed a check or money order to pay my application fee. (Payment provided via e-check)
- ☐ I would like to pay my application fee online. Please contact me with the necessary information.

# LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE

Pickett Mountain Metallic Mine, T6 R6
WELS, Penobscot County

January 18, 2023

Prepared for:

Wolfden Mount Chase, LLC
One Canal Plaza, 9th Floor
Portland, ME 04101

Prepared by:

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

# EXECUTIVE SUMMARY

## INTRODUCTION/LOCATION

Wolfden Mount Chase LLC is a wholly owned subsidiary of Wolfden Resources Corporation, a mining exploration and development company with specific interest in a high-grade poly-metallic mineral resource in T6 R6 WELS, Penobscot County, Maine, referred to as the Pickett Mountain deposit. The Pickett Mountain Project (Project) is a state-of-the-art proposal to mine zinc, lead, copper, silver and gold from this high-value deposit. These metals are used in a variety of applications such as cell phones, automobiles (including electric vehicles), electronics, low-carbon power generation, construction, and infrastructure. In 2017, Maine enacted the most stringent mining regulations in the nation. The Project will meet those requirements and showcase mining techniques that allow for responsible and safe extraction of metallic minerals that are key to our future.

This Application is part one of a two-step mining permit regulatory process. Part one requires rezoning the area of the underground mine from General Management (M-GN) to a Planned Development (D-PD) subdistrict. Part two is a full evaluation and permitting by the Department of Environmental Protection (DEP) under Maine's *Metallic Mineral Exploration, Advanced Exploration and Mining* regulations, Chapter 200. The purpose of the D-PD subdistrict is to allow a large-scale well-planned development that depends on a particular natural feature or location that is available at the site. To demonstrate the feasibility of the Project and compliance with applicable rezoning criteria, the Application includes data on the site and surrounding resources and uses, the anticipated economic impact of the Project, the processes and activities used in removal of metallic mineral ore from the site, the design of a water treatment facility to ensure that any discharges to groundwater will be at or below background levels, and other measures to ensure that the Project will not have an adverse impact on the environment or surrounding uses. The final design of the Project will occur after the required review and approval of baseline surveys by the DEP, with input from the public on the work plan for the surveys. Those baseline surveys are anticipated to occur over a period of two years.

A specific goal in the 2010 Comprehensive Land Use Plan (CLUP), which governs development in the unorganized and deorganized areas, is to "allow environmentally responsible exploration and mining of metallic and non-metallic mineral resources where there are not overriding, conflicting public values which require protection."[1] As described in the Application, the Project will not interfere with existing uses and will be operated in a manner fully protective of water and other natural resources. In addition to the significant indirect economic opportunities, it offers an estimated 272 high paying direct Project related jobs. It will also allow Maine to be a leader in showcasing responsible mining carried out in accordance with the strictest rules in the country, and in a manner consistent with the goals and policies of the CLUP and the rezoning requirements for a D-PD subdistrict.

[1] Comprehensive Land Use Plan, Chapter 1, Section 1.2.G, at p. 15.

# PROJECT DESCRIPTION

The Project is a small underground mine that is targeting the extraction of 1200 metric tonnes of ore per day and includes underground tunnels and excavations along with supporting surface infrastructure. Mined ore and waste rock brought to surface would be stockpiled on impermeable lined storage pads with leachate and stormwater collection systems where contact water would be collected and treated to background or better water quality. No ore concentration or tailings storage areas are proposed in the rezone area. The Project duration is estimated at 10-15 years and the funds required for full reclamation of the site would be provided in advance and held in trust, before issuance of the mining permit by DEP.

The Project is consistent with D-PD development subdistrict standards and after reviewing several alternatives, Wolfden and its independent engineering consultants have concluded that the Project is in the most suitable location. The current site conditions are forested lands with limited recreational resources in adjacent areas. Post closure and reclamation, the site will resemble its current state. All buildings and infrastructure will be demolished and disposed of off-site, and the site will be re-graded and revegetated. Wolfden will conduct long term monitoring of groundwater, surface water and other natural resources in accordance with a monitoring and post-closure maintenance plan approved by DEP.

# KEY RESOURCE EVALUATIONS

A water management strategy inclusive of Water Collection, Water Treatment, Water Recharge Systems and Water Recharge Areas (WRS and WRA respectively) has been developed to ensure there is no adverse impact to wetlands, surface waters, or ground waters. Exhibit 10 describes the details of these strategies and how they ensure no adverse impacts to the surrounding water resources.

Wildlife habitat was evaluated based on review of readily available, public information published and provided by and MDIF&W and USFW. There are no known State of Maine rare, threatened or endangered species or significant wildlife habitat areas within the area of rezoning. There are two federal fish and wildlife mapped critical habitats (Atlantic Salmon and Canada Lynx) in the area surrounding the Project, however, none of these species have been observed in the area to be rezoned and will not be adversely impacted by the Project. No in-stream work is proposed and there will be buffers around wetlands and surface waters to minimize potential impacts to surface waters that might provide future Salmon habitat. The water management strategy will ensure that there are no adverse impacts to surface waters from mine operation. Given the recent wood harvesting (5-to-10-year growth), the habitats for both the Canada Lynx and Northern Long-eared Bat is marginal. The amount of potential habitat impacted by the Project is minimal and is not expected to adversely impact any species. In addition, clearing in the area will occur between November 1 and April 14 to minimize potential impacts to sensitive bat species. Details related to Plant and Wildlife habitat are described in Exhibits 10 and 26.

Low intensity soils evaluations have been completed on the proposed footprint and a series of soil types and depths have been identified. Additional information collected includes depth to the nearest constrained boundary (water, bedrock) as well as slope information. This data helped inform proposed layout design and water recharge systems, and ultimately resulted in a series of options for infrastructure placement on the proposed site. There are currently no identified soils limitations to the Project that

cannot be addressed through standard construction measures and engineering practices, as discussed in Exhibit 23.

The financial practicability of the Project is based on the anticipated cashflow and return on investment generated by the Project over an assumed 10-15-year Project life as evaluated in the Preliminary Economic Assessment found in Exhibit 14. The site contains a high-value economic deposit that allows development of a state-of-the art mine inclusive of strict environmental controls. In accordance with Chapter 200, all funding required for full reclamation of the site and sufficient to address any required remediation, will be set aside in trust prior to commencement of construction.

The economic assessment (EA) evaluates the socioeconomic impacts, both positive and negative, of the Project on the immediate area and communities likely to be affected by the Project. The EA details anticipated expenditures during the start-up as well as operational phases of the Project, employment and wages associated with the Project, and the indirect and induced economic impacts. The Project is expected to provide a significant economic boost to a region of otherwise limited economic activity and where poverty rates exceed the state average.

The Project is located several miles north of Route 11 and will be out of view from all traffic and residences along the highway. There will be no Project visibility from the Katahdin Woods and Waters National Monument or Baxter State Park. Potential visibility of the headframe (the tallest feature) is limited to the following recreation resources:

- The snowmobile/ATV trail immediately south of the Project Area
- Southern and Eastern most shore of Pickett Mountain Pond
- Northern shore of Pleasant Lake
- Summit of Mount Chase (based on field observations)

Services to the site have all been evaluated to confirm availability. Wolfden has collected confirmations from the school board, fire and ambulance support, internet and communications, solid waste disposal, healthcare, and electricity supply that they can provide appropriate support for the Project. Additionally, Wolfden plans to hire a significant portion of employees locally and therefore there will not been a burden on existing services due to an increase in local population.

The private and public roads have ample capacity to allow for added traffic resulting from the Project. Improvements to road infrastructure are evaluated and discussed in Exhibit 21.

The initial archaeological resource assessment identified five archaeologically sensitive areas that fall within or overlap portions of the Project area. Four of these areas were classified as sensitive due to the presence of knappable lithic material of a type known to have been used by Native Americans to make stone tools. One area with a small overlap of the rezone buffer area was identified as sensitive as a Native American archaeological habitation site. None of the areas are impacted by the Project design, but all will be further evaluated as part of the DEP Chapter 200 process. Details of the initial surveys are found in Exhibit 25.

# CONCLUSION

In balancing its planning and zoning objectives, the Commission places an emphasis on:

- Serving the regions in which the unorganized and de-organized areas are located;
- Honoring the rights and participation of residents and property owners; and
- Encouraging and facilitating regional economic viability.

The state-of-the-art, small footprint Pickett Mountain Project represents a significant opportunity for new economic growth in an area of the State where economic opportunities are limited. Wolfden has been working with residents and businesses in the region to ensure that the Project is responsive to the needs of the region and will benefit the people who live and work there. Several neighboring towns have passed ordinances or resolutions in support of the Project. Finally, the Project will be developed, operated, and reclaimed in accordance with strict regulations that ensure protection of the surrounding environment, thereby advancing economic viability without compromising important natural resource values and recreational opportunities. Morevoer, the technical analysis for each component of the Project and each aspect of natural resources protection demonstrate that the Project is feasible and consistent with the values prioritized by the Commission.

If approved by the Commission, the next level of review as mandated by Chapter 200 will further ensure that the Project is fully consistent with these values. Based upon the scientific, socio-economic, financial, and environmental information presented herein, Wolfden respectfully requests the Project area be rezoned so that it can proceed with the additional two-plus years of detailed technical studies that will further ensure that that the Project will generate significant positive socioeconomic benefits while being protective of the environment.

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Attachment 10-D: Water Treatment Scoping Study
Attachment 10-E: Water Management at the Pickett Mountain Mine Site Technical Memorandum
Attachment 10-F: Recreational Use of Pleasant Lake Letters from Residents
Attachment 13-A: Notice of Filing Forms and Certified Mail Receipts
Attachment 14-A: Preliminary Economic Assessment (PEA) Report
Attachment 14-B: September 2020 Update Letter to PEA Report
Attachment 16-A: Line of Sight Analysis from Pleasant Lake
Attachment 16-B: Noise Assessment
Attachment 17-A: Island Falls Fire and Ambulance Support Letter
Attachment 19-A: Sargent Corporation Consumption of Excess Chipped Material Letter
Attachment 19-B: Casella Waste Systems Capacity to Handle Solid Waste Materials
Attachment 20-A: Versant Power Letter
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Attachment 23-A: Soil Suitability Report
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Attachment 25-A: Northeast Archaeology Research Center, Inc., Phase 0 Assessment
Attachment 25-B: MHPC Communications on Phase 0 Assessment Report
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Attachment 26-A: USFWS Correspondence
Attachment 26-B: MDIFW Correspondence
Attachment 26-C: MNAP Correspondence
Attachment 26-D: MDEP Correspondence
Attachment 26-E: Botanical Desktop Assessment
Attachment 26-F: MDIFW Memorandum on Clayton’s Copper Butterfly

# Abbreviations and Acronyms

| | |
|---|---|
| % | percent |
| ATV | all-terrain vehicle |
| CLUP | Comprehensive Land Use Plan |
| D-PD | Planned Development Zone |
| LMA | labor market area |
| LUPC | Land Use Planning Commission |
| MDEP | Maine Department of Environmental Protection |
| MDIFW | Maine Department Inland Fisheries and Wildlife |
| MDOT | Maine Department of Transportation |
| ME | Maine |
| MHPC | Maine Historic Preservation Commission |
| MNAP | Maine Natural Areas Program (Department of Conservation) |
| M-GN | General Management Zone |
| MRSA | Maine Revised Statutes |
| PEA | Preliminary Economic Assessment |
| POR | point of reception |
| RTE | rare, threatened, or endangered |
| SR | State Route |
| TMF | Tailings Management Facility |
| WRA | Water Recharge Area |
| WRS | Water Recharge System |

# INTRODUCTION

The Pickett Mountain Project (Project) is proposing to mine commercially viable ore grades of zinc (Zn), lead (Pb), copper (Cu), silver (Ag) and gold (Au) from a known metallic mineral deposit located in T6 R6, Penobscot County, Maine (see **Exhibit 1, Figure 1-1**). Wolfden Mount Chase LLC (Wolfden) owns the land, access, timber and mineral rights of the property, which holds the Pickett Mountain Mineral Deposit, a high-grade poly-metallic resource. To develop a mine on this property, the Land Use Planning Commission (LUPC) requires rezoning of the proposed Project footprint of approximately 374 acres from General Management (M-GN) to a Planned Development (D-PD) subdistrict. The purpose of the D-PD subdistrict is to allow for a well-planned development dependent on a particular natural feature or location that is available at the proposed site. LUPC Chapter 10 and 12 require a narrative description of the nature and basis for the subdistrict change being requested.[1,2] If rezoning is approved, mining operations must also satisfy Maine Department of Environmental Protection (MDEP) Chapter 200 *Metallic Mineral Exploration, Advanced Exploration and Mining* rules and receive a mining permit.[3]

Wolfden previously prepared and submitted a rezoning petition on January 27, 2020, to LUPC for the Project, which included the mine, a concentrator, and tailings facility all within the rezone area. After discussions with LUPC staff regarding the previous petition and consideration of alternatives, Wolfden withdrew its petition in October 2021. One previous alternative under consideration was to limit the rezone area to the mine-only as the mine is dependent upon a natural feature that is present at the site. The concentrator and tailings facility may be located some distance from the mine so there is greater flexibility in the siting of those facilities. As a result, this application is limited to the mine-only alternative; the concentrator and tailings facilities will be located outside of T6 R6. Over the last year, Wolfden has been working with surrounding communities to finalize the location of the concentrator and tailings facility.

[1] https://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Ch10_ver2021_November1.pdf
[2] https://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Chapter12_ver2013.pdf
[3] https://www.maine.gov/sos/cec/rules/06/096/096c200.docx

# EXHIBIT 1.0 DIRECTIONS AND LOCATION MAP

The proposed Project site is located in T6 R6 WELS, Maine, approximately 9 miles north of Patten, Maine. The site borders both Penobscot and Aroostook counties as shown in **Figure 1-1** with the center of the site at a location of approximately 46.138150°; -68.467392°. **Exhibit 5 – Land Division History** provides a narrative and figure detailing the approximate boundaries of parcels within the general area. Access to the project site is via approximately 4.4 miles of private logging roads that connect to Maine State Route 11 (Route 11; **Figure 1-1**). Additional details on roadways are discussed in **Exhibit 21 – Public Roads** of this application.

# EXHIBIT 1 FIGURES

Figure 1-1: Project Location and Access

# EXHIBIT 1 ATTACHMENTS

Not Applicable

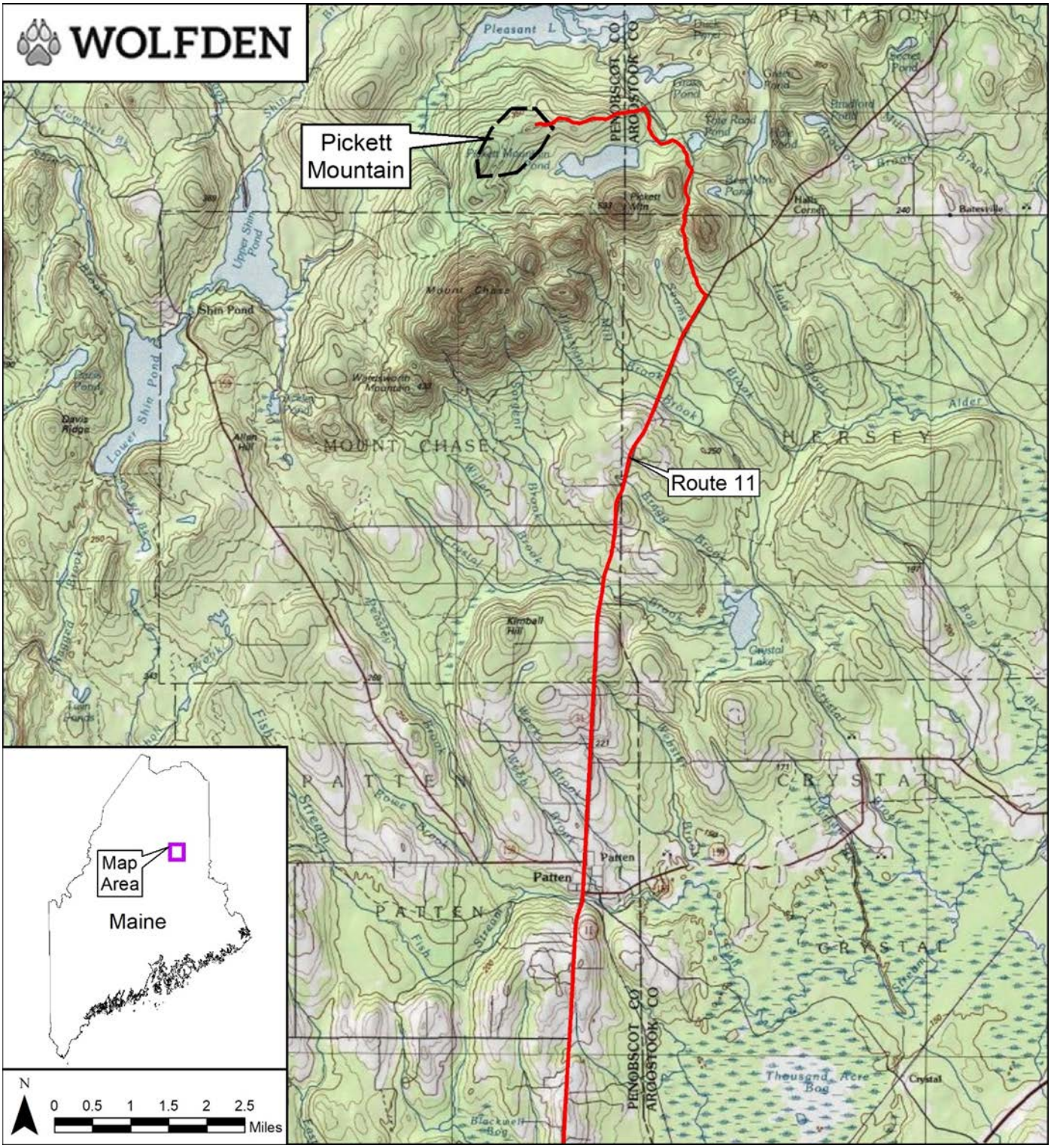



**Figure 1-1: Project Location and Access**

# EXHIBIT 2.0 PROJECT DESCRIPTION

## 2.1 REZONE AREA

Wolfden's rezoning application to LUPC proposes rezoning approximately 374 acres of land (Project Area) required for the construction, mining, and closure and reclamation of the Project. These activities are estimated to occur over a 10- to 15-year life of the Project with a conceptual site plan provided as **Figure 2-1**. The Project Area is located within a Wolfden-owned contiguous tract of approximately 7,135 acres currently zoned primarily as M-GN (**Figure 2-2).** The total area to be cleared for the project is approximately 129 acres. The area proposed for impervious development of mine facilities, water treatment, water storage, and water recharge area (WRA) is approximately 31 acres. In addition, a 400-foot-wide undisturbed buffer around the area of development is included within the approximately 374-acre rezone area. This rezoning application is specific to development and extraction of ore from the mine and supporting infrastructure within the Project Area. Mined ore will be transported off-site by truck to a concentrator and tailings facility in a yet to be determined location. These offsite facilities will be permitted under MDEP Chapter 200 regulations and are not part of this LUPC application.

**Exhibit 6 Structures, Features, and Uses** presents details on the proposed mine facilities and associated infrastructure. Site plans have been developed to avoid jurisdictional wetland, stream, and vernal pool resources (see **Exhibit 7 Site Plans**). The footprint of the proposed rezone area provides Project flexibility to adjust the sizes and locations of proposed facilities during the mine design and permitting phase under the MDEP Chapter 200 permitting process. Mine facilities (i.e., ore storage pad, waste rock staging area, offices, parking, and septic and wastewater management facilities) collectively occupy a footprint largely in the central portion of the site. Underground ventilation facilities are in the southwestern portion of the site. The Project's water treatment plant (Map ID 5 on **Figure 2-1**) will be in the northeast portion of the site. Storage ponds for the capture of stormwater and mine process water as well as water recharge systems (WRS) to return clean water into the ground are distributed throughout the site. The Project's overall water management plan is discussed in detail in **Section 10.5.2 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**. An approximate 47-acre area located in the north has been included to support a potential solar facility, if subsequent evaluations, planning, and agency consultations indicate this is viable. The primary purpose of the solar facility would be to provide a significant portion of the energy required for mine operations.

## 2.2 PROJECT OVERVIEW

Project planning and site development includes the required facilities and associated infrastructure to complete underground mining of metallic minerals containing economic grades of zinc (Zn), lead (Pb), copper (Cu), silver (Ag) and gold (Au) (**Table 2-1**) from the Pickett Mountain Mineral Deposit. The overall process is for ore to be excavated from underground via drilling and blasting into manageable sized fragments that can be loaded into underground trucks or into a skip (vertical material conveyance) and hauled or hoisted to surface to be stored on a temporary stockpile. Ore sorting is a mechanical sorting process that uses optical sensors and compressed air bursts, which will occur underground if justified, to

separate any rocks that do not contain any minerals of value from the ore before the collected ore is trucked to the offsite processing facility.

**Table 2-1: Forecasted Run of Mine (Diluted) Metal Grades from Pickett Mine Deposit**

| Metal | Forecasted Grades |
|---|---|
| Zinc (Zn) | 8.56% |
| Lead (Pb) | 3.40% |
| Copper (Cu) | 1.11% |
| Silver (Ag) | 88.80 (g/t) |
| Gold (Au) | 0.79 (g/t) |

Note: The grade of ore refers to the concentration of the metal it contains.
Key: g/t = grams/tonne

## 2.3 ABOVE GROUND INFRASTRUCTURE

The preliminary design for the Project requires above ground facilities and services within the Project Area to support mining activities, including office support, emergency services, security, electrical infrastructure, equipment maintenance/repair, equipment storage, fuel and explosive storage, mine ore handling, and water treatment/discharge. The following aboveground facilities are included in the preliminary design plan (see **Figure 2-1**):

- Mine Access (Portal)
- Headframe and Hoist
- Waste Rock Storage Pad #1 and #2
- Low Grade Ore Storage Pad
- Ore (Mill Feed) Storage Pad #1 and #2
- Backfill Plant
- Laydown (Equipment/Supplies Storage)
- Core Shack and Storage
- Blast Shack
- Temporary Explosives Storage
- Mine Office and Mine Rescue Facility
- Warehouse
- Maintenance Shop
- Equipment Fueling Station
- WRAs
- Fire Water Pumphouse
- Sanitary Subsurface Wastewater Disposal System
- Parking Facility
- Back-up Power Generation (Diesel or Propane)
- Solar Farm Facilities
- Ventilation Raises
- Water Treatment Facility
- Pre-Treatment Water Storage Pond
- Post-Treatment Water Storage Pond
- Organics Storage
- Snow Storage
- Site Roads
- Security Guard House/Gate
- Security fencing
- Electric Substation

## 2.4 BELOW GROUND INFRASTRUCTURE

Development activities below ground will provide mine personnel access and service drifts (tunnels) for equipment from the surface to reach and allow mining of the ore deposit, estimated to be between 160 feet and 2,700 feet below ground surface level. The following types of underground infrastructure are anticipated for the Project:

- A portal (opening at surface) for a ramp to access the underground ore deposit and act as a haulage route for manpower, materials, rock, and services, including ventilation, electricity, water, and compressed air
- A vertical shaft for conveyance of ore, waste, materials, ventilation, and potentially manpower
- Lateral tunnels on each working level to connect the ramp to the ore deposit
- Ventilation shafts near vertical tunnels to provide clean air or exhaust to and from the tunnels and ramps to provide underground workers with a clean air environment
- Auxiliary tunnels used to carry in and out services/utilities such as compressed air, process water, dewatering, electrical, secondary and escape routes from the mine
- Mine safety refuge stations, water collection sumps and pumping stations, electrical distribution substations, material storage areas, and washroom facilities
- Temporary rock storage areas (remucks)
- Ore crushing and sorting
- Explosives storage

Figures and conceptual schematics depicting the general layout of explosive storage areas, crusher stations, sump systems, fueling stations, electrical system, latrines, refuge stations, and other underground infrastructure are provided in **Attachment 2-A** of this Exhibit.

The development and continued operation of the underground infrastructure will require various methods that include:

- Horizontal drilling for tunnels that is typically completed using a carrier mounted drill and an operator in the larger drifts. Vertical or inclined openings may be mined by a jackleg, stoper or wagon drill;[4]
- Blasting, which would typically occur two to three times per day once personnel are clear of the mine. Loading for blasting events would be performed using hand-held pneumatic loaders, hand loading emulsions sticks into the drill holes, or by a qualified mine workers operating an explosives loading unit;
- Ground support such as bolts, screen/mesh and rebar would be typically used to stabilize walls and roof of the underground workings for worker safety. In addition to ground support, other underground

[4] Jacklegs are pneumatic rock drills that are attached to telescoping legs, which push the drill for the operator. A stoper is a hammer drill with a self-rotating drill bit and an automatic feed by means of an air piston. A wagon drill is a pneumatic drill named for the wagon-like base upon which they rest.

construction may include reinforcement using cement, timber, and steel. Plumbing, electrical, and other utilities will provide necessary services.

- Removal of the rock from a developed area is typically completed with a low-profile front-end loader, with rock then placed into a low-profile truck for haulage for further handling within the mine or at the surface. These low-profile trucks are also used for hauling rock and cement back into the mine during the backfilling phase.

- Sump management includes the collection of drilling process water and groundwater seepage into a series of sumps throughout the mine. Collected water would be retained in the sumps to allow for suspended solids to settle out and allow for water to be clarified. The water is then pumped out of the mine for water treatment and recycling. Fine rock sediment in the sumps is managed periodically by draining the water from the sump and allowing the rock sediment to dry out for handling with an underground loader. Rock sediment is removed from the sump and deposited into active backfill areas or blended with waste rock fill.

## 2.5 PROJECT PHASES

The Project includes four phases: Permitting, Construction, Operations and Reclamation/Remediation. Each of these phases will occur sequentially; however, the latter three phases will overlap to some degree. **Figure 2-1** provides general locations of buildings and facilities for the proposed Project and **Attachment 2-B** provides a conceptual schedule for timing of Project elements, broken down into the four phases.

### 2.5.1 Phase 1 – Permitting

The Project is regulated under LUPC Chapter 10, 12 and 13 rules (rezoning) and MDEP wastewater discharge and mining regulations. Following LUPC rezoning of the Project Area from M-GN to D-PD, there is a comprehensive process for conducting base line surveys and collecting data in support of a mine application and before a mine permit application can be filed with MDEP (minimum of two years), and then an adjudicatory process including a required public hearing as part of MDEP's review of the mine permit application under Chapter 200, and a wastewater discharge permit under 38 MRSA Sec. 413. The permitting process with MDEP generally includes the following:

- Conduct pre-application meeting and site visit

- Prepare Baseline Characterization Study Work Plan to evaluate soil, groundwater, surface water, sediment, biological conditions as well as archeological, and other environmental conditions of the property

- Review and approval of Baseline Characterization Study Work Plan with MDEP and subject to public review and comment period

- Conduct public scoping process for the required Environmental Impact Assessment, including a public comment period

- Complete Baseline Study, which includes at least two years of baseline water quality monitoring data

- Submit a mining permit application

  - Submit a Mining Operation Plan with the permit application to provide a detailed metallic mineral mining feasibility study, including, but not limited to, designs, plans and specifications, analyses, and schedules along with supporting data and information
  - Submit an Environmental Impact Assessment

- Required adjudicatory review process, including provisions for public and local participation, municipal and county intervenor assistance grants, and a required public hearing
- Receive MDEP approval of the mining permit application and wastewater discharge license

### 2.5.2 Phase 2 – Construction

Upon completion and approval of the MDEP Chapter 200 mining permit and wastewater license applications, the Project enters the construction phase. Construction of the Project will include the following elements (not necessarily in this order):

- Installation of ground and surface water monitoring locations
- Construction of organics storage pad
- Tree removal and grubbing
- Construction of roadways and parking facilities
- Construction of ore and waste rock pad
- Installation of backup power generation
- Installation of temporary explosives magazines
- Installation of air monitoring systems
- Installation of site plumbing
- Installation of core shack and storage
- Construction of the water management ponds and WRAs
- Construction of the water treatment facility
- Construction of maintenance/repair facility
- Excavation of the mine portal and installation of temporary mining services (compressed air, power generation, ventilation, process water)
- Installation of temporary blast shack
- Excavation of west and east ventilation raise to surface
- Installation of potable water system
- Installation of sanitary subsurface wastewater system

- Installation of security infrastructure.
- Installation of mine office complex, including mine rescue and mine dry facility (change house)
- Installation of warehouse and laydown area
- Installation of electrical substation
- Installation of equipment fueling system
- Tie in electrical infrastructure to newly installed grid (completed by Versant)
- Installation of solar facility
- Installation of backfill mixing plant.
- Construction of Ore Storage Pad #2
- Construction of Waste Rock Storage Pad #2
- Installation of hoist and headframe

The following figures present typical efforts to prepare the Project Area during construction:

- **Figure 2-3:** Proposed Grading Plan. Figure provides grading of significant mine facilities for the site to better define quantities, drainage patterns and water collection areas to be piped to water storage ponds.
- **Figure 2-4:** Proposed Grading and Cross Sections. Consists of grading and cross sections at major mine facilities.
- **Figures 2-5 and 2-6**: Detailed cross sections at major locations depicted on **Figure 2-4.**
- **Figure 2-7**: Site details consisting of typical access road build up, infiltration gallery design, lined pad and pond systems, and conceptual erosion control measures to be incorporated into full design plans.

The Project conservatively estimated backfill and grading material to support the aboveground mine infrastructure in the order of 30,000 cubic yards (cy) based on the site plans shown in **Figure 2-1.** Sargent Corporation has provided a letter (**Attachment 2-C)** detailing their capacity to support the transport of required backfill and an estimate of anticipated cost based on updated volumes.

Wolfden intends to utilize as much local and state construction skill sets as possible. A majority of material used during construction will be sourced locally or within the State of Maine. Specialty skillsets, services, and materials will be sourced externally as required and are expected to include initial or contract mining services. As programs advance through construction, skillsets will be built and trained locally to convert external services to in-state or near project services. Stormwater and process water treatment during the construction phase will include the collection of water in onsite pre-treatment ponds, ultra-filtration and reverse osmosis to remove contaminants, and a return of clean water to the environment through developed WRSs. Further details on construction and operations water treatment activities are presented in **Section 10.5.2 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**.

During construction, potable water will be supplied via a drilled well and storage tank within a small potable water facility contained within the footprint of the office complex. Potable water will be used for hand washing, showers, and washrooms but not for drinking purposes. Drinking water will be imported to site in large containers, such as those used to supply water coolers. Sewage will be managed with portable toilets.

### 2.5.3 Phase 3 – Operations

During operations, Project mining staff will excavate the ore from underground via drilling and blasting into manageable sized fragments that can be loaded into underground trucks or into a skip and hauled or hoisted to surface to be stored on a temporary stockpile for transporting to the off-site concentrator and tailings facility. Material handling in the first three years of mine development and production will be restricted to underground truck haulage via the ramp and portal. After year three, the shaft, headframe, hoist, and skips will be installed and will be the primary conveyance of waste rock and ore to the surface. The portal and ramp infrastructure would be used for secondary material conveyance and mine workers. Ore sorting, if utilized, is expected to occur underground to separate potential waste rock from ore before hauling/hoisting it to surface. The mine production rate is estimated to average 1,322 tons (1,200 tonnes) per day.

As the site is constructed, further development of underground mineral deposits will continue to take place. Waste rock hauled to surface, will be deposited and stored on a lined surface pad. The mineralized ore hauled to surface will be stored on the mill feed storage pad and stockpiled until it is trucked off-site for processing. These storage pads will have impervious liners with drainage layers designed to collect leachate, oil and water separators, and sumps to collect run-off. Pads, liners, and sumps would be built to MDEP Chapter 200 specifications. Water collected from the lined pads will be pumped to the Water Treatment Facility for treatment to background water quality prior to discharge to designated WRAs (**Figure 2-1**).

#### 2.5.3.1 Operations Activities

Site activities will occur continuously during the operational phase to explore, develop, and excavate ore material from underground. These activities are further described below.

##### 2.5.3.1.1 Exploration

Exploration will continue during the operations phase of the Project with the intent to refine the locations of local reserves for mining throughout the operation. Exploration activities include:

- Exploration geology, geophysics, mapping, soil sampling, trenching;
- Diamond drilling, core logging, core sampling, and sample preparation;
- Geotechnical drilling and logging; and
- Geological modelling and reserve estimation.

#### 2.5.3.1.2 Production Activities

The approach for mine production is to conduct underground mining with a decline and shaft to an estimated maximum depth of 2,700 feet. This will allow for underground haulage trucks and a hoist to carry rock to a surface staging pad, where waste rock will be segregated from ore. Ore will be trucked off-site to the concentrator facility. Rock of no value will be stored on the waste rock storage pad until it can be returned underground for backfill. A backfill plant located on the surface will be used to blend a binder with waste rock for backfilling mined excavations underground. Rock that is placed underground as backfill will be approved for use by MDEP. It is simply placed as rock fragments with or without the addition of binder (typically cement) to add strength.

Once productive areas in the mine are prepared, production miners will begin work with an estimate retrieval of ~1,322 tons (1,200 tonnes) per day of ore. The general sequence to be used during production activities will include:

- Blast hole drilling to place explosives for fragmentation of areas of mineralized ore;
- Blasting to fragment mineralized ore;
- Potential crushing and ore sorting if deemed economically viable;
- Haulage of ore and waste rock to the surface or other portions of the mine; and
- Backfilling of productive areas once fully excavated.

#### 2.5.3.1.2 Backfilling and Source of Backfill Material

It is anticipated that voids created during the Project's mining activities can be back filled utilizing a combination of material removed as part of the mining process and off-site sources. Sargent Corporation (a Maine-based construction company) has reviewed the requirement for off-site material and has provided a conceptual borrow source identified in their proposal (see **Attachment 2-C)**. There is no intention of developing an on-site rock quarry for borrow rock material within the rezoned area of this application. Off-site material delivered to site for use as backfill will be delivered to the waste rock storage pad until it is consumed as backfill.

The addition of cement to the rock backfill as a binder provides improved strength to interior mine wall voids when multiple tunnels are located close to each other. The backfill plant is a batch mixing plant where cement is mixed in bulk with water and then blended with the rock backfill. When batches are complete, they are transported underground via low profile loaders and dumped into the void spaces that required Cemented Rock Fill (CRF). The Project plans to utilize reject water from the proposed water treatment plant for mixing of CRF or other concrete required for backfilling. See **Section 10.5.2 of Exhibit 10 – Surrounding Uses and Anticipated Impacts** for details on how this water will be utilized to support backfilling operations.

### 2.5.4 Phase 4 – Reclamation/Remediation

Upon completion of the Project's production mining activities, final reclamation activities will take place. These activities would be based on a previously engineered and approved reclamation plan as required by the MDEP Chapter 200 permit. The required reclamation work will include:

- Decommissioning, sale and salvage of site buildings;
- Break up and removal of foundations;
- Removal and disposal of approved demolition debris into underground openings and remaining debris transported to an appropriate licensed landfill facility;
- Ground surface cleanup and contouring;
- Spreading subgrade overburden, topsoil, and final capping material (vegetation and seeding);
- Construction of underground opening blockages (plugs);
- Removal of unused water retention sumps, ditches, storage ponds, and storage pad infrastructure; and
- Operation of water treatment facility treated water distribution systems, and monitoring of water quality until standards are met and the remaining infrastructure is removed.

If, after mine operations end, the solar facility can generate energy for sale back to the main electric grid, Wolfden may choose to continue operations of this facility for remainder of its useable life. If this is not practicable, the solar facility will be decommissioned, and its location reclaimed. Once the wastewater has been treated and disposed of, the collection ponds will be removed to prevent future accumulation of water. The area will be regraded and vegetated with a native seed mix. Monitoring of the surrounding environment will continue in accordance with Chapter 200 requirements. Details on the reclamation and closure costs, unplanned or extended reclamation/remediation, and the Financial Assurance Trust fund are presented in **Exhibit 14 Financial Capacity**.

## 2.6 SITE ACCESS AND SAFETY

Access to the Project is via an existing 4.4-mile gravel road that connects to Route 11. This existing gravel road will be subject to ongoing maintenance and improvements to safely facilitate mine operations**.** The existing road infrastructure upgrades will include load and traffic requirements for transporting the ore off-site for processing. Access to the interior of the Project Area will be managed by a series of fixed barricades at each road access to the property as well as a stationed security facility and traffic gate at the project entrance (**Figure 2-1**). Further details on site access and the evaluation of required road improvements are presented in **Exhibit 21 – Public Roads and Exhibit 21, Attachment 21-A**.

"Danger" and "No Unauthorized Entry" signs will be posted around the perimeter of the rezoning boundary within visual distance of any point of the boundary. The perimeter will not be fenced at any point of the Project life. Security will be provided through a vendor for 24 hour per day, 7 days per week coverage. Within the Project Area, explosives will be stored in locked facilities with regular logging of activity and management of these supplies. Once the mine has been substantially developed, explosives

will be stored in an excavation and powder magazine specifically designed to contain explosives and managed by specifically assigned and trained workers. Explosives will be managed per federal and state regulations. Signage throughout the Project Area will be posted to notify workers and visitors of any access requirements such as personal protective equipment, potential hazards and training.

## 2.7 ELECTRICAL SUPPLY

The Project will require a new transmission line to supply the additional electrical power required for mine operations beyond what is generated from solar operations. The purpose of including solar energy in the Project is to reduce the overall carbon footprint during operations while reducing operating costs. Further details on communications with Versant Power regarding the solar facility, electrical transmission and distribution are presented in **Exhibit 20 Electricity and Communications**. If the solar facility is not viable, the new transmission line would provide the total required electric supply. The transmission line route has been planned by Versant Power (formerly Emera Maine) and would extend to the Project from a substation located on Route 11, located approximately 0.6 miles south of downtown Patten, Maine. The transmission line would extend north and northeast along Route 11 for 8.8 miles then extend along the gravel access road proposed for 4.4 miles to the Project. The corridor width for the transmission line has been calculated into the planned access road width and is 18 feet in addition to the shoulder of the proposed roadway. Transmission lines will be managed by Versant Power from the Project to a termination point at the electrical substation at the Project. A backup generator will also be installed adjacent to the electric substation (**Figure 2-1**). High voltage electrical infrastructure within the Project will be fenced in or otherwise enclosed to restrict access to only authorized workers.

## 2.8 WATER MANAGEMENT

The Project's overall water management plan includes a water treatment facility to manage, treat, and redistribute all treated/cleaned mine water and all collected surface contact water and stormwater. Generally, the water management components consist of collection ditches, pipes, storage sumps, storage ponds, a water treatment facility and WRSs distributed throughout the Project Area. These elements will be used to collect, store, treat/clean, and redistribute all water in a manner that meets the baseline groundwater conditions at the site. Reject water, or water not meeting groundwater standards, will not be allowed to return to the natural environment and will be recirculated through the treatment system or mixed with concrete for use as mine backfill. The water treatment facilities and various elements of cleaning process can treat all the various waters sufficiently to meet MDEP standards. Specific details on the components of the Project's water management and treatment plan, including the handling of reject water, are described in **Section 10.5.2 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**.

## 2.9 LUPC PLANNED DEVELOPMENT SUBDISTRICT (D-PD) STANDARDS

The purpose of the D-PD subdistrict is to allow for large-scale, well-planned development considerate of surrounding uses and its dependence on a particular natural feature or location available at the proposed site. Wolfden's selection of the Project Area is driven by the documented presence of a viable in-situ source of metallic ore, which precludes the selection of alternate location. Although new to Maine, the Project's proposed mine design would be considered a state of the art, small-scale, small footprint

underground mining operation by typical worldwide mining methodologies and able to achieve Maine's strict subdistrict standards. Based on the Project's analyses and considerations of LUPC Rules for a D-PD subdistrict as detailed in this application, the Project request for rezoning would be consistent with applicable subdistrict standards and meet the purpose of a D-PD subdistrict. **Table 2-2** summarizes the LUPC Chapter 10 and 12 Standards for a D-PD subdistrict and directs the reader to exhibits in the application where additional detail is provided.

### Table 2-2: Crosswalk of LUPC D-PD Subdistrict Standards and Application Locations

| LUPC D-PD Subdistrict Standard | Legal Citation | Application Location |
|---|---|---|
| Minimum area of 50 contiguous acres | 01-672 CMR 10.21,H,2,c | Exhibit 2: Project Description |
| Development located at least 400 feet from any property line | 01-672 CMR 10.21,H,2 | Exhibit 2: Project Description<br>Exhibit 7: Site Plans |
| Development must be reasonably self-contained and self-sufficient and, to the extent practicable, provide for its own water and sewage services, road maintenance, fire protection, solid waste disposal and police security (Chapter 10);<br>Potential impacts on services (such as fire and police protection, education and solid waste disposal) and utilities, proximity or availability of those services and utilities, and obligations or burdens for communities or State, county or local governments to provide those services (Chapter 12);<br>Potential impacts on existing infrastructure and any needs for new infrastructure to support the proposed activities (Chapter 12) | 01-672 CMR 10.21,H,2;<br>01-672 CMR 12,4,B,3,b;<br>01-672 CMR 12,4,B,3,c | Exhibit 17: Fire, Police, and Ambulance<br>Exhibit 19: Solid Waste Disposal<br>Exhibit 20: Electricity and Communications<br>Exhibit 21: Public Roads<br>Exhibit 24: Sewage Water Disposal (Wastewater Disposal) |
| Application filed only by owner or lessee (Chapter 10);<br>A legal description and delineation of the property boundaries proposed for redistricting, including names, addresses and affiliations of current owners and any other entities having a legal interest in the property (Chapter 12) | 01-672 CMR 10.21,H.4;<br>01-672 CMR 12,4,C,1,b | Exhibit 3: Deed, Lease, Sales Contract, or Easement |
| Statement on why site is best reasonably available for proposed use(s) (Chapter 10);<br>A narrative description of the nature and basis for the subdistrict change being requested (Chapter 12);<br>An explanation of how this proposal is consistent with the standards and purpose of the D-PD Development Subdistrict (Chapter 12) | 01-672 CMR 10.08,B,2<br>01-672 CMR 10.21,H,8,a,(1);<br>01-672 CMR 12,4,B,1,a;<br>01-672 CMR 12,4,C,1,a;<br>01-672 CMR 12,4,C,1,p | Exhibit 2: Project Description<br>Exhibit 9: Consistency with the CLUP |
| Expected development schedule, including time required to complete, and approximate start date (Chapter 10);<br>A preliminary plan for general location and timing of project elements (Chapter 12) | 01-672 CMR 10.21,H,8,a,(2);<br>01-672 CMR 12,4,C,1,d | Exhibit 2: Project Description |
| Statement that project is realistic and can be financed and completed | 01-672 CMR 10.21,H,8,a,(3) | Exhibit 14: Financial Capacity |
| Statement of compatibility of proposed development with existing uses and resources, foreseeable adverse effects, and measures taken to minimize such effects (Chapter 10);<br>The change in districting will have no undue adverse impact on existing uses or resources or a new district designation is more appropriate for the protection and management of existing uses and resources within the affected area (Chapter 12);<br>A description of general measures that may be undertaken to assure that mining in the specified location will not have undue adverse impacts on existing uses and resources and measures that a permittee may take to avoid, minimize or mitigate any adverse impacts (Chapter 12) | 01-672 CMR 10.21,H,8,a,(4);<br>01-672 CMR 12,4,B,1,b;<br>01-672 CMR 12,4,C,1,m | Exhibit 10: Surrounding Uses and Anticipated Impacts<br>Exhibit 16: Harmonious Fit and Natural Character<br>Exhibit 25: Archeological and Historic Resources |
| Statement of how natural resources will be managed and protected equivalent to original subdistrict designation (Chapter 10);<br>Potential impacts to existing uses and natural resources including, but not limited to: forest resources; historic sites; wildlife and plant habitats; scenic resources; water resources; and recreation resources (Chapter 12) | 01-672 CMR 10.21,H,8,a,(5);<br>01-672 CMR 12,4,B,3,d | Exhibit 10: Surrounding Uses and Anticipated Impacts<br>Exhibit 26: Rare or Special Plant Communities and Wildlife Habitat |
| Location map showing all existing subdistricts and proposed D-PD subdistrict boundaries | 01-672 CMR 10.21,H,8,a,(6) | Exhibit 2: Project Description |
| Map showing existing and proposed lot lines, noting names of adjoining lot owners, and any lots to be placed in common or private ownership | 01-672 CMR 10.21,H,8,a,(7) | Exhibit 5: Land Division History |
| Maps showing the soils and slope at the development site, at a mapping intensity sufficient to show that the site has suitable soils to support the development (Chapter 10);<br>A soils map of low intensity that encompasses those portions of the property proposed for D-PD Development Subdistrict designation, including identification of soils used in the USDA Soil Series (Chapter 12) | 01-672 CMR 10.21,H,8,a,(8);<br>01-672 CMR 12,4,C,1,g | Exhibit 23: Soil Suitability |
| Legal description of the proposed district boundaries, including a statement of present and proposed ownership. | 01-672 CMR 10.21,H,8,a,(9) | Exhibit 3: Deed, Lease, Sales Contract, or Easement<br>Exhibit 5: Land Division History |

| LUPC D-PD Subdistrict Standard | Legal Citation | Application Location |
|---|---|---|
| Statements establishing which land uses will be allowed in the D-PD subdistrict; whether each allowed use will be allowed without a permit, allowed without a permit subject to standards, allowed with a permit, or allowed by special exception; and where each land use will be allowed within the subdistrict. | 01-672 CMR 10.21,H,8,a,(10) | Exhibit 27: Additional Information - Custom Zoning Strategy |
| A statement of the applicant's intentions with regard to future selling, leasing or subdividing of all or portions of the project | 01-672 CMR 10.21,H,8,a,(11) | Exhibit 2: Project Description |
| If the proposed D-PD subdistrict would be located on a portion of a larger parcel, a statement of the anticipated future use of the remainder of the parcel outside the D-PD subdistrict. | 01-672 CMR 10.21,H,8,a,(12) | Exhibit 2: Project Description |
| Site plan showing existing features within the development site | 01-672 CMR 10.21,H,8,a,(13) | Exhibit 2: Project Description<br>Exhibit 6: Structures, Features, and Uses |
| Site plan showing proposed features | 01-672 CMR 10.21,H,8,a,(14) | Exhibit 7: Site Plans |
| Statement of any steps the applicant will take to avoid or minimize the effects of the rezoning to D-PD on existing uses or resources | 01-672 CMR 10.21,H,8,a,(14) | Exhibit 10: Surrounding Uses and Anticipated Impacts |
| Statement of any design requirements or other standards that will ensure further development and uses meet the purpose of the D-PD subdistrict | 01-672 CMR 10.21,H,8,a,(16) | N/A – No Further Development Proposed |
| Positive and negative impacts upon the areas within and adjacent to the Commission's jurisdiction resulting from the change in use and development of the area. Such impacts may include, but are not limited to, impacts to regional economic viability, Maine's natural resource-based economy, local residents and property owners, ecological and natural values, recreation, and public health, safety, and general welfare | 01-672 CMR 12,4,B,2,a | Exhibit 10: Surrounding Uses and Anticipated Impacts<br>Exhibit 16: Harmonious Fit and Natural Character<br>Exhibit 25: Archeological and Historic Resources |
| Positive and negative impacts upon the areas within and adjacent to the Commission's jurisdiction resulting from the use and development of associated transportation routes and other infrastructure (Chapter 10);<br>A map and description of the location and extent of existing infrastructure to include roadways and transportation routes to be utilized, potential impacts on this existing infrastructure, as well as infrastructure to be constructed or improved (Chapter 12) | 01-672 CMR 12,4,B,2,b;<br>01-672 CMR 12,4,C,1,j | Exhibit 21: Public Roads |
| Potential for future reclamation and beneficial use of the affected area, in accordance with the Commission's Comprehensive Land Use Plan, following closure of the site;<br>A description of the anticipated site conditions following closure and the potential for future reclamation and beneficial use of the affected area | 01-672 CMR 12,4,B,2,c;<br>01-672 CMR 12,4,C,1,q | Exhibit 2: Project Description<br>Exhibit 14: Financial Capacity |
| Potential short- and long-term socioeconomic impacts, both positive and negative, upon the immediate area and communities likely to be affected by the proposed activities and resulting from the construction, operation and closure of the proposed activity;<br>A description of socioeconomic impacts, both positive and negative, of the proposed metallic mineral mining or level C mineral exploration activities upon the immediate area and communities within and adjacent to the Commission's jurisdiction likely to be affected by the proposed activities, as well as to the county and state | 01-672 CMR 12,4,B,3,a;<br>01-672 CMR 12,4,C,1,n | Exhibit 10: Surrounding Uses and Anticipated Impacts |
| Names and addresses of property owners located within 1,000 feet of the subject property | 01-672 CMR 12,4,C,1,c | Exhibit 3: Deed, Lease, Sales Contract, or Easement<br>Exhibit 5: Land Division History<br>Exhibit 13: Notice of Filing |
| A location map drawn to scale on the most recent version of the USGS topographic map and a Maine Land Use Planning Commission Land Use Guidance Map that indicates the area for which a D-PD Development Subdistrict designation is sought and the estimated boundaries of the ore body proposed to be explored or mined | 01-672 CMR 12,4,C,1,e | Exhibit 7: Site Plans |
| A map drawn to scale of at least 1 inch to 100 feet showing existing site conditions, including contours at 10-foot intervals or less, water courses, unique or unusual natural conditions, forest cover, wetlands, known or likely deer wintering areas, lakes, ponds, existing structures, road and transportation routes, property boundaries and names of adjoining property owners, scenic locations and other prominent topographical and natural resource features | 01-672 CMR 12,4,C,1,f | Exhibit 5: Land Division History<br>Exhibit 10: Surrounding Uses and Anticipated Impacts<br>Exhibit 21: Public Roads<br>Exhibit 26: Rare or Special Plant Communities and Wildlife Habitat |
| Surficial and bedrock geology maps at a scale of 1:24,000, or largest scale available, of the property proposed for D-PD Development Subdistrict designation | 01-672 CMR 12,4,C,1,h | Exhibit 6: Structures, Features, and Uses |

| LUPC D-PD Subdistrict Standard | Legal Citation | Application Location |
|---|---|---|
| A map and or description of the location of public, private and industrial water supplies as well as mapped aquifers located within a three-mile radius of the mining area or exploration site | 01-672 CMR 12,4,C,1,i | Exhibit 6: Structures, Features, and Uses<br>Exhibit 10: Surrounding Uses and Anticipated Impacts |
| A map identifying significant natural resources and sensitive natural areas located within a three-mile radius of the mining area or exploration site including protected water bodies, significant wildlife and plant areas, fragile mountain areas, historic sites, scenic resources, public lands, registered critical areas, and Commission subdistricts | 01-672 CMR 12,4,C,1,k | Exhibit 2: Project Description<br>Exhibit 25: Archeological and Historic Resources<br>Exhibit 26: Rare or Special Plant Communities and Wildlife Habitat |
| A map and description of existing uses, such as recreational uses, within a three-mile radius of the mining area or exploration site | 01-672 CMR 12,4,C,1,l | Exhibit 10: Surrounding Uses and Anticipated Impacts |
| An evaluation of the sufficiency of existing services and utilities, a description of any general measures necessary to increase those service capacities and an examination of the burdens on communities or government to provide those services | 01-672 CMR 12,4,C,1,o | Exhibit 10: Surrounding Uses and Anticipated Impacts<br>Exhibit 17: Fire, Police, and Ambulance<br>Exhibit 20: Electricity and Communications |

# EXHIBIT 2 FIGURES

Figure 2-1: Project Conceptual Site Plan

Figure 2-2: LUPC Sub-District Map

Figure 2-3: Proposed Grading Plan – Overview of Cross Sections

Figure 2-4: Proposed Grading Plan – Sheet 1

Figure 2-5: Proposed Grading Plan – Sheet 2

Figure 2-6: Proposed Grading Plan – Sheet 3

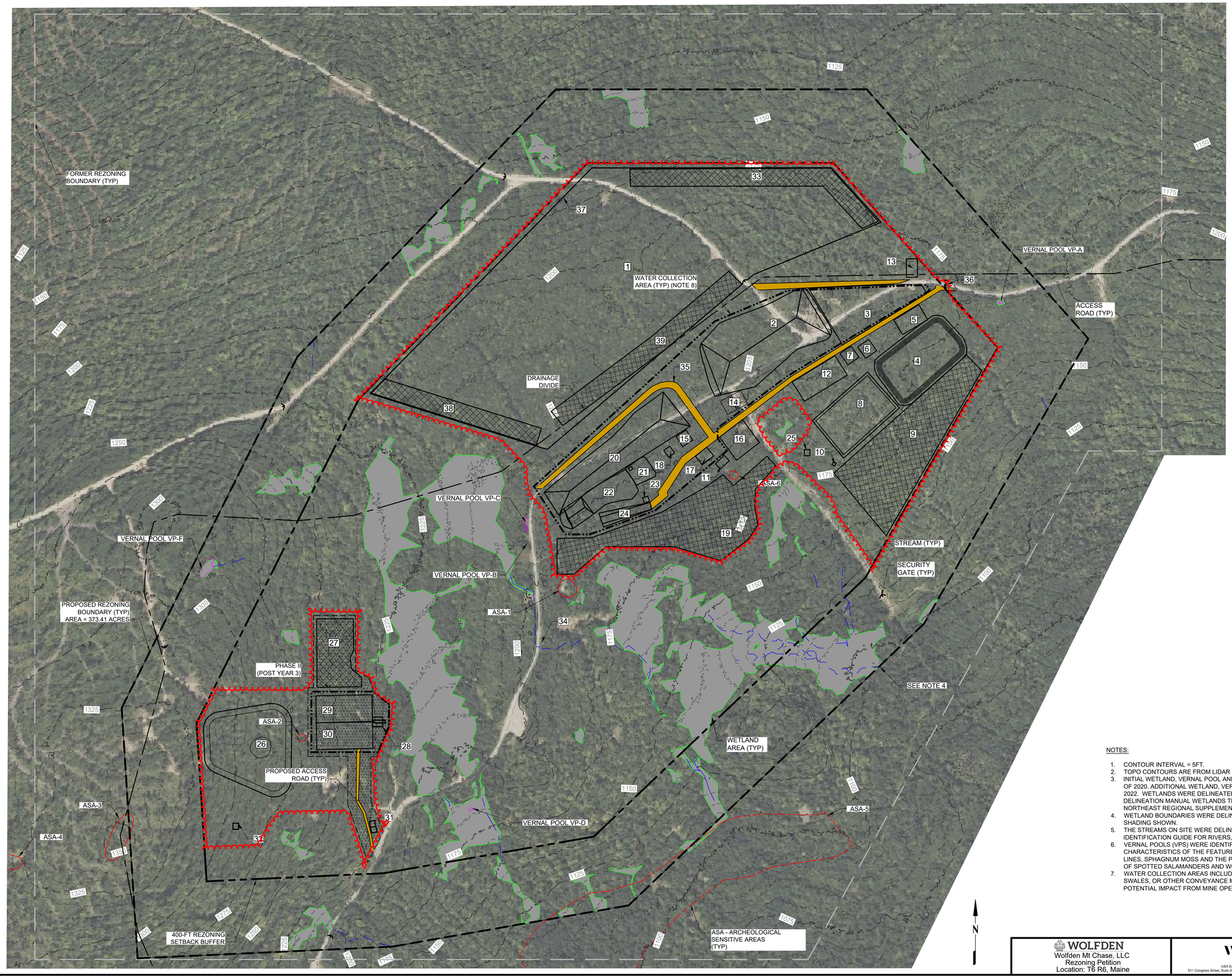
Figure 2-7: Typical Site Details

# EXHIBIT 2 ATTACHMENTS

Attachment 2-A: Underground Infrastructure Drawings

Attachment 2-B: Conceptual Project Schedule

Attachment 2-C: Sargent Corporation Quote for Backfill Hauling




| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACILITY |
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| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
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| 9 | WATER RECHARGE AREA #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | WATER RECHARGE AREA #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | WATER RECHARGE AREA #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK STORAGE PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | WATER RECHARGE AREA #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | WATER RECHARGE AREA #5 |
| 39 | WATER RECHARGE AREA #6 |

LEGEND:

- 1125 — MAJOR CONTOURS
- 1124 — MINOR CONTOURS
- STREAM
- EXISTING SITE ROAD
- VERNAL POOLS
- ASA - ARCHEOLOGICAL SENSITIVE AREAS
- 400-FEET REZONING
- SETBACK BUFFER
- PROPOSED REZONING
- OLD REZONING
- WETLAND
- 14 — FACILITIES DESIGN
- WATER COLLECTION AREA
- WATER RECHARGE AREA
- PHASE II (POST YEAR)
- PROPOSED SITE ROAD
- DRAINAGE DIVIDE
- X — SECURITY FENCE
- SECURITY GATE
- CLEARING LIMIT

NOTES:

1. CONTOUR INTERVAL = 5FT.
2. TOPO CONTOURS ARE FROM LIDAR DATA (NOAA.GOV), MARCH 2021.
3. INITIAL WETLAND, VERNAL POOL AND STREAM DATA WERE COLLECTED BY WOOD AND OTHERS IN MAY-JUNE OF 2020. ADDITIONAL WETLAND, VERNAL POOL, AND STREAM DATA WERE COLLECTED BY STANTEC-JUNE OF 2022. WETLANDS WERE DELINEATED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL WETLANDS TECHNICAL REPORT (Y-87-1) AND THE NORTH CENTRAL AND THE NORTHEAST REGIONAL SUPPLEMENT (ERDC/EL TR-12-1).
4. WETLAND BOUNDARIES WERE DELINEATED WITHIN THE REZONE BOUNDARY AND MAY CONTINUE BEYOND THE SHADING SHOWN.
5. THE STREAMS ON SITE WERE DELINEATED FOLLOWING THE NATURAL RESOURCE PROTECTION ACT (NRPA) IDENTIFICATION GUIDE FOR RIVERS, STREAMS, AND BROOKS (DANIELSON, 2018).
6. VERNAL POOLS (VPS) WERE IDENTIFIED ON MAY 17, MAY 18, AND MAY 28, 2020, BASED ON PHYSICAL CHARACTERISTICS OF THE FEATURES INCLUDING ISOLATED WATER BODIES, WATER STAINED LEAVES, WATER LINES, SPHAGNUM MOSS AND THE PRESENCE OF HYDROPHYTIC VEGETATION AS WELL AS EGG MASS COUNTS OF SPOTTED SALAMANDERS AND WOOD FROGS WERE COLLECTED.
7. WATER COLLECTION AREAS INCLUDE AREAS WHERE STORMWATER RUNOFF IS COLLECTED BY BERMS, SWALES, OR OTHER CONVEYANCE METHODS AND TREATED AT THE WATER TREATMENT FACILITY DUE TO POTENTIAL IMPACT FROM MINE OPERATIONS.

0 125 250 500
SCALE IN FEET

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

CONCEPTUAL
SITE PLAN
Project 3617-22-7547
Figure 2-1

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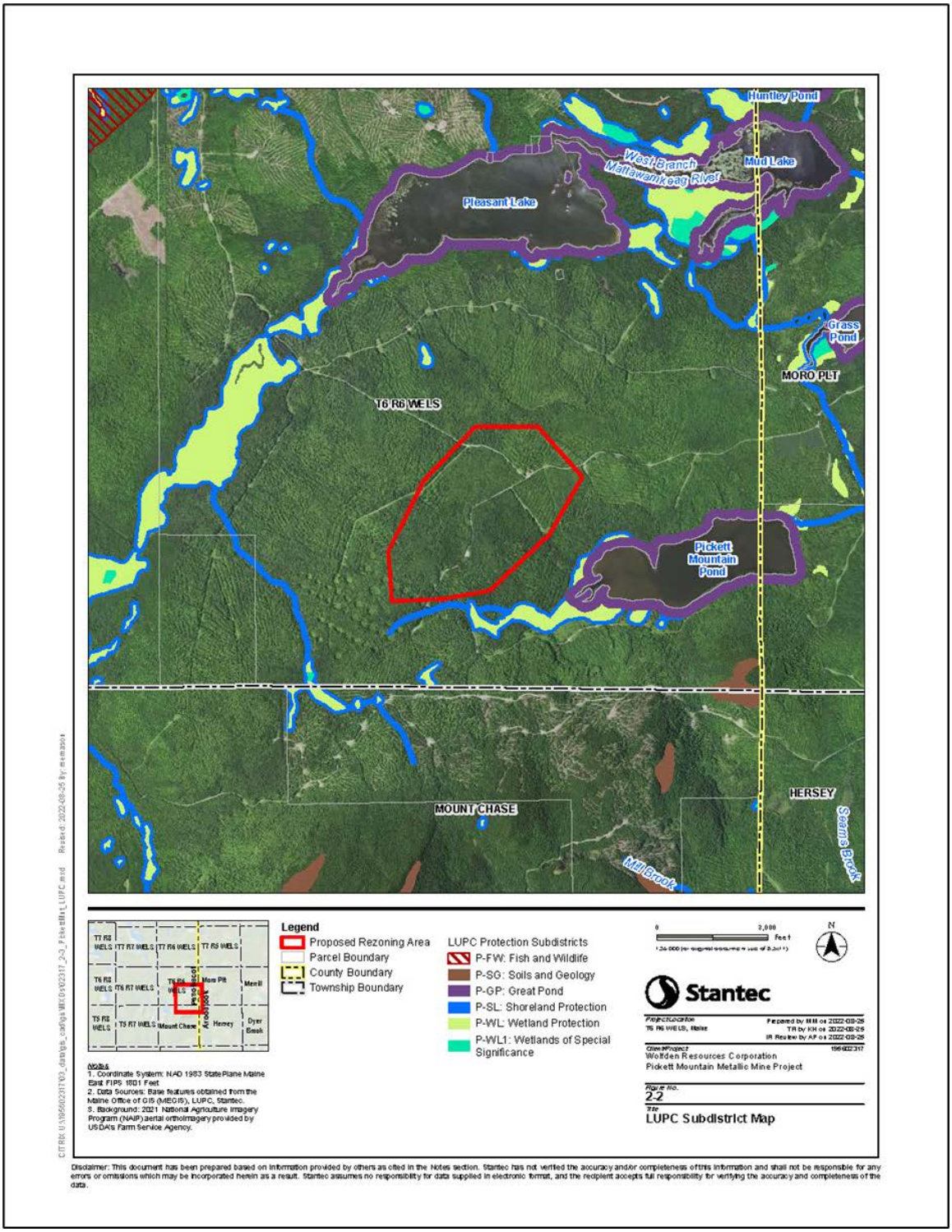
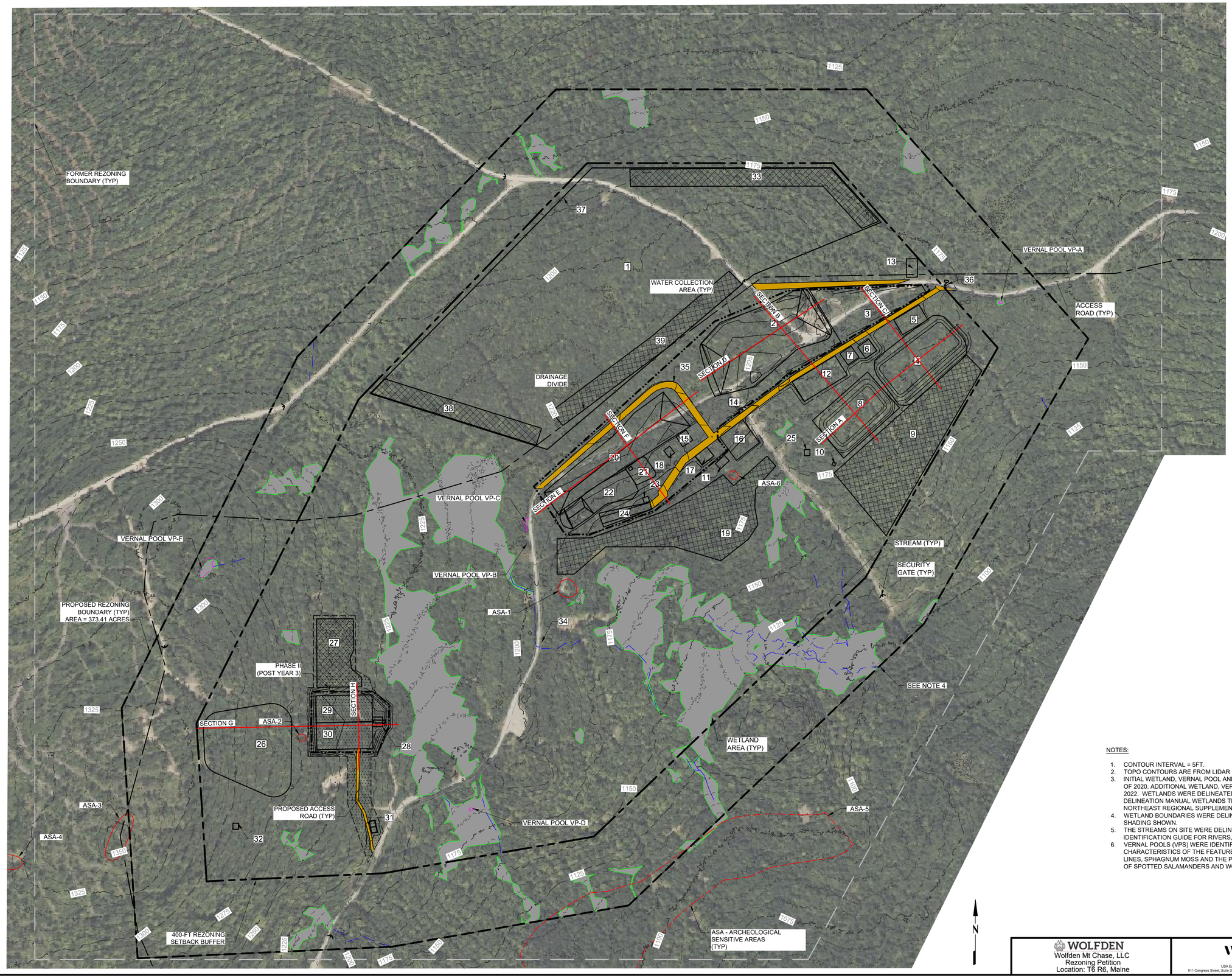



**Figure 2-2: LUPC Sub District Map**

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| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
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| 9 | WATER RECHARGE AREA #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
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- OLD REZONING
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- PROPOSED SITE ROAD
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- SECURITY FENCE
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0 125 250 500
SCALE IN FEET

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

CONCEPTUAL
GRADING AND SECTION LOCATION PLAN
Project 3617-22-7547
Figure 2-3

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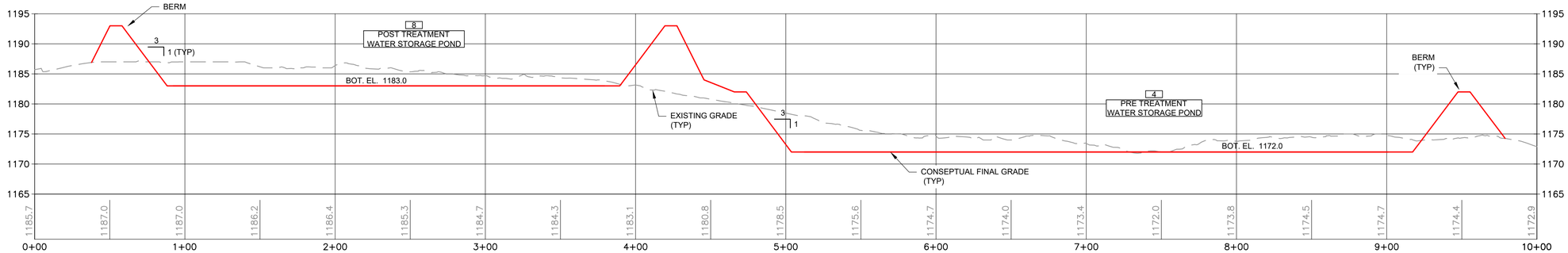
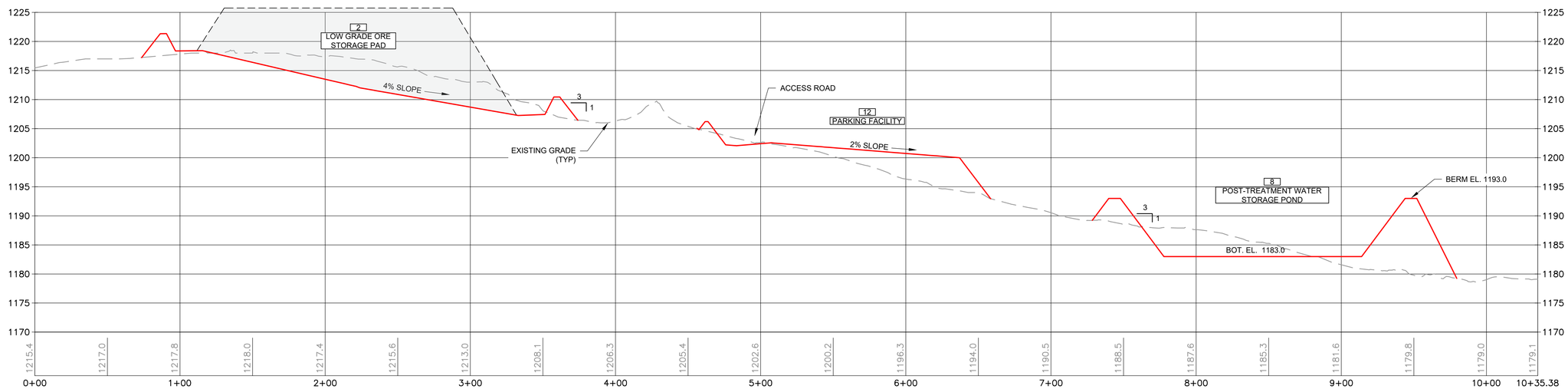
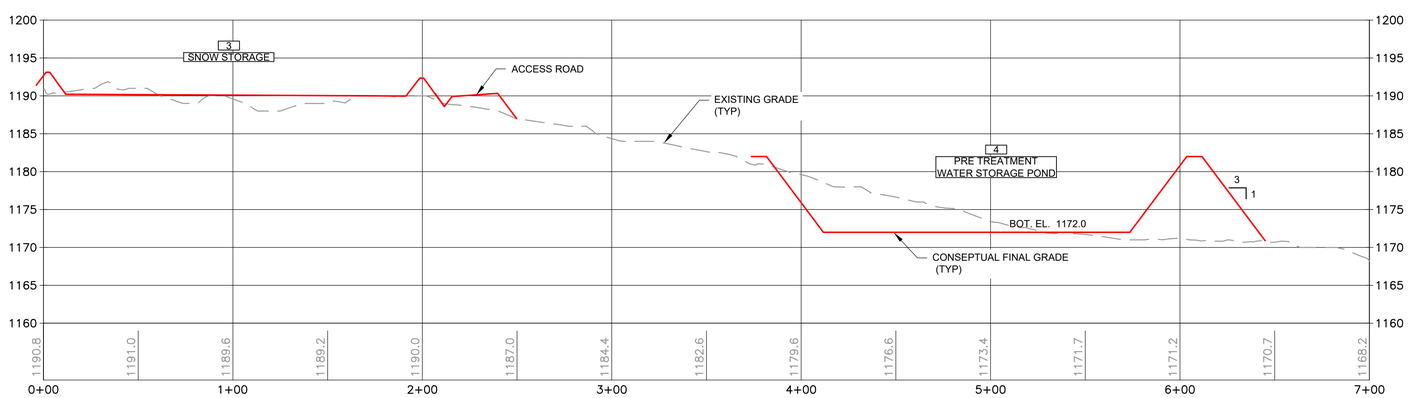



## SECTION A - WATER TREATMENT PONDS




## SECTION B - LOW-GRADE ORE AND POST-TREATMENT POND




## SECTION C - SNOW STORAGE AND PRE-TREAMENT POND

Prepared/Date: WJW10/17/22
Checked/Date: MAP10/17/22

0 20 40 80
HORIZONTAL SCALE IN FEET

0 5 10 20
VERTICAL SCALE IN FEET

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

CROSS-SECTIONS - 1

Project 3617-19-7478
Figure 2-4

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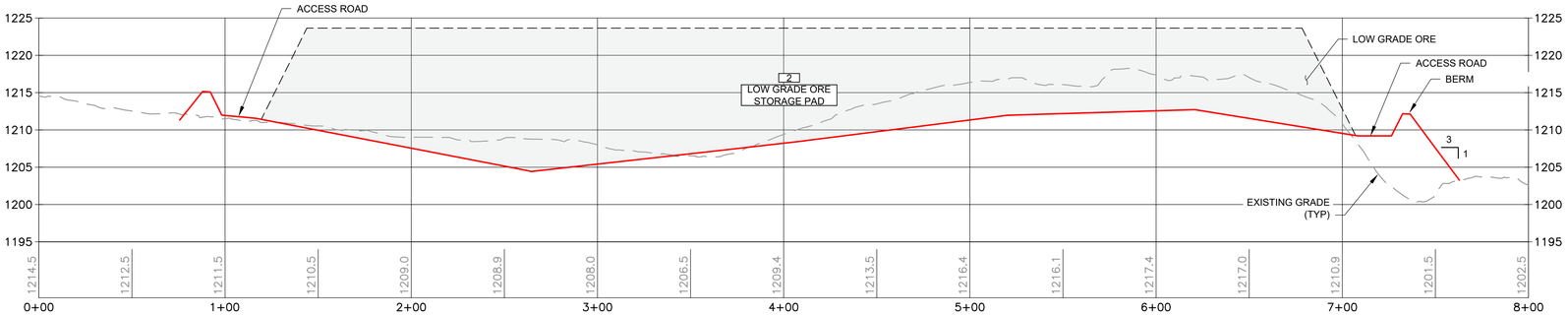
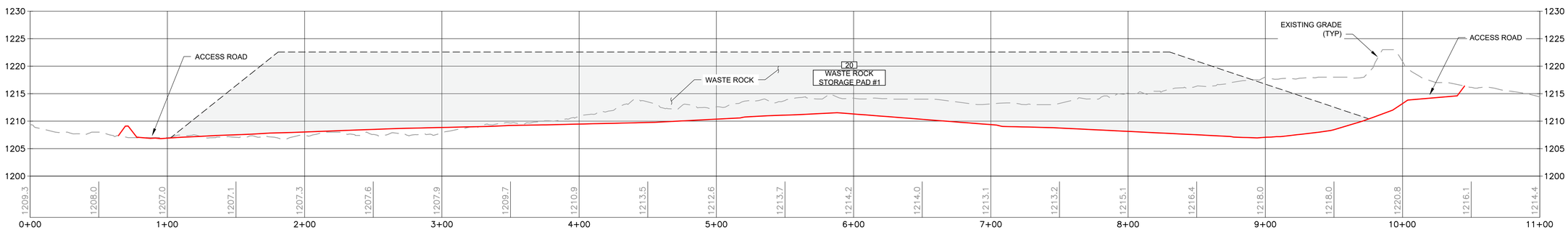
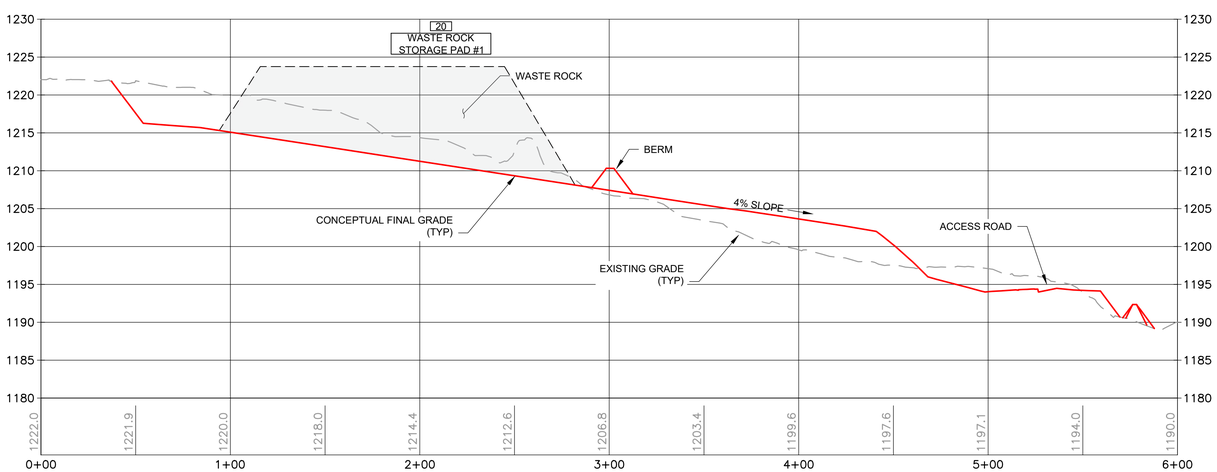



## SECTION D - LOW GRADE ORE STORAGE PAD




## SECTION E - WASTE ROCK STORAGE PAD #1
## (Longitudinal)




## SECTION F - WASTE ROCK STORAGE PAD #2
## (Transectional)

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

0 20 40 80
HORIZONTAL SCALE IN FEET

0 5 10 20
VERTICAL SCALE IN FEET

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
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CROSS-SECTIONS - 2

Project 3617-19-7478
Figure 2-5

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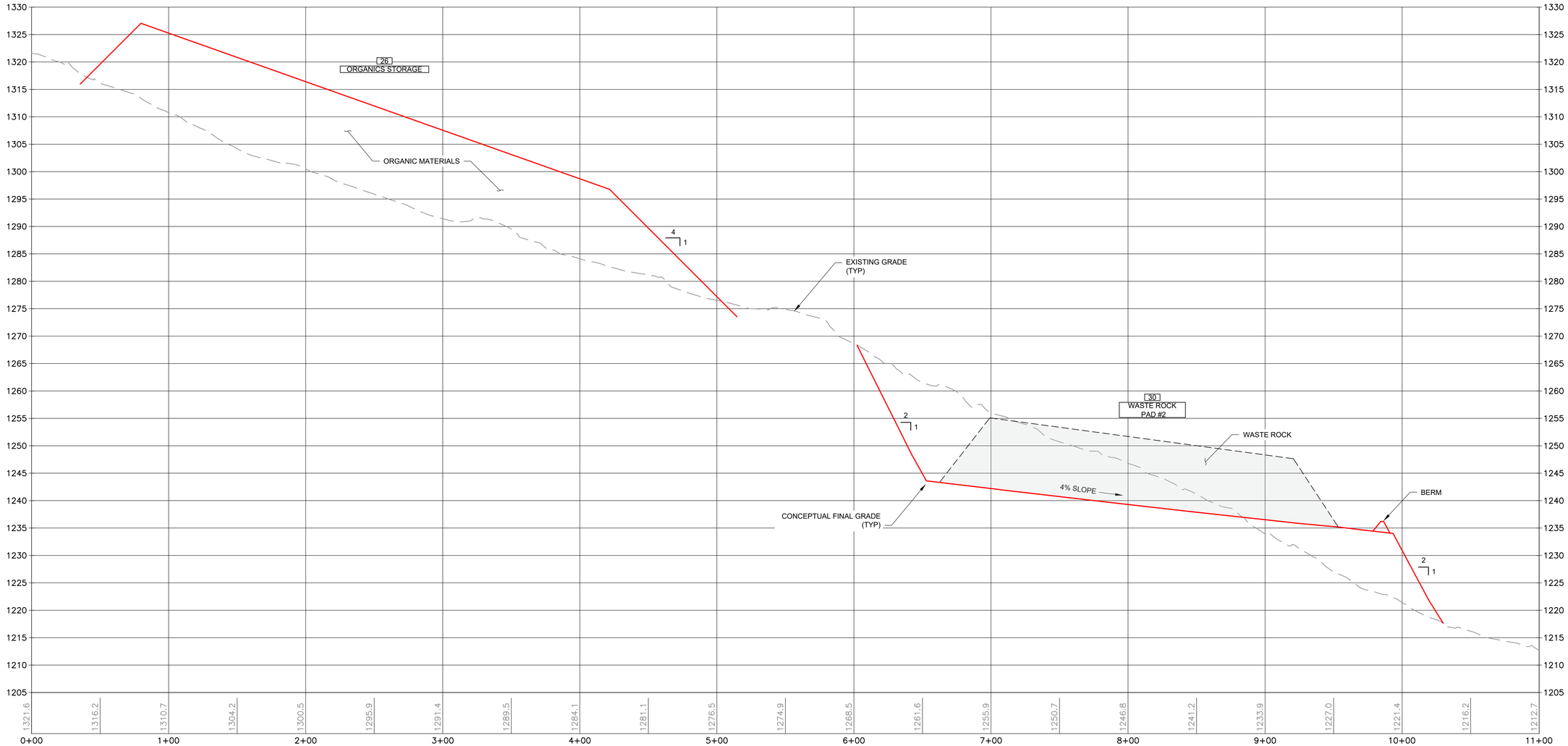
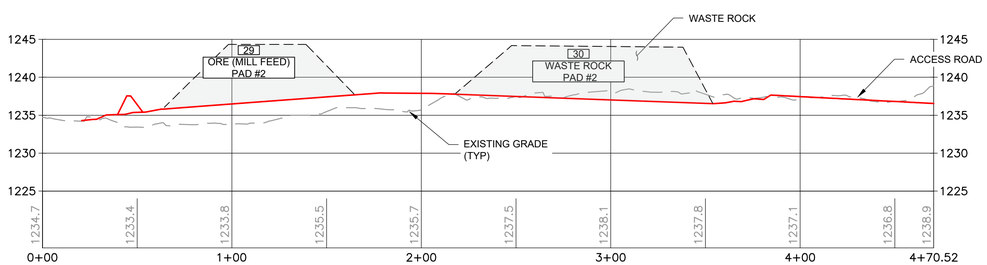



## SECTION G - ORGANIC MATERIAL STORAGE AND WASTE ROCK PAD #2 (PHASE II)




## SECTION H - ORE (MILL FEED) PAD #2 AND WASTE ROCAK PAD #2 (PHASE II)

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

0 20 40 80
HORIZONTAL SCALE IN FEET

0 5 10 20
VERTICAL SCALE IN FEET

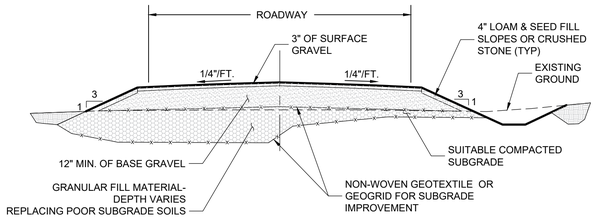
WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

CROSS-SECTIONS - 3

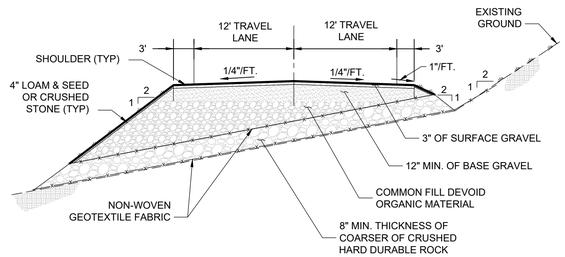
Project 3617-19-7478
Figure 2-6

C:\Users\william.whitten\OneDrive - Wood PLC\Projects\Wolfden Resources\8.0 Drawings\Design 2022\Sheets\Figure 2-6_ Cross-sections-3.dwg Mon, 17 Oct 2022 - 1:26pm william.whitten



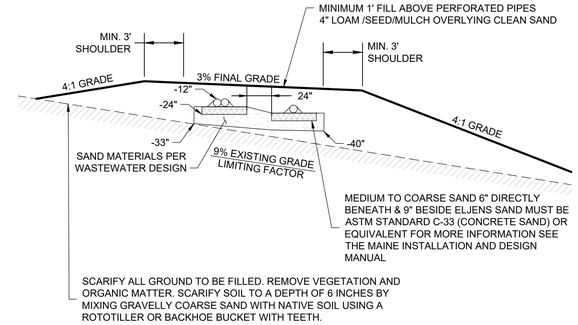

## 1 TYPICAL ROAD CROSS-SEC. FOR POOR SOILS CONDITIONS

NOT TO SCALE



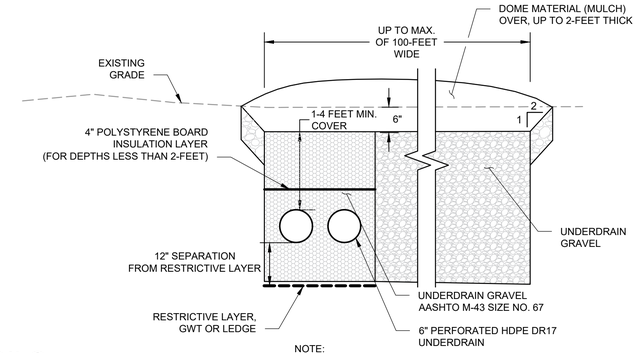

## 2 TYPICAL ROAD CROSS-SEC. W/SANDWICH MATERIAL AND DITCH

NOT TO SCALE




## 3 TYPICAL MOUNDED WASTEWATER DISPOSAL SYSTEM DESIGN FOR SOILS WITH HIGH WATER TABLE

NOT TO SCALE

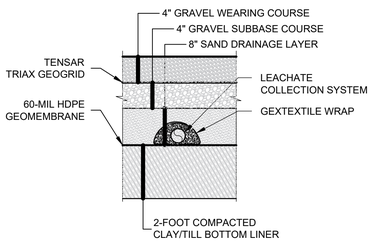



NOTE:

1. MULTIPLE PERFORATED PIPES NUMBER BASED ON WIDTH OF INFILTRATION GALLERY.
2. INSTALL TWO 6" PERFORATED PIPES ON UPSLOPE SIDE OF INFILTRATION GALLERY AND ALLOW TO INFILTRATE INTO GROUNDWATER.

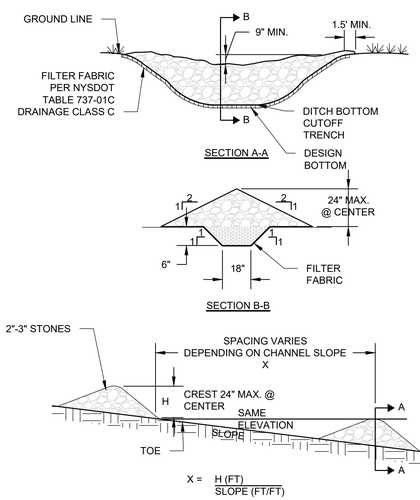
## 4 INFILTRATION GALLERY

NOT TO SCALE




## 5 LINED PAD (TYP)

NOT TO SCALE

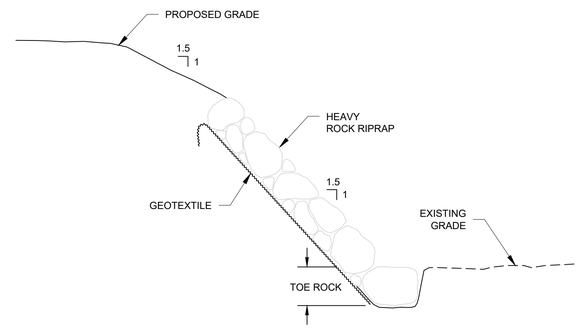



NOTES:

1. STONES WILL BE PLACED ON A FILTER FOUNDATION TO THE LINES, GRADES AND LOCATIONS SHOWN ON PLANS.
2. SET SPACING OF CHECK DAMS TO ASSUME THAT THE ELEVATIONS OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF THE UPSTREAM DAM.
3. EXTEND THE STONE A MINIMUM OF 1.5 FEET BEYOND DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
4. PROTECT THE CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
5. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.

## 7 ROCK CHECK DAM

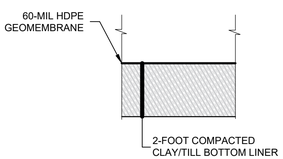
NOT TO SCALE




HEAVY ROCK RIPRAP AND FILL DETAIL TYPICAL CROSS-SECTION LOOKING DOWNSTREAM

## 8 RIPRAP

NOT TO SCALE




## 6 LINED POND (TYP)

NOT TO SCALE

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

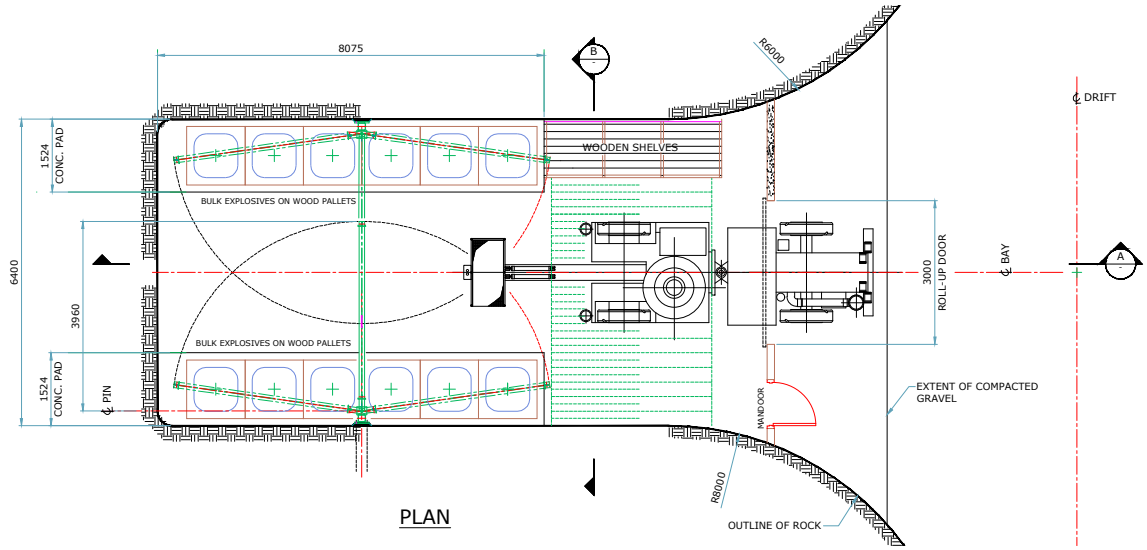
| | | |
|---|---|---|
| WOLFDEN<br>Wolfden Mt Chase, LLC<br>Rezoning Petition<br>Location: T6 R6, Maine | wsp<br>USA Earth & Environment<br>511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401 | DETAILS<br><br>Project 3617-19-7478<br>Figure 2-7 |

G:\Users\william.whitten\OneDrive - Wood PLC\Projects\Wolfden Resources\8.0 Drawings\Design 2022\Sheets\Figure 2-7_Details.dwg Mon, 17 Oct 2022 - 1:41pm william.whitten

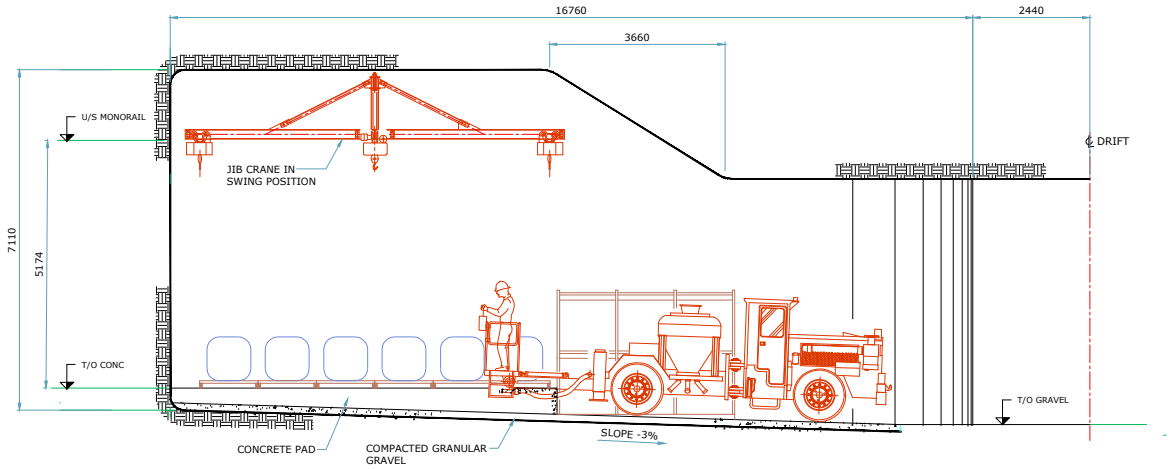
**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 2-A: Conceptual Mine Drawings




PLAN




SECTION A
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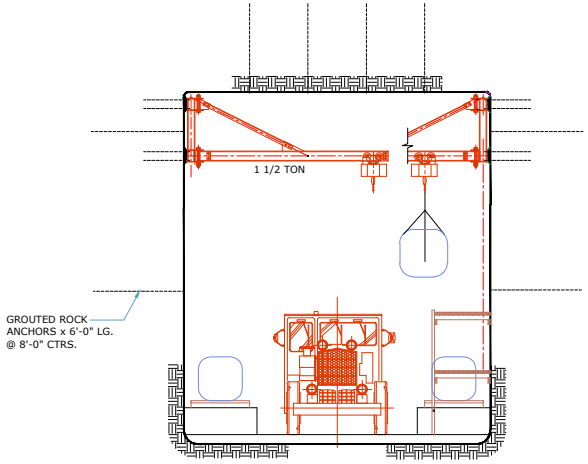


SECTION B
1:50

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|---|---|---|---|---|
| | | | | |

| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

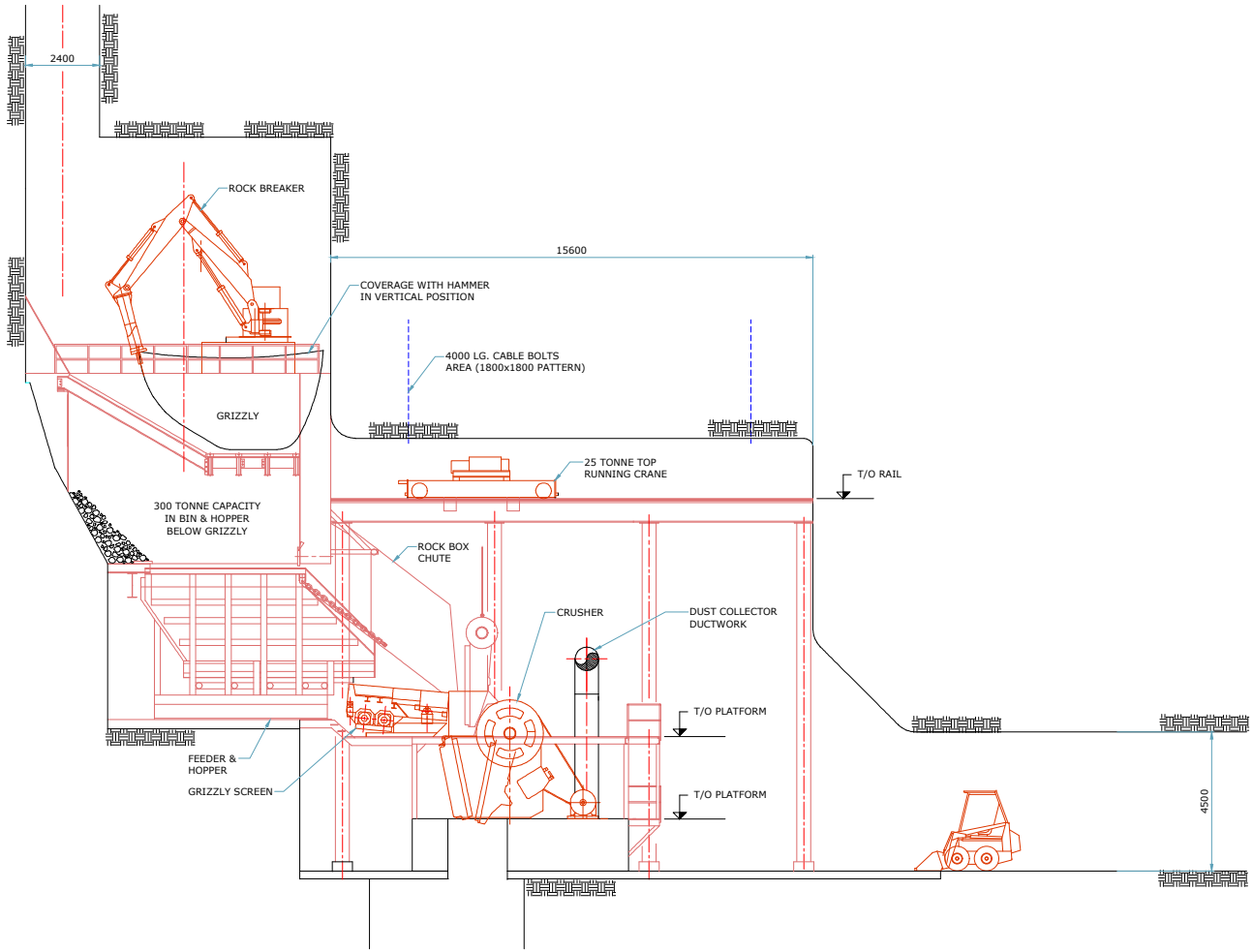
Minnova Corporation
PL Mine

TITLE:
CAP & POWDER MAGAZINE
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

SCALE: AS NOTED PROJ. NO.
DRAWING NO. REV

D - 22 x 34




SECTION A 005
1:75

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| | | | | |

| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

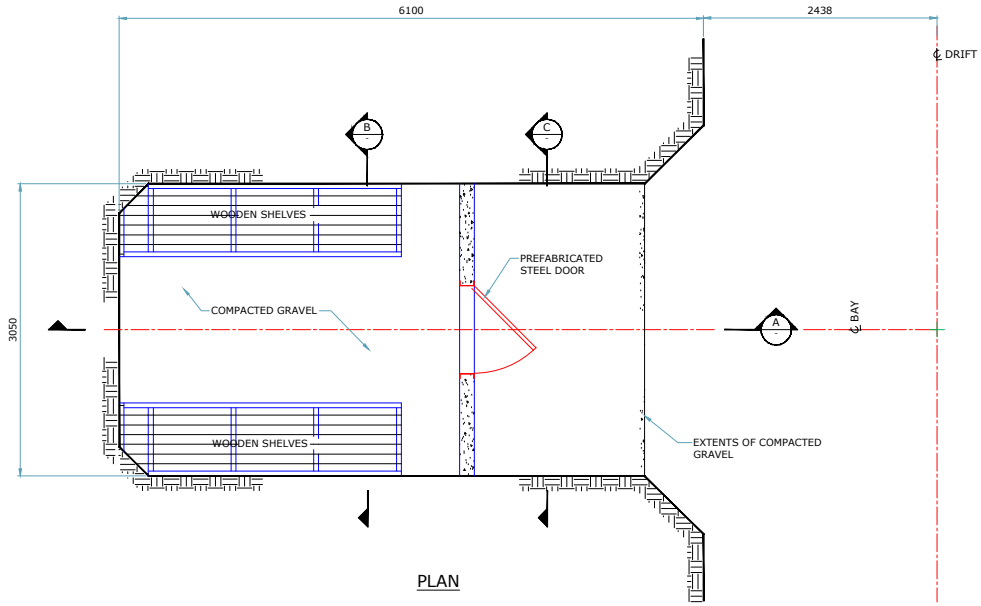
Minnova Corporation
PL Mine

TITLE:
CRUSHER STATION
GENERAL ARRANGEMENT

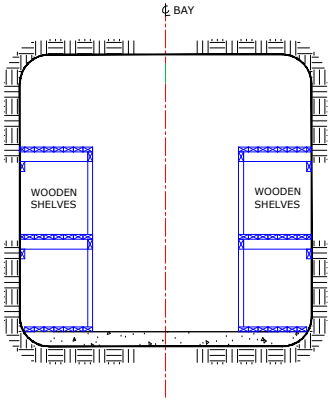
A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

SCALE: AS NOTED PROJ. NO.
DRAWING NO. REV

D - 22 x 34




PLAN

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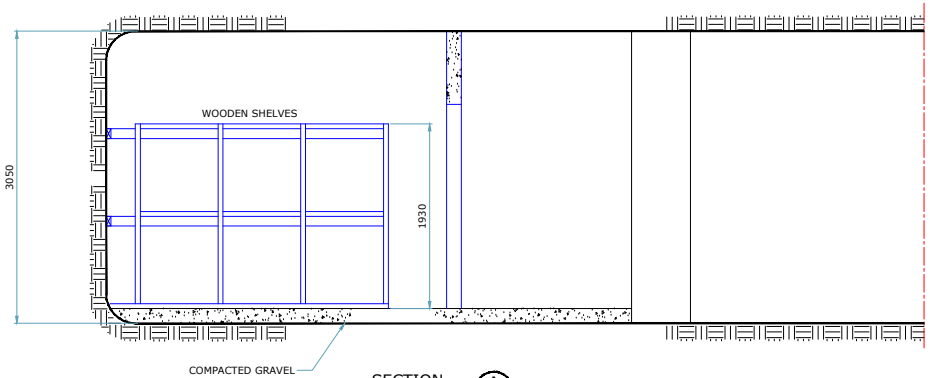


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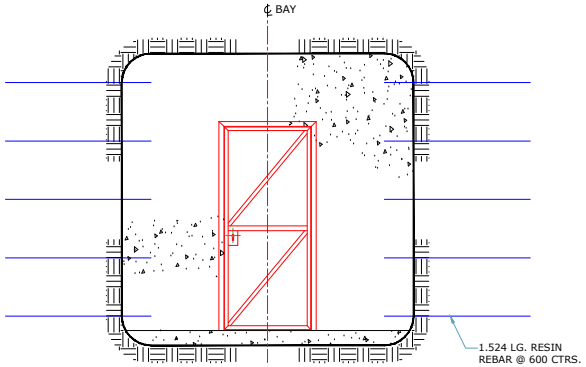


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| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

Minnova Corporation
PL Mine

TITLE:
DETONATOR STORAGE
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

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DRAWING NO. REV

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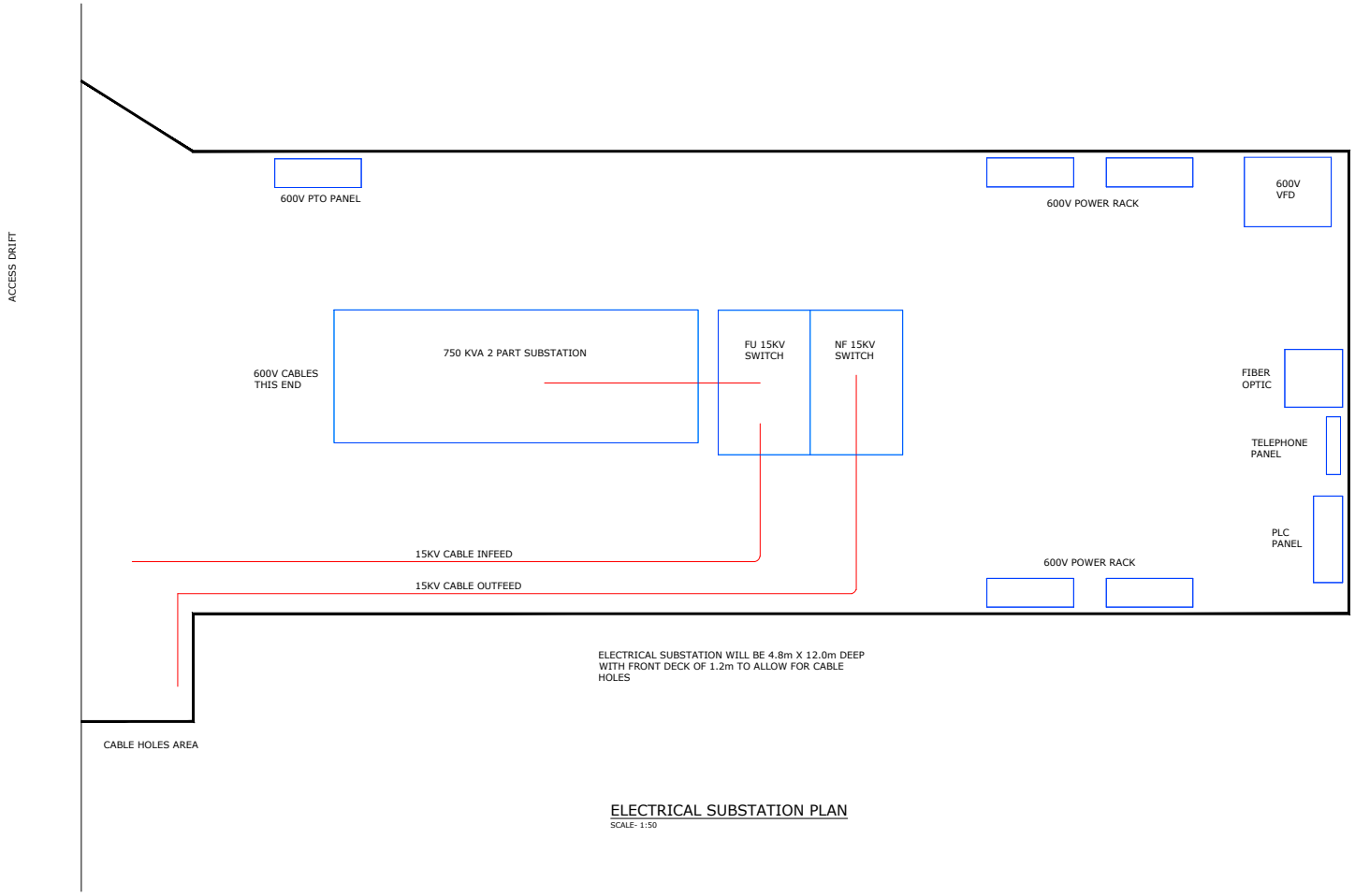


ELECTRICAL SUBSTATION PLAN

SCALE- 1:50

| NO. | DATE | REVISIONS | BY | APP. |
|---|---|---|---|---|

| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

Minnova Corporation
PL Mine

TITLE:
ELECTRICAL SUBSTATION
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

SCALE: AS NOTED PROJ. NO.

DRAWING NO. REV

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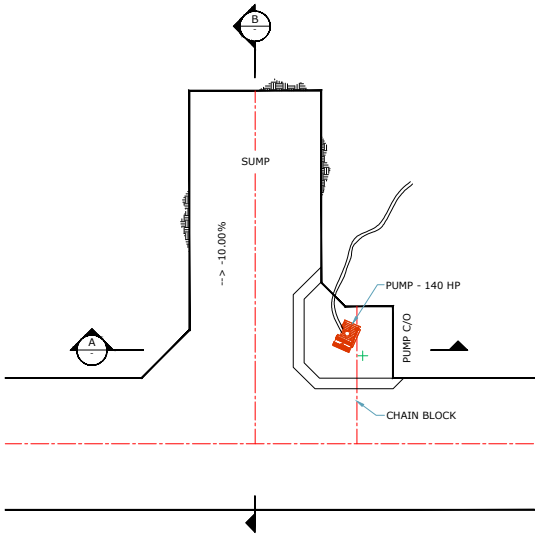


SUMP PLAN
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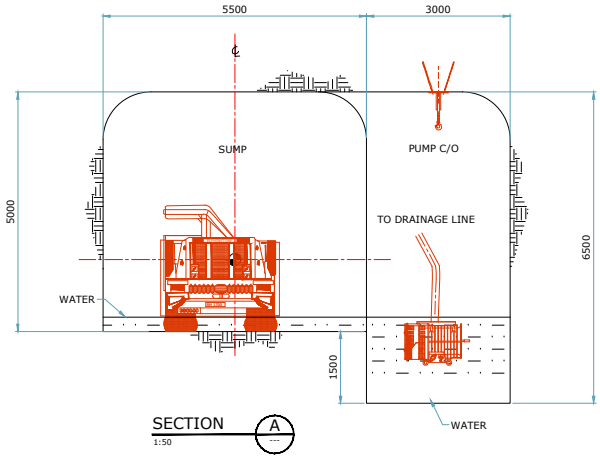


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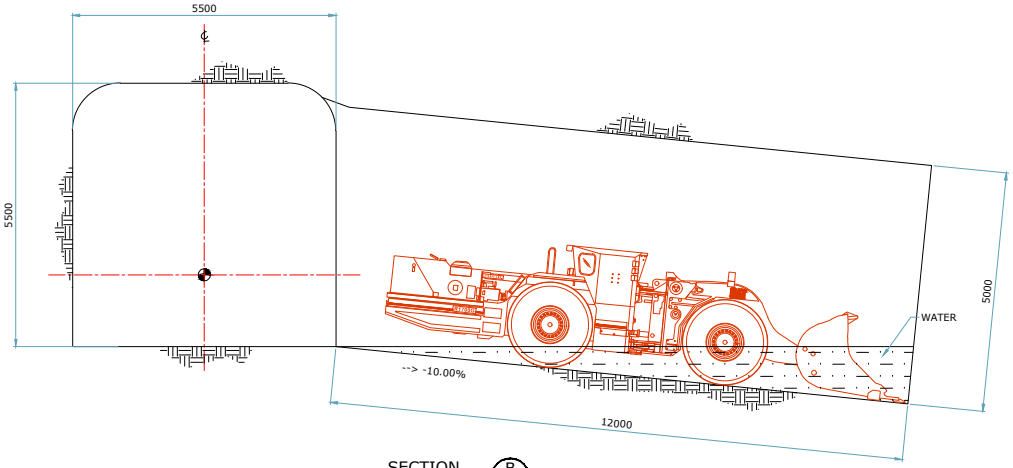


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| | | | | |

| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

Minnova Corporation
PL Mine

TITLE:
DRIVING SUMP 2
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

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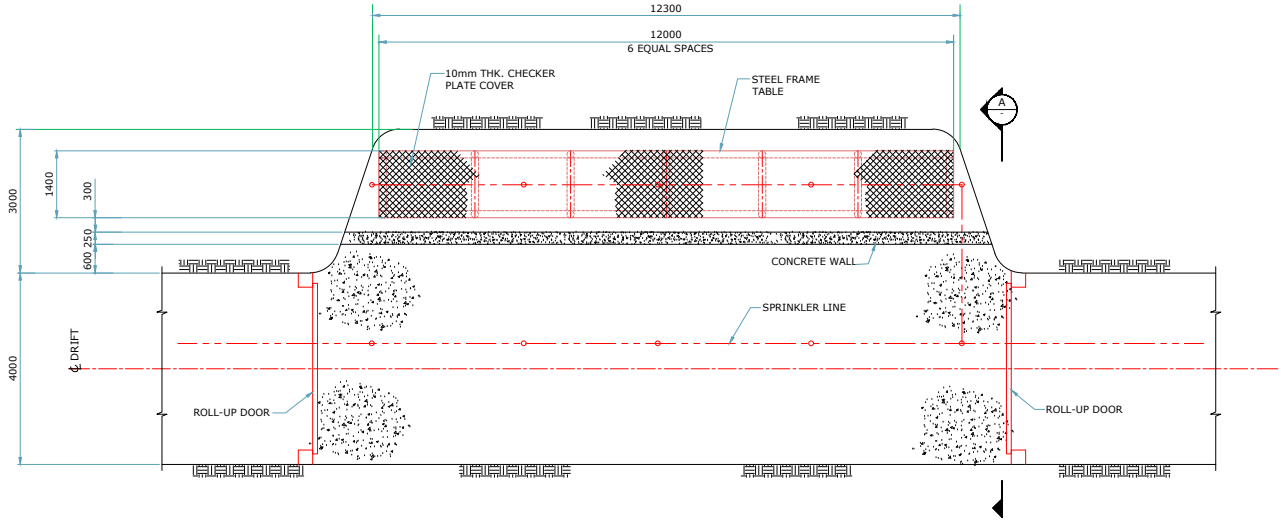


FUEL STATION PLAN

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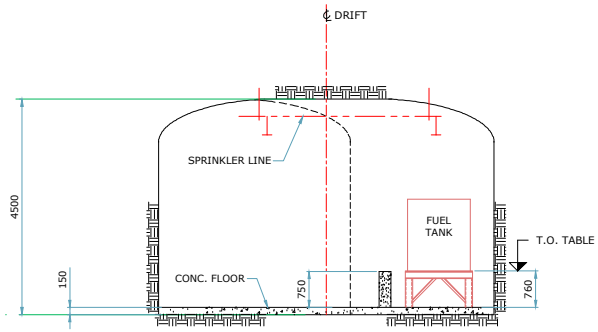


SECTION A

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| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

Minnova Corporation
PL Mine

TITLE:
FUEL STATION
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

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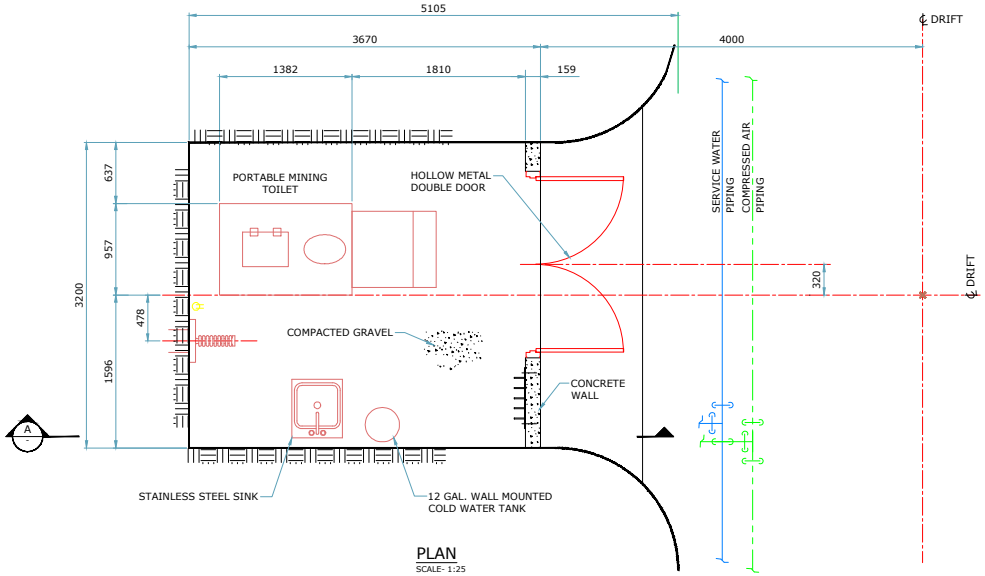
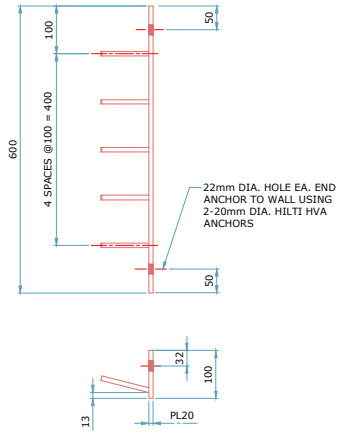
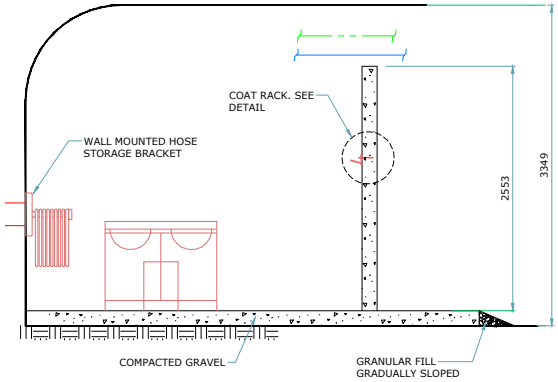



PLAN
SCALE- 1:25




COAT RACK DETAIL
SCALE- 1:5




SECTION A
1:25

| NO. | DATE | REVISIONS | BY | APP. |
|---|---|---|---|---|
| | | | | |

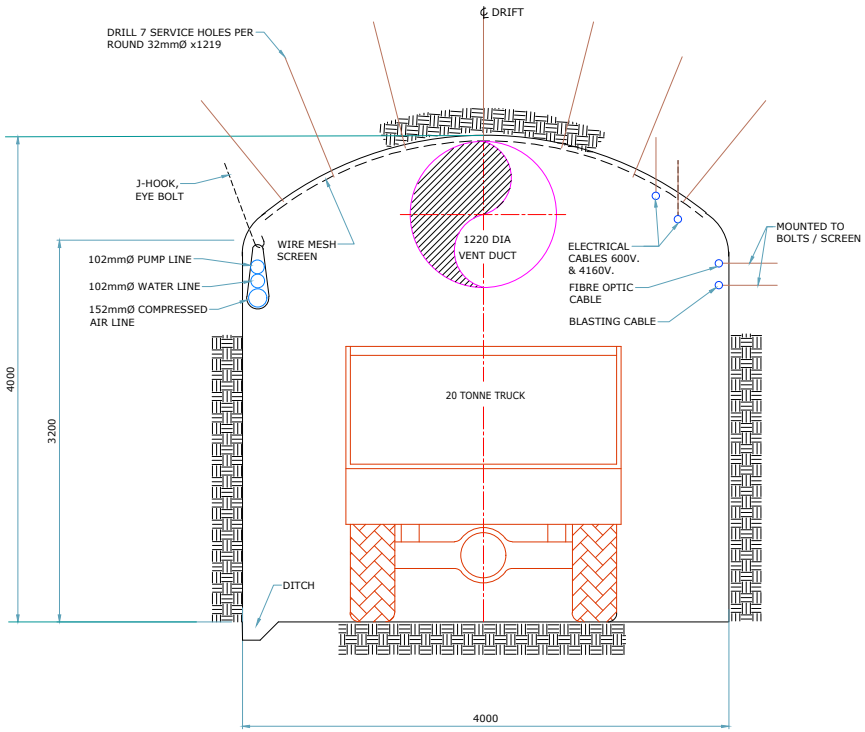
| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

Minnova Corporation
PL Mine

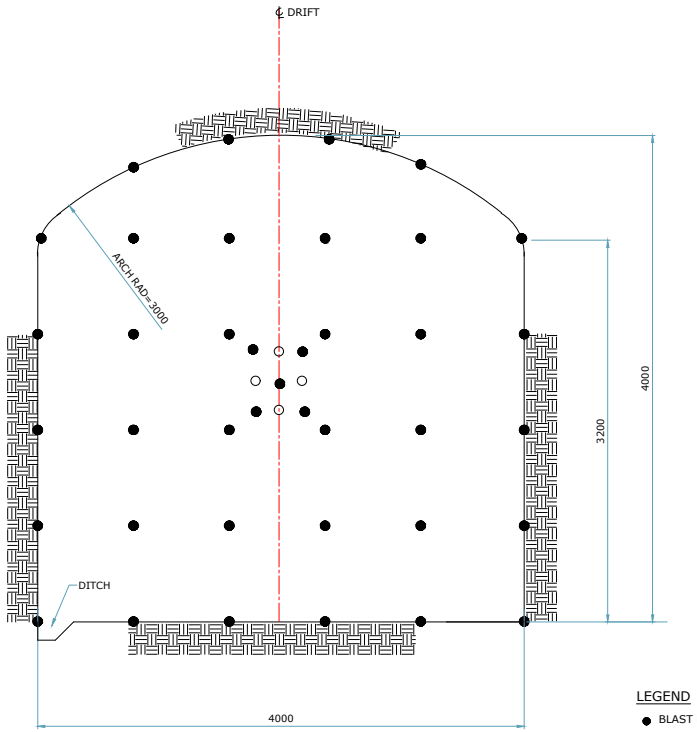
TITLE:
MAIN LEVEL LATRINE
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada
SCALE: AS NOTED PROJ. NO.
DRAWING NO. REV

D - 22 x 34




CROSS SECTION
4.0m H. x 4.0m W. DRIFT




BLAST - HOLE PATTERN
4.0m H. x 4.0m W. DRIFT

LEGEND

● BLAST HOLES (800mm SPACING c/c)

○ BURN HOLES

NOTES:-

1. ALL HOLES 45mm DIA.
2. PERIMETER HOLES TO BE LOADED WITH CONTROL TYPE EXPLOSIVE

GROUND SUPPORT

STANDARD - 1829 MECHANICAL BOLTS 16 DIA C/W 100 x 100 x 6 PLATES ON 1.2m x 1.2m PATTERN TO 1.524m FROM FLOOR

SCREEN 4" x 4" # 9 WELDED WIRE MESH

ADDITIONAL GROUND SUPPORT TO BE DETERMINED IN THE FIELD AS GROUND CONDITIONS WARRANT

HOLES DRILLED

| | |
|---|---|
| BLASTHOLES | 39 |
| REAMED HOLES | 4 |
| TOTAL HOLES | 43 |

A Z Mining Professionals

| NO. | DATE | REVISIONS | BY | APP. |
|---|---|---|---|---|

| PREPARATION | BY | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

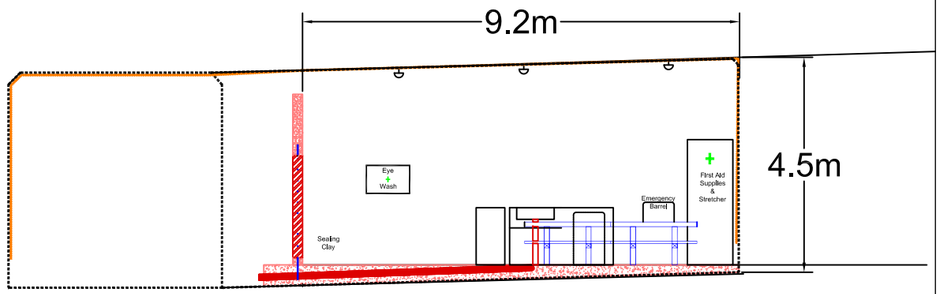
Minnova Corporation
PL Mine

TITLE:
TRACKLESS DRIFT
GENERAL ARRANGEMENT

A-Z Mining Professionals
Thunder Bay, Ontario, Canada Toronto, Ontario, Canada

SCALE: 1:20 PROJ. NO.
DRAWING NO. REV

D - 22 x 34

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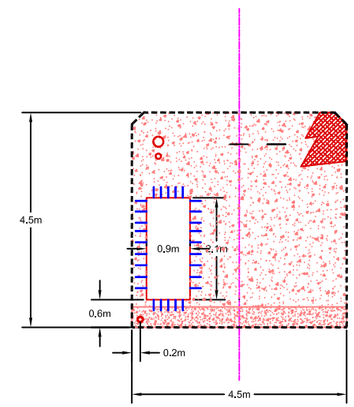
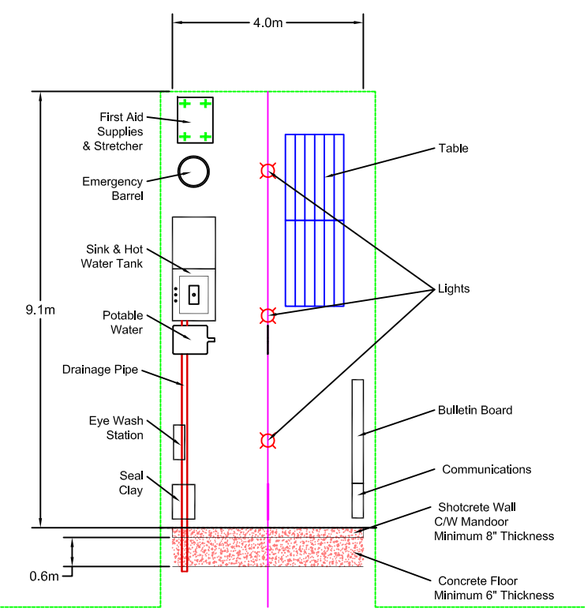



1:125

Material Requirements:

•

1:125




1:125

**R.R.O. 1990, REGULATION 854**
**MINES AND MINING PLANTS**

**Refuge Station Regulations:**

**26.** Where the procedure in case of a fire in an underground mine provides for the use of a refuge station for workers, the refuge station shall,

(a)be constructed with materials having at least a one hour fire-resistance rating;

(b)be of sufficient size to accommodate the workers to be assembled therein;

(c)be capable of being sealed to prevent the entry of gases;

(d)have a means of voice communication with the surface; and

(e)be equipped with a means for the supply of,

(i)compressed air, and

(ii)potable water. R.R.O. 1990, Reg. 854, s. 26.

| Checks/Approvals | Signatures | Date | Checks/Approvals | Signatures | Date |
|---|---|---|---|---|---|
| Drawn By | | | MTS Manager | | |
| Survey | | | Superintendent | | |
| Senior Geologist | | | Mine Manager | | |

RUBICON MINERALS CORPORATION
Suite 830 – 121 King Street West
Toronto, Ontario, Canada M5H 3T9
PHOENIX GOLD PROJECT
Cochenour, Ontario

Mine Standards– Drifts
GA– Refuge Station

| | |
|---|---|
| DRAWN BY: CATHERINE WILLETT | SCALE: 1:250 metric |
| DATE: 2019–02–24 | LEVEL: all |
| FILE: | |

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 2-B: Conceptual Project Schedule

| Project Life in Years | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **-4** | **-3** | **-2** | **-1** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **…** | **43** |
| **Permitting Phase** | | | | | | | | | | | | | | | | | | | | |
| Conceptual Plan | | | | | | | | | | | | | | | | | | | | |
| Rezoning Application Submission | | | | | | | | | | | | | | | | | | | | |
| Baseline Study/Feasibility Study/Environmental Impact Assessment | | | | | | | | | | | | | | | | | | | | |
| Mining Permit Application Filing | | | | | | | | | | | | | | | | | | | | |
| Mining Permit Approval | | | | | | | | | | | | | | | | | | | | |
| **Construction Phase** | | | | | | | | | | | | | | | | | | | | |
| Removal of trees, stumps and organics | | | | | | | | | | | | | | | | | | | | |
| Earthworks | | | | | | | | | | | | | | | | | | | | |
| Installation of services and admin structures | | | | | | | | | | | | | | | | | | | | |
| Construction of the water management infrastructure | | | | | | | | | | | | | | | | | | | | |
| Construction of laydown areas and storage pads | | | | | | | | | | | | | | | | | | | | |
| Excavation of the mine portal and capital development of drifts (Tunnels) | | | | | | | | | | | | | | | | | | | | |
| **Operations Phase** | | | | | | | | | | | | | | | | | | | | |
| Mine Development | | | | | | | | | | | | | | | | | | | | |
| Mine Production Ramp Up | | | | | | | | | | | | | | | | | | | | |
| Commercial Production | | | | | | | | | | | | | | | | | | | | |
| Production Ramp Down | | | | | | | | | | | | | | | | | | | | |
| Mine Closure | | | | | | | | | | | | | | | | | | | | |
| **Reclamation Phase** | | | | | | | | | | | | | | | | | | | | |
| Decommissioning of site buildings | | | | | | | | | | | | | | | | | | | | |
| Site final cleanup and contouring | | | | | | | | | | | | | | | | | | | | |
| Spread stored overburden and capping material on impacted sites | | | | | | | | | | | | | | | | | | | | |
| Construction of underground bulkheads (Plugs) | | | | | | | | | | | | | | | | | | | | |
| Removal of storage pad infrastructure | | | | | | | | | | | | | | | | | | | | |
| Operation of water treatment facility | | | | | | | | | | | | | | | | | | | | |
| Removal of water treatment facility and ponds | | | | | | | | | | | | | | | | | | | | |
| Ground and surface water monitoring program | | | | | | | | | | | | | | | | | | | | |

## Attachment 2-C: Sargent Corporation Letter

SARGENT

December 8, 2022

Attn: Jeremy Ouellette
Project Pickett Mtn. Project
RE: Indicative pricing for Pickett Mtn. Mining – Imported Fill Material for the Mine Site

Jeremy:

Sargent Corporation is pleased to provide the following indicative pricing to import and place fill material to the Pickett Mountain mine site (site). This material will be a blasted rock / partially processed product coming from the same quarry location (quarry) that was previously proposed for the 4" minus mine fill material. Our pricing is contingent on the ability of Sargent to successfully permit and utilize the quarry and is also based on 2020 US dollars. Pricing does not include mine site prep work including but not limited to clearing, stumping / grubbing, topsoil stripping, and erosion controls.

Our pricing is broken down into costs to prepare and rehab the quarry, process and deliver rock material to the project, and to place and compact the material on site.

| | | | | |
|---|---|---|---|---|
| **Indicative pricing for mine site fills - priced in 2020 US dollars.** | | | | |
| **Submitted 12/8/22.** | | | | |
| | | | | |
| PREP QUARRY SITE - ADDITIONAL FOOTPRINT | 1.00 | AC | $ 36,537.40 | $ 36,537.40 |
| REHAB QUARRY SITE - ADDITIONAL FOOTPRINT | 1.00 | AC | $ 12,032.15 | $ 12,032.15 |
| BLAST / LOAD / HAUL / PROCESS ROCK FILL | 41,000.00 | MT | $ 9.70 | $ 397,700.00 |
| PREMIUM TO PLACE & COMPACT MATERIAL ON SITE | 41,000.00 | MT | $ 3.66 | $ 150,060.00 |
| | | | | **$ 596,329.55** |

We hope that you find this information helpful. Please call if you have any questions. I can be reached at (207) 215-2055.

Respectfully,

Glenn J. Adams, P.E.
Business Development Director


**Corporate Headquarters**
Telephone: 207-827-4435
Fax: 207-827-6150
378 Bennoch Road
P.O. Box 435
Stillwater, ME 04489

**New Hampshire Operations**
Telephone: 603-734-2132
Fax: 603-734-2197
25 Spaulding Road
Unit 19
Fremont, NH 03044

**Mid-Atlantic Operations**
Telephone: 804-368-7118
Fax: 804-368-7387
11139 Air Park Road
Suite 1
Ashland, VA 23005

sargent.us

# EXHIBIT 3.0 DEED, LEASE, SALES CONTRACT, OR EASEMENT

## 3.1 DEED

A copy of the deed, which demonstrates the applicant's full rights to the property, has been included as **Attachment 3-A**.

## 3.2 EASEMENT

A copy of the easement allowing use of the private logging roads that connect the Project area with Route 11 during construction, operation, and decommissioning is included as **Attachment 3-B**.

## 3.3 RESTRICTIONS

There are no restrictions on the Project Area or private access roads.

## 3.4 LEGAL DESCRIPTION AND DELINEATION OF THE PROPERTY BOUNDARIES PROPOSED FOR REZONING

*A certain piece or parcel of land located within township 6, range 6 wells (t6, r6 wells), county of Penobscot, state of Maine and being more particularly bounded and described as follows:*

*Beginning at a point located in the Maine state plane coordinate system-NAD 83 (east zone-1801), as measured in United States survey feet at north: 901910.4220, east: 995529.5778; thence running through the land of the grantor on a course of south twenty-nine degrees fifty-six minutes forty-three seconds west (S 29° 56' 43" W) a distance of one thousand seven hundred eighty-four and thirty-three hundredths (1784.33) feet to a point located at north 900364.2935, east 994638.8868;*

*Thence running through the land of the grantor on a course of south forty-six degrees twenty-two minutes forty-four seconds west (S 46° 22' 44" W) a distance of two thousand two hundred thirteen and fifty-six hundredths (2213.56) feet to a point located at north 898837.1935, east 993036.4493;*

*Thence running through the land of the grantor on a course of south eighty degrees seven minutes thirteen seconds west (S 80° 07' 13" W) a distance of one thousand three hundred three and seventy-nine hundredths (1303.79) feet to a point located at north 898613.4902, east 991751.9960;*

*Thence running through the land of the grantor on a course of south eighty-seven degrees twenty-three minutes four seconds west (S 87° 23' 04" W) a distance of one thousand three hundred seventy-nine and thirty-three hundredths (1379.33) feet to a point located at north 898550.5425, east 990374.1055;*

*Thence running through the land of the grantor on a course of north three degrees thirty-nine minutes six seconds west (N 03° 39' 06" W) a distance of one thousand three hundred fifty-nine and sixty-eight hundredths (1359.68) feet to a point located at north 899907.4634, east 990287.5060;*

*Thence running through the land of the grantor on a course of north twenty-six degrees thirty-six minutes sixteen seconds east (N 26° 36’ 16" E) a distance of two thousand one hundred thirty and seven tenths (2130.70) feet to a point located at north 901812.8389, east 991241.1408;*

*Thence running through the land of the grantor on a course of north forty-four degrees two minutes fifty-three seconds east (N 44° 02' 53" E) a distance of two thousand fifteen and forty-two hundredths (2015.42) feet to a point located at north 903261.4363, east 992642.3903;*

*Thence running through the land of the grantor on a course of north eighty-nine degrees fifty-nine minutes zero seconds east (N 89° 59' 00" E) a distance of one thousand six hundred eighty-five and eighty-three hundredths (1685.83) feet to a point located at north 903261.9253, east 994328.2162;*

*Thence running through the land of the grantor on a course of south forty-one degrees thirty-eight minutes three seconds east (S 41° 38' 03" E) a distance of one thousand eight hundred eight and twenty-seven hundreds (1808.27) feet to the aforementioned point of beginning.*

*Said parcel contains three hundred seventy-three and forty-one hundredths (373.41) acres more or less*

*The above-described parcel is a portion of land owned by the grantor as described in book 14672, page 27 of the Penobscot registry of deeds located in Bangor, Maine.*

A map of the above legal description is in **Figure 3-1**.

# EXHIBIT 3 FIGURES

Figure 3-1: Map of Proposed Rezoning Area

# EXHIBIT 3 ATTACHMENTS

Attachment 3-A: Deed

Attachment 3-B: Easement

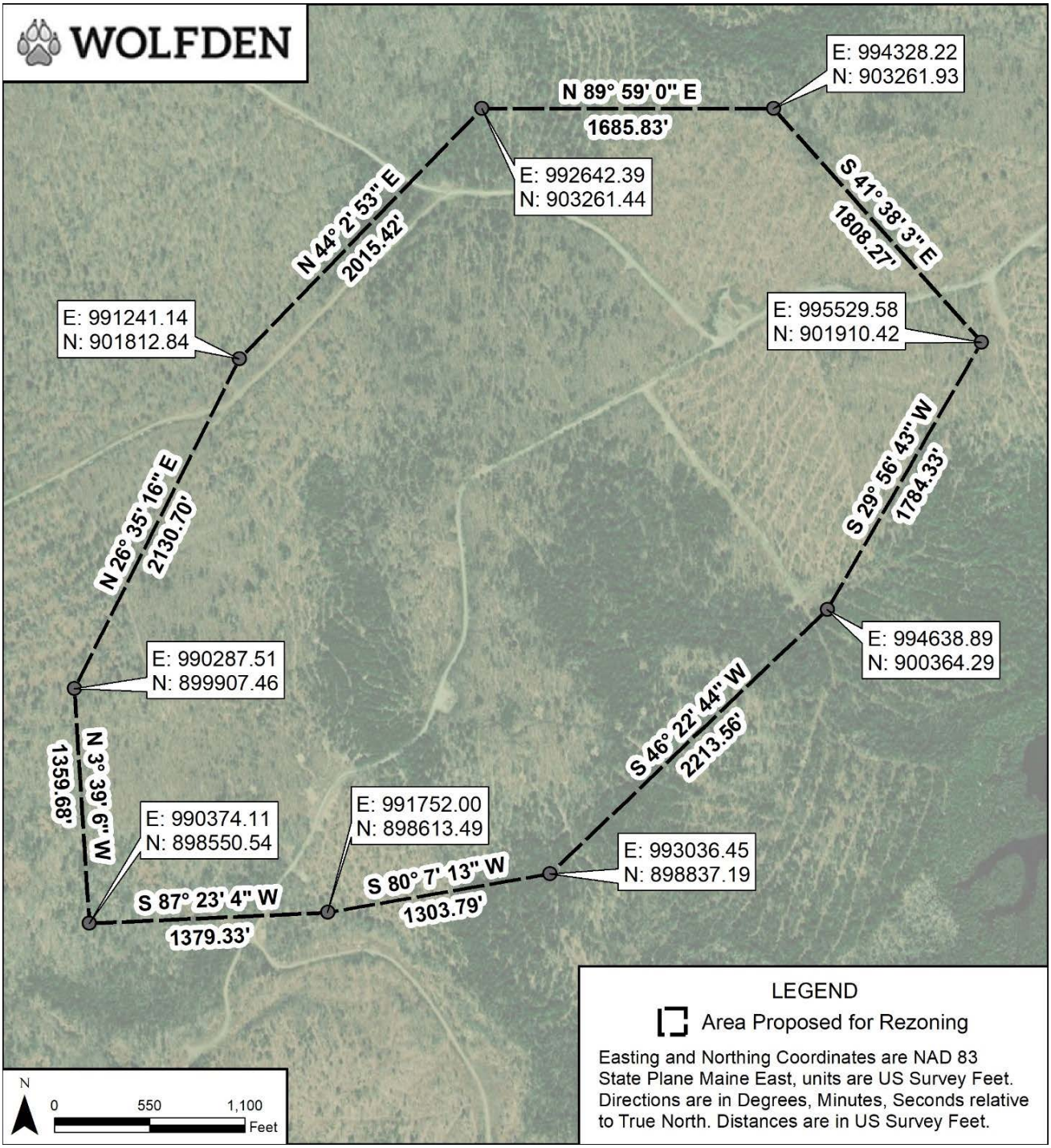



**Figure 3-1: Map of Proposed Rezoning Area**

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 3-A: Deed

Bk 14672 Pg27 #36240
11-16-2017 @ 10:28a

**QUITCLAIM DEED WITH COVENANT**
(Maine Statutory Short Form)

KNOW ALL BY THESE PRESENTS, that **SYLVAN TIMBERLANDS, LLC**, a Delaware limited liability company having a place of business in Exeter, County of Rockingham, and State of New Hampshire ("Grantor"), for consideration paid, GRANTS to **WOLFDEN MT. CHASE LLC**, a Delaware limited liability company having a mailing address of 1100 Russell Street, Thunder Bay, Ontario P7B 5N2 ("Grantee"), with QUITCLAIM COVENANT, certain real estate located in T6 R6 WELS, Penobscot County, Maine, which is more particularly described in Exhibit A attached hereto and made a part hereof (the "Property").

TOGETHER WITH all appurtenances, structures, improvements, and rights associated therewith, as well as all minerals, mining, subsurface and surface rights to the extent owned by Grantor.

This conveyance also is made SUBJECT TO those matters set forth on Exhibit B attached hereto and made a part hereof.

IN WITNESS WHEREOF, **SYLVAN TIMBERLANDS, LLC** has caused this instrument to be executed on its behalf by its duly authorized undersigned representative as an instrument under seal, this 10th day of November, 2017.

**SYLVAN TIMBERLANDS, LLC**

Witness

By: _____
Scott Mooney, Authorized Person

STATE OF SOUTH CAROLINA
County of Greenville SS.

November 13, 2017

Then personally appeared the above-named Scott Mooney, Authorized Person of **SYLVAN TIMBERLANDS, LLC** and acknowledged the foregoing instrument to be his free act and deed in his said capacity, and the free act and deed of said **SYLVAN TIMBERLANDS, LLC.**

SEAL

Before me,

Sandra D. Edwards
Notary Public/Maine Attorney-at-Law
Printed Name: Sandra D. Edwards

**Exhibit A**

Those certain parcels of land located in the southeast quarter of Township 6, Range 6 WELS, Penobscot County, Maine known as "Tract 3200" and described in a deed from Huber Timber LLC to Sylvan Timberlands, LLC dated November 6, 2009 and recorded in the Penobscot County Registry of Deeds in Book 11981, Page 165; being more particularly described as follows:

Being the southeast quarter of Township six (6) Range six (6) W.E.L.S., the same being three (3) miles square, according to the survey and plan of Lore Alford, and the 1388 acre lot, so-called, which adjoins said southeast quarter, as shown on said plan, a copy of said plan being recorded in Penobscot Registry of Deeds Land Office Plan Book 2, Page 33, hereby referred to for a further and more particular description.

EXCEPTING from this conveyance the 2 acre parcel conveyed to Ansel L. Lumbert by deed dated October 12, 1914 and recorded in said registry in Book 859, Page 434.

Also EXCEPTING the following described parcel:

A certain lot or parcel of land with the buildings thereon, situated on the north side of Pleasant Lake, so called, lying adjacent to and easterly of Spring Brook, so-called, bounded and described as follows, viz:
Beginning at a point in the thread of Spring Brook, said point being about four (4) chains northerly of its junction with the north side of Pleasant Lake; thence south thirty-four (34) degrees and thirty (30) minutes east, twenty-three (23) links to a cedar post surrounded by stones and marked on north "Huber"; on south "Finnegan" thence on same course three and eighty-one hundredths (3.81) chains from point of beginning to second cedar post surrounded by stones on the north bank of Pleasant Lake, said post being marked on north "Huber" and on south "Finnegan"; thence on same course nineteen (19) links to high-water mark on said shore of Lake; thence on same course to low-water mark on shore of said Lake; thence by and along said low-water mark in a southerly and westerly direction to the junction of Spring Brook with said Lake; thence northerly following the thread of said Spring Brook about four (4) chains to point of beginning and containing 1.25 acres, more or less.

Also EXCEPTING a parcel on the north shore of Pleasant Lake as described in a deed from Huber Timber LLC to Raye M. Porter et al dated April 24, 2008 and recorded in Book 11374, Page 213.

Also EXCEPTING a parcel approximately 500 feet south of Pleasant Lake as described in a deed from Elizabeth J. Grass to Ryan R. Allen and Maria A. Allen dated November 9, 2007 and recorded in Book 11201, Page 277.

**Exhibit B**
**Permitted Encumbrances**

1. Ad valorem real estate taxes not yet due and payable.

2. Matters which would be shown on a survey of the Property which would not have a material and adverse effect on Purchaser's use of the Property as recreational property, commercial timberlands or a mineral exploration property but expressly excluding matters relating to encroachments over boundary lines by abutters.

3. Rights or claims to any bottomlands, streams, creeks or rivers by the state where the Property is located or any other governmental agencies and any and all other riparian rights.

4. Applicable rules and regulations of any planning and/or zoning board or commission or any other rules or regulations of or by any other governmental authority.

5. Any existing public streets and all railroad and public utility lines located within the Property.

Maine Real Estate
Transfer Tax Paid

Susan F. Bulay, Register
Penobscot County, Maine

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 3-B: Easement

# EASEMENT DEED

**HERBERT C. HAYNES, INC.**, also known as **H.C. Haynes, Inc.**, and **LAKEVILLE SHORES, INC.** both Maine corporations with a mailing address of P.O. Box 96, Winn, Maine 04495 (collectively, "Grantor"), for consideration paid, grant to **WOLFDEN MT. CHASE, LLC** a Delaware limited liability company, with a mailing address of 1100 Russell Street, Thunder Bay, Ontario, Canada P7B 5N2 ("Grantee"), with Quitclaim Covenant, the following described easements over land of the Grantor in **Hersey** and **Moro Plantation, Aroostook County, Maine**:

Appurtenant easements (i) for all purposes of ingress and egress, (including, but not limited to, purposes of land management, mining exploration, mine development, mine extraction and processing and other natural and mineral resource extraction, timber harvesting, transportation of ore, minerals, timber and other natural resources and any related equipment or supplies), and (ii) to erect, construct, maintain, repair, and rebuild electrical and telecommunications lines and their appurtenances (collectively "the Easements"); over, under and upon a sixty six (66) foot strip of land ("the Easement Strip") in Hersey and Moro Plantation, Aroostook County, Maine, the centerline of which is the centerline of an existing gravel road, the general location of which is depicted on the sketch attached hereto as Exhibit A. The Easement Strip runs from State Route 11 at Point A shown on Exhibit A to and through Points A through H and G to I to the easterly line of the land conveyed to the Grantee by deed of Sylvan Timberlands LLC dated November 10, 2017 and recorded in Book 14672, page 27 of the Penobscot County Registry of Deeds (hereinafter referred to as the " Benefited Land"). The Easement Strip sidelines shall extend to Route 11 and to the east line of the Benefited Land as required to provide an uninterrupted easement corridor from State Route 11to the Benefited Land.

The Easements shall be subject to the following provisions:

1. The Easements shall be in common with Grantor, and Grantor's successors and assigns.

2. Grantee's use of the Easements shall at all times be conducted so as not to unreasonably interfere with lawful use by the Grantor, nor materially interfere with the ordinary conduct of operations and management of

Grantor's land, including the harvesting and removal of forest products and other materials therefrom.

3. The Easements shall be perpetual, and in common with Grantor, and Grantor's successors and assigns, and shall include the rights to perform all work required to keep the road in good order, including, without limitation, the rights to upgrade, grade, construct, widen, repair, and maintain the roadway and related bridges, culverts, grades, and ditches within the Easement Strip, and to clear and dispose of interfering trees and other growth from time to time. The Easements also include the right to flow water from the road from ditches and culverts onto lands of the Grantor, provided that such right to flow does not unreasonably interfere with the use and enjoyment of such lands by the Grantor.

4. The use of the Easements for the permitted utility services shall include, without limitation, the right to construct, maintain, operate and upgrade, from time to time, utility lines consisting of overhanging wires with the necessary fixtures and supports, with the right to transmit electricity and intelligence over said lines and to clear and dispose of interfering branches and other growth from time to time, with permission to enter upon the land of Grantor for the above purposes and the right to assign to others, including, without limitation, Emera Maine, and Maine Public Service, and their successors and assigns, in whole or in part, any portion or all of the Easements for purposes of serving the benefited land.

5. The Easements shall (i) be appurtenant to, and run with the Benefited Land, and any contiguous or nearby land which the Grantee may hereafter acquire, and every portion thereof, (ii) be binding upon, the parties hereto, and their respective successors and assigns, and (iii) run with the burdened land in Hersey and Moro Plantation conveyed (a) to H. C. Haynes Inc. by deed from Penobscot Forest, LLC dated December 29, 2005 and recorded in Aroostook County Registry of Deeds (Southern District) Book 4230, page 111, (b) to H. C. Haynes Inc. by deed from Lakeville Shores, Inc. dated May 4, 2011 and recorded in Book 4937, page 180, and (c) to Lakeville Shores, Inc. by deed of Heartwood Forestland Fund V Limited Partnership dated September 28, 2010 and recorded in Book 4868, page 93 of said Registry.

6. The Easements shall not extend to the general public.

7. The Grantee, its successors and/or assigns, shall be solely responsible for the selection, supervision, control, direction, compensation, work rules, discipline, and termination of Grantee's surveyors, invitees, employees, contractors, and consultants who may enter the Easement Strip pursuant to the Easements. The Grantee, whenever possible and practical shall work with or use the services offered by the Grantor to upgrade, service or

maintain the easement strip, whereby both parties shall agree in advance to any compensation for such services. Of course, the Grantor shall be able upgrade, maintain and repair the easement strip at any time, at its own expense for its own use, or at a shared expense with the Grantee, upon the Grantee's acceptance in writing, by letter or email.

8. Except for alterations allowed hereunder, the Grantee shall promptly repair and restore the land of Grantor to the same or similar condition as existed before Grantee's entry.

9. Grantor shall retain title to all merchantable timber and forest products within the Easement Strip and Grantee will not remove from Grantor's land merchantable timber or other forest products severed from the Easement Strip without the prior written agreement of Grantor. Grantor will cooperate with Grantee to designate laydown areas on Grantor's remaining land for any such severed timber and forest products.

10. The use of the Easements by Grantee, its successor and/or assigns shall be at the sole risk of Grantee and its successors and/or assigns.

11. Grantee's work, and improvements placed or constructed within Easement Strip by Grantee, shall be in compliance with all applicable laws, rules and ordinances.

12. Grantee will not suffer or permit any mechanic's or materialman's lien to be filed against the land of Grantor, for or purporting to be for, labor and materials supplied to, or at the instance of, or for the benefit of, Grantee or any contractor or subcontractor engaged, or claiming to be engaged by Grantee.

13. As used below, a "Dispute" means any dispute whatsoever arising out of or concerning the interpretation, application, effect, or enforcement of this Easement Deed, including without limitation any claim concerning the scope or effect of the following agreement to negotiate, mediate, and/or arbitrate. The parties agree that final Dispute resolution, privacy and speed are their common goals. The parties agree in the first instance to attempt to settle any Dispute by good faith, confidential, direct discussions between the parties. If in the good faith judgment of either party, at any time, these attempts fail, or will most likely not succeed, either party may demand that the Dispute be the subject of confidential, private mediation in Bangor, Maine, within forty-five (45) days, with the mediation to be conducted by a disinterested mediator satisfactory to both parties. If the parties cannot within a week after the demand for mediation agree on a mediator, each will within three (3) business days select a mediator, and the two mediators will within five (5) business days select a third mediator, who will conduct the mediation. The service of the two mediators who were designated by the

parties to select a third mediator will then end, with each party paying for its own designated mediator. The fee for the mediator conducting the mediation shall be shared equally.

If the Dispute is not then resolved by mediation, the Dispute shall be resolved by binding arbitration, also conducted in Bangor, Maine. If a Dispute arises and is not resolved at mediation, the parties have ten (10) business days to agree on a single arbitrator who will decide all procedural and substantive disputes. If the parties fail to agree upon a single arbitrator, they must, in the succeeding five (5) business days, each designate one arbitrator. The two designated arbitrators will agree upon a third arbitrator within the next five (5) business days, or as soon as reasonably practicable, if later. The service of the two arbitrators who were designated by the parties will then end, with each party paying for its own designated arbitrator. The third arbitrator will set a schedule which will cause resolution of the Dispute to be completed within sixty (60) calendar days of his/her appointment as arbitrator. The arbitrator will act in accordance with Maine arbitration law. The fee for the arbitrator conducting the arbitration shall be shared equally.

The arbitrator will decide all factual issues based upon reasonably reliable evidence. The arbitrator's determination of "reasonably reliable evidence" is final. The arbitration opinion and award shall be final and binding on the parties, and shall be enforceable thereafter by any court, if any party resists or attempts to avoid the satisfaction of the arbitration order or award. The substantially prevailing party shall be entitled to recover from the substantially unsuccessful party in such arbitration all of the substantially prevailing party's costs and expenses (including reasonable attorneys' fees) incurred in connection with such arbitration, and the costs of such arbitration (including arbitrator's fees and expenses) shall be borne by the substantially unsuccessful party. The parties recognize that this means that all Disputes will be resolved on a confidential basis, before an impartial arbitrator, if need be, instead of before a court of law and/or a jury, and that if any party attempts to circumvent this dispute resolution process by the filing a civil action in court, that action shall be subject to immediate dismissal by the court, with an order that the parties abide by this dispute resolution process, instead, and that the party filing the civil action must pay all costs and reasonable attorney's fees of the other party incurred in having to enforce this dispute resolution process.

IN WITNESS WHEREOF, Herbert C. Haynes, Inc. and Lakeville Shores, Inc. have caused this deed to be executed as an instrument under seal, by their duly authorized officers as of the 1st day of April, 2020.

WITNESS:

**HERBERT C. HAYNES, INC.**

By: Ginger E. Maxwell
Ginger E. Maxwell
It's Treasurer

WITNESS:

**LAKEVILLE SHORES, INC.**

By: Ginger E. Maxwell
Ginger E. Maxwell
It's Treasurer

STATE OF MAINE
PENOBSCOT COUNTY

April 1st, 2020

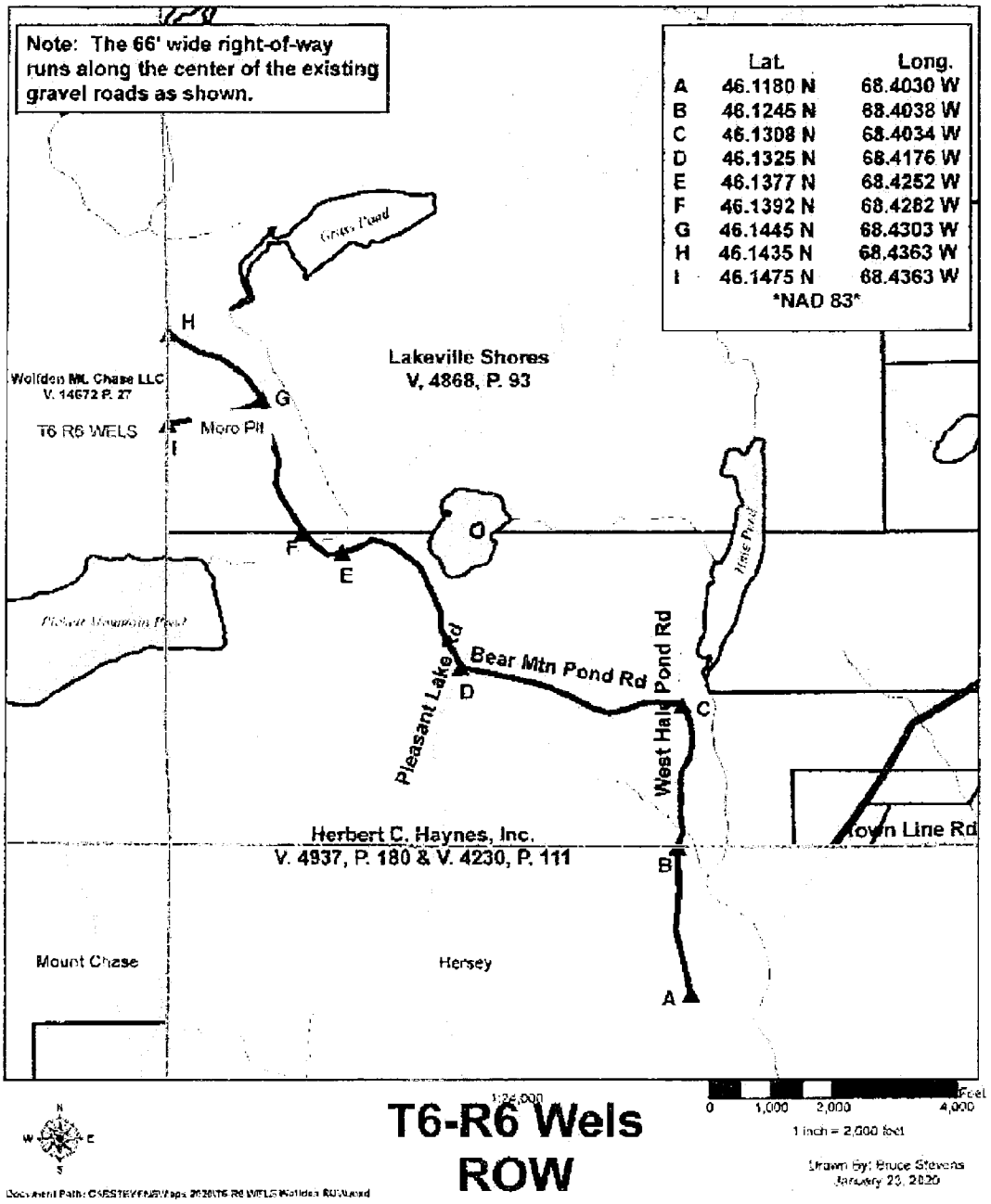
Then personally appeared the above named Ginger E. Maxwell in her capacity as Treasurer of Herbert C. Haynes, Inc. and of Lakeville Shores, Inc. and acknowledged the foregoing instrument to be her free act and deed in said capacities and the free act and deed of said corporations.

Before me,

Kim Rutty
Notary Public/~~Maine Attorney~~
Name:

KIM RUTTY
Notary Public, State of Maine
My Commission Expires 12/7/2025

# Exhibit A




# T6-R6 Wels ROW



MELISSA L. RICHARDSON REGISTER
ARCOSTOOK SOUTH COUNTY MAINE E-RECORDED

# EXHIBIT 4.0 APPLICATION FEE

On January 18, 2023, Wolfden provided application and processing fees totaling $93,737.28 to the LUPC as part of filing the rezoning application.

# EXHIBIT 4 FIGURES

Not Applicable

# EXHIBIT 4 ATTACHMENTS

Not Applicable

# EXHIBIT 5.0 LAND DIVISION HISTORY

The ownership history and configuration changes of the Wolfden property over the last 20 years are presented in **Attachment 5-A**, including the book and page numbers, the seller/grantor and buyer/grantee names, the date of the deed or lease, and the size of the lot resulting from the transaction. There appear to be six other “camp lots” at Pleasant Lake, identified as Tax Map 1, Lot 2.1, Lot 4, Lot 5, Lot 5.1, Lot 6, and another with no specific Lot #. Each of these lots was created before the January 1, 2002, start date of the attached 20-year Land Division History report and, therefore, are not included in that report.

# EXHIBIT 5 FIGURES

Not Applicable

# EXHIBIT 5 ATTACHMENTS

Attachment 5-A: Land Division History Narrative

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 5-A: Land Division History Narrative

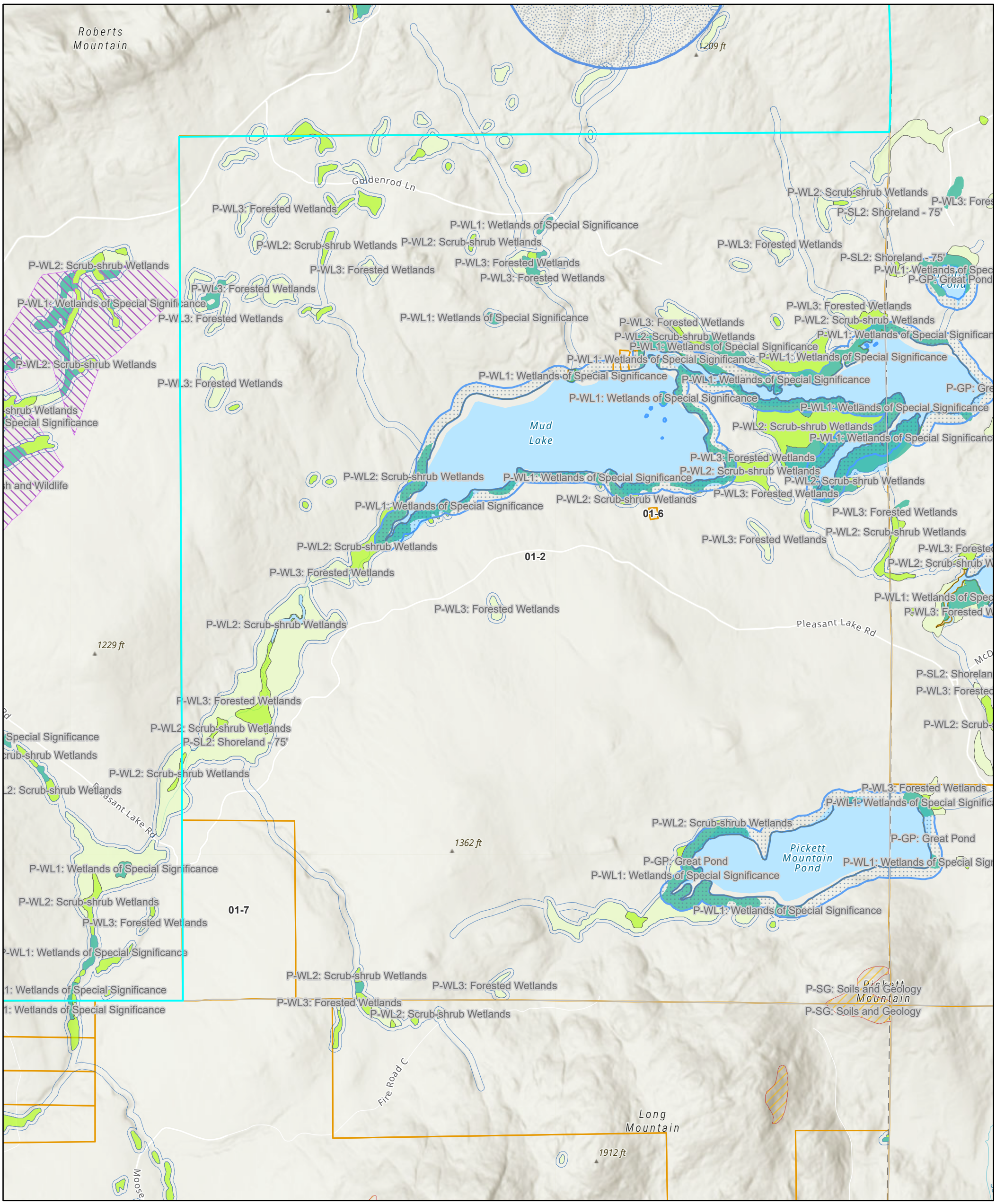
**Land Division History** Applicant/Project Name: **Wolfden MT Chase (Tract 3200)**

Parcel shown as **Map PE009 Plan 01 Lots 2 and 7, T6 R6 WELS, Penobscot County**
January 13, 2023

| **Drawing (does not have to be to scale)** | **Transaction Details, Including Names of Seller/Grantor and Buyer/Grantee** | **Date of Transaction** | **Book & Page Numbers** | **Lot Size *(in acres)*** |
|---|---|---|---|---|
| | | | | |
| | The combined Parcel shown as Map PE009 Plan 01 Lots 2 and 7, T6 R6 WELS, Penobscot County is owned by J. M. Huber Corporation by virtue of deeds from (i) Wilfred A Finnegan, Jr et al., and (ii) the State of Maine | 01/1/2002 (beginning of 20-year search) | Book 1609 Page 256; Book 2700 Page 207 | 7136.18 ac. |
| | Entire Parcel conveyed by J. M. Huber Corporation to Huber Timber LLC | 11/30/2007 | Book 11226 Page 193 | 7136.18 ac. |
| See attached 2008 Plan of "Gallagher Addition" (Penobscot Plan File 2008-86) | Parcel shown as Map PE009 Plan 01 Lot 2.1, T6 R6 WELS, Penobscot County is conveyed by Huber Timber LLC to Raye M. Porter, Kathy L. Grant and Chris R. Gallagher. This was a conveyance to an abutter, since at the time those same grantees owned the adjacent lot shown as Map PE009 Plan 01 Lot 5.1 (see Bk 9535 Pg 291) | 04/24/2008 | Book 11374 Page 213 | 1.18 ac. |

| | | | | |
|---|---|---|---|---|
| See attached LUPC Plan | Entire remaining Parcel shown as Map PE009 Plan 01 Lots 2 and 7, T6 R6 WELS, Penobscot County is conveyed by Huber Timberlands LLC to Sylvan Timberlands, LLC | 11/16/2009 | Book 11981 Page 165 | 7135 ac. |
| | Entire Parcel is conveyed by Sylvan Timberlands, LLC to Wolfden Mt. Chase LLC | 11/13/2017 | Book 14672 Page 27 | 7135 ac. |
| | There is one existing Lease Agreement of a campsite to Stanley Grass Jr.; Wolfden Mt. Chase LLC (current landlord) reports that the site has been continuously leased (to Stanley Grass Jr. and his predecessors) since before 2002. | Pre-2002 | N/A | N/A |

# LUPC Zoning and Parcel Viewer




7/18/2022, 5:23:37 PM

Maine Towns

Zones

- P-FW: Fish and Wildlife
- P-GP: Great Pond
- P-RR: Recreation
- P-SG: Soils and Geology
- P-SL2: Shoreland - 75'
- P-WL1: Wetlands of Special Significance
- P-WL2: Scrub-shrub Wetlands
- P-WL3: Forested Wetlands
- Unorganized Territory Parcels

1:36,112

0 0.28 0.55 1.1 mi

0 0.45 0.9 1.8 km

Province of New Brunswick, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS

Maine Land Use Planning Commission
2018

2008-86

## LEGEND

⊙ 5/8" DIAM. IRON REBAR SET WITH PLASTIC, YELLOW CAP ENGRAVED, "MCNALLY L.S., P.L.S. #2325", PROJ. 1.0'

BOUNDARY

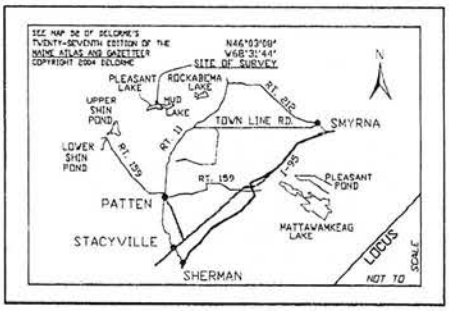
ABUTTERS BOUNDARIES

EDGE OF GRAVEL

APPROX. MEAN HIGH WATER

N

(See Note #1)




## NOTES:

1. BEARINGS ARE TRUE BEARINGS BASED ON a READING FROM A HANDHELD SILVA COMPASS. GPS WAS NOT USED FOR A BASIS OF BEARINGS. THE MAINE STATE PLANE EAST COORDINATES PROVIDED AT POINTS 1 AND 2 ON THIS PLAN WERE OBTAINED USING ASHTECH PROMARK2 SINGLE FREQUENCY RECEIVERS AND WERE OBTAINED AT THE JOBSITE FOR THE SOLE PURPOSE OF PROVIDING A LOCATION OF THE PROPERTY ON THE FACE OF THE EARTH.

2. NUMBERS IN PARENTHESES ARE RECORD DISTANCES. CIRCLED LETTERS AND NUMBERS ARE SHOWN TO FACILITATE REFERENCE TO MONUMENTS, BOUNDARY CORNERS AND POINTS OF INTEREST. THE SURVEYED BOUNDARY IS DEPICTED BY CORNERS C-D-F-G-C

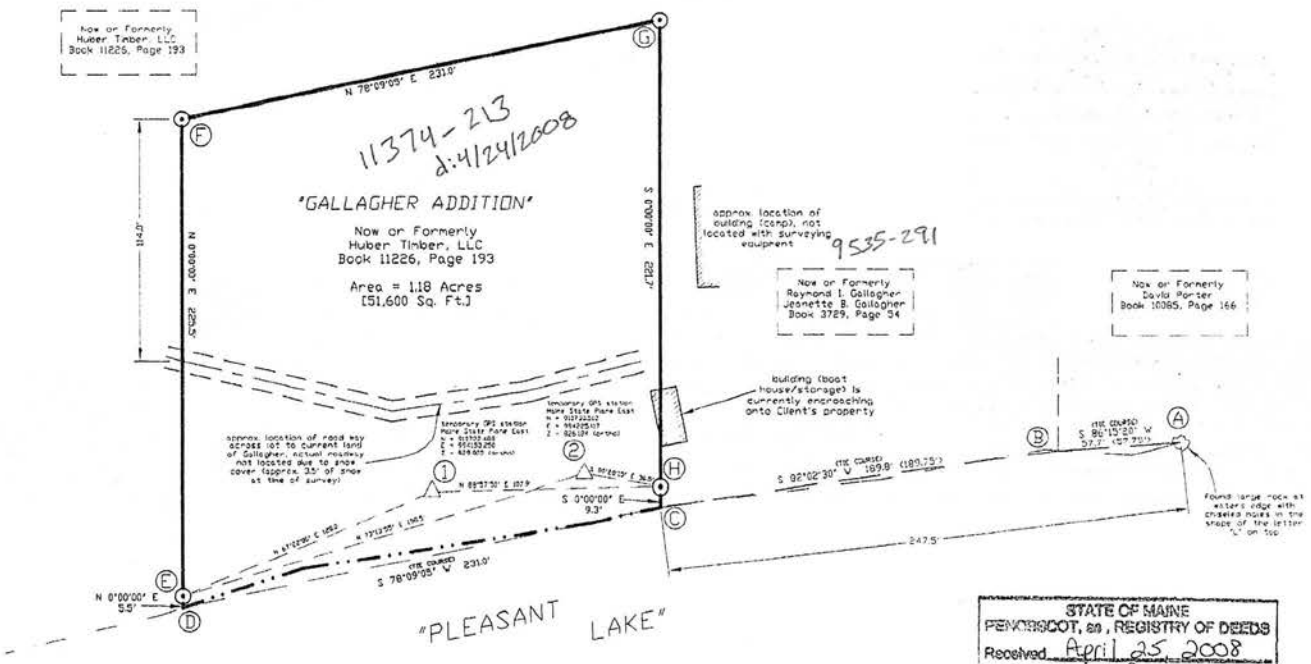
3. THE PROPERTY CURRENTLY OWNED BY THE GALLAGHERS INCLUDES AN EASEMENT OVER THE EXISTING ROAD LEADING WESTERLY FROM ROUTE 11 AROUND THE SOUTH, WEST AND NORTH SIDES OF PLEASANT LAKE. THE EASEMENT BOUNDARIES WERE NOT LOCATED OR DEFINED. THE PROPOSED CONVEYANCE SHOULD ALSO INCLUDE AN EASEMENT.

THE SURVEYED PROPERTY IS SUBJECT TO AN EASEMENT APPURTENANT TO THE PROPERTY OF DAVID PORTER (SEE PORTER'S DEED).

4. "DIMENSIONAL REQUIREMENTS", SUCH AS LOT SIZES CAN BE FOUND IN CHAPTER 3: "LAND USE STANDARDS" OF THE LAND USE DISTRICTS AND STANDARDS, (CHAPTER 10 OF THE COMMISSION'S RULES AND STANDARDS). THE MINIMUM SIDELINE SETBACK FROM PROPERTY LINES IS 15'. THE CLIENTS SHOULD CONTACT THE LAND USE REGULATION COMMISSION (LURC) PRIOR TO MAKING IMPROVEMENTS TO THE PROPERTY.

5. A NEW DESCRIPTION AND REPORT OF SURVEY WERE PREPARED AS A RESULT OF THIS SURVEY. SEE REPORT OF SURVEY FOR ADDITIONAL INFORMATION.

6. THE GROUND WAS COVERED WITH APPROXIMATELY 3.5' OF SNOW AT THE TIME OF THE FIELD SURVEY. THE LOCATION OF THE ROAD AND MEAN HIGH WATER LINE WERE APPROXIMATE.




STATE OF MAINE
PENOBSCOT, ss., REGISTRY OF DEEDS
Received April 25, 2008
at 1 h 33 m P M, and recorded
in Plan File 2008-86
ATTEST:
Susan F. Bulay
REGISTER

THIS SURVEY WAS PERFORMED UNDER MY DIRECTION IN ACCORDANCE WITH CHAPTER 90, "STANDARDS OF PRACTICE" OF THE "RULES" OF THE MAINE BOARD OF LICENSURE FOR PROFESSIONAL LAND SURVEYORS. THIS PLAT REPRESENTS MY PROFESSIONAL OPINION OF THE BOUNDARY SURVEYED, THAT THE BOUNDARIES ARE IN HARMONIOUS AGREEMENT WITH RECORDED AND UNRECORDED DOCUMENTS AND EVIDENCE LOCATED ON THE GROUND.

STATE OF MAINE
GARTH B. McNALLY
2325
PROFESSIONAL LAND SURVEYOR

SEAL

GARTH B. McNALLY, P.L.S. #2325

March 20, 2008
DATE

STATE OF MAINE
PENOBSCOT SS. REGISTRY OF DEEDS
RECEIVED _____
AT ___H___M___M. AND RECORDED
INSTRUMENT NO. _____
FILE _____ NO. _____
ATTEST
_____
REGISTER

BOUNDARY SURVEY OF A PORTION OF THE LAND OWNED BY HUBER TIMBER LLC ON THE NORTH SHORE OF PLEASANT LAKE IN TOWNSHIP 6 RANGE 6, W.E.L.S., COUNTY OF PENOBSCOT AND STATE OF MAINE

LOCATED:
On the north shore of Pleasant Lake about 600' west of its outlet running to Mud Lake, generally located at 46°09'33.2" N latitude and 68°27'39.3" W longitude

OWNED BY AND SURVEYED FOR:
Huber Resources Corporation
P.O. Box 554
Old Town, ME 04468

REFERENCE PLANS:
No Reference Plans were used for this survey.


MCNALLY LAND SURVEYORS
781 HAPPY CORNER RD., PATTEN, ME 04765
PHONE: (207)528-6500 FAX: (207)528-6165
email: surveyit@pwrelessnet


Field survey performed on March 13, 2008

SCALE:
1 INCH = 40 FEET
40 20 0 40 80 120

DATE: MARCH 20, 2008
JOB #: 07-24
CALCS: GBM
DRAFT BY: GBM

# EXHIBIT 6.0 STRUCTURES, FEATURES, AND USES

## 6.1 SITE CONDITIONS

The following sections describe the present condition of 1) the Wolfden property, and 2) the area to be rezoned (Project Area), including water features, water frontage, wetlands, slope and topography, existing vegetation, timber harvesting activities, special natural areas, and cultural/historical conditions and features. These features are discussed in additional detail in **Exhibit 10 – Surrounding Uses & Anticipated Impacts, Exhibit 16 – Harmonious Fit and Natural Character, Exhibit 23 – Soil Suitability, Exhibit 25 – Archaeological and Historic Resources,** and **Exhibit 26 – Rare or Special Plant Communities and Wildlife Habitat**.

### 6.1.1 Water Features

The Wolfden property includes lakes, ponds, and streams, including Pleasant Lake, Pickett Mountain Pond, Mud Pond, and West Branch of the Mattawamkeag River (**Figure 6-1**). The Project Area does not contain lakes, ponds or rivers. Numerous streams (ephemeral, intermittent and perennial) are located on the Wolfden property (**Figure 6-1**) and within the Project Area (**Figures 6-1a to 6-1e),** A summary of streams surveyed within the Project Area is presented in **Attachment 6-A.**

### 6.1.2 Water Frontage

The Project Area does not have water frontage on lakes or ponds. The Project Area is approximately 5% of the total Wolfden property (**Figure 6-1**). The balance of the Wolfden property (outside the Project Area) includes Pleasant Lake and the western portions of Mud Lake and Pickett Mountain Pond (**Figure 6-1**). The water frontage of Pickett Mountain Pond is approximately 17,300 feet and wooded and includes areas outside of the Wolfden property. Combined, Pleasant and Mud lakes have a frontage of approximately 48,860 feet and are wooded. Eastern Mud Lake is outside the Wolfden property.

### 6.1.3 Wetlands

A detailed wetland and vernal pool survey was conducted in the Project Area during the growing season and amphibian breeding season in spring 2020. Additional wetland delineations and field verifications occurred in June 2022. A report of the findings of the wetland surveys is presented in **Attachment 6-A**. Wetland boundaries within the Project Area are depicted on **Figures 6-1a to 6-1e**. Within the balance of the Wolfden property outside the Project Area, LUPC mapped forested wetland and scrub-shrub wetlands are present in the surrounding drainages and streams associated with the lakes and ponds (**Figure 6-1**).

### 6.1.4 Slope and Topography

Topography within the Project Area has variable sloping where development is proposed. Minimum slopes of 2.5% to maximum slopes of 13% exist within the Project Area, and within the development locations of the Project Area slopes range from 2.4% to 9.2%. The remainder of the Wolfden property has a wide range of topographic conditions, from flat lying forested and wetland areas around the previously

mentioned lakes and streams to a series of moderate mountain peaks, including Pickett Mountain to the south (elevation 1,753 feet), a prominent ridge line in middle of the property (maximum elevation 1,330 feet), and a series of unnamed ridges north of Pleasant Lake ranging from 1,146 feet to 1,100 feet. The steepest hill slopes are around Pickett Mountain, which rises approximately 710 feet above Pickett Mountain Pond.

### 6.1.5 Existing Vegetation

The Project Area includes a network of logging access roads and remnants of old skidder trails are present throughout. Much of the Project Area has been logged at various points in the past and is currently in vegetative re-growth. The Project Area is dominated by forested upland, with several large, forested wetland complexes and many smaller wetlands throughout. There is a large hill in the southwest portion of the Project Area, and topography slopes up to the north and to the east through much of the Project Area. The crest and side slopes of the hill are characterized by moderately shallow soils. Tree species in the upland forested areas include American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), gray birch (*Betula populifolia*), paper birch (*Betula papyrifera*), eastern white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), and balsam fir (*Abies balsamea*). The upland sapling and shrub layer is dominated by regenerating species present in the forest canopy, as well as striped maple (Ac*er pensylcanicum*) and hobblebush (*Viburnum lantanoides*). The upland herbaceous layer is dominated by evergreen wood fern (*Dryopteris intermidia*), Canada mayflower (*Maianthemum canadense*), and Canadian bunchberry (*Cornus canadensis*).

Forested wetlands within the Project Area are dominated by yellow birch (*Betula allenghanis*), balsam fir, red maple, black ash (*Fraxinus nigra*) and eastern arbovitae (*Thuja occidentalis*) in the tree layer. Dominant vegetation in the shrub layer of these wetland areas includes young tree species, speckled alder (*Alnus incana*), and pussy willow (*Salix discolor*). The herbaceous wetland layer includes wood horsetail (*Equisetum sylvaticum*), sensitive fern (*Onoclea sensibilis*), lady fern (*Athyrium angustum*), cottongrass bulrush (*Scirpus cyperinus*), fowl manna grass (*Glyceria striata*), spotted touch-me-not (*Impatians capensis*), nodding sedge (*Carex gynandra*), interrupted fern (*Osmunda claytoniana*), melic manna grass (*Glyceria melicaria*), bristly dewberry (*Rubus hispidus*), three-seed sedge (*Carex trisperma*), and necklace sedge (*Carex projecta*). See **Attachment 6-A** for additional detail.

It is expected that the forest habitat in the remaining balance of the Wolfden property is dominated by similar vegetation types as were documented in the Project Area.

### 6.1.6 Timber Harvesting Activities

The Project Area and the Wolfden property are in vegetative regrowth from past logging efforts. Wolfden actively leases its timber rights to a local logging company, preserving productive use of its working forests. The undeveloped areas of the Project Area will not be harvested during the life of the Project. The Wolfden property will remain a forest resource for lumber and fiber production.

### 6.1.7 Special Natural Areas

Special natural areas were not observed in the Project Area during site reconnaissance for the wetland delineation. The Maine Natural Areas Program (MNAP) prepared an environmental site review and identified no rare botanical features in the Project Area based on available data. A Stantec botanist conducted a desktop analysis of the potential for rare botanical features and concluded "the Project site has low to very low potential to support rare or exemplary botanical resources based on a review of the available ecological site data, landscape position, and past disturbances from forestry operations. As such, botanical field surveys are not recommended at this time." See **Exhibit 26 – Rare or Special Plant Communities and Wildlife Habitat** for additional information.

### 6.1.8 Cultural/Historical Conditions and Features

A Phase 0 archeological survey was conducted in spring 2020 with a follow-up survey in summer 2022. The scope of the survey was developed in consultation with the Maine Historic Preservation Commission (MHPC) to identify the potential presence of historic or prehistoric cultural features. Results are presented in **Exhibit 25, Attachment 25-A Archaeological Phase 0 Assessment**. The Phase 0 assessment of the proposed Project Area indicates that five areas of the proposed project are archaeologically sensitive for the presence of Native American archaeological sites. All five areas extend, at least partially, into the current Project Area. Four of these archaeologically sensitive areas (ASAs) (ASA 1–3 and 6) are locations of outcropping "cherty rhyolite", which is a knappable lithic material of a type known to have been used by Native Americans to make stone tools. The artifacts from the nearby previously identified Native American site, 147.001, may be of this material, or a very similar type. These areas are defined as sensitive for archaeological sites representing Native American quarry or workshop sites. The Project design avoids these areas. They will be investigated with a Phase 1 survey during final design under MDEP Chapter 200 rules. The Project Area is not considered sensitive for the presence of Euroamerican archaeological resources. All areas outside of the defined ASAs are considered to possess low sensitivity for the presence of Native American archaeological sites.

### 6.1.9 Surficial and Bedrock Geology

Surficial geology for the Project Area and surrounding 3-mile radius is presented on **Figure 6-2**. The surficial geologic units include Till, Bedrock, and Eskers, which are defined as follows:

- Till is debris (boulders, soil, gravel, sand, silt, etc.) left behind by the glaciers.
- Bedrock is dominantly rock outcrops.
- Eskers (sand and gravel) represent glacial drainage channels and fluvial sedimentation points related to glaciers.

Bedrock geology for the Project Area and surrounding 3-mile radius is presented on **Figure 6-3**.

## 6.2 STRUCTURES

**Table 6-1** lists proposed structures or development within the Project Area and includes structure type, dimensions, duration in place, and distances to roads, property lines, ponds/lakes, streams, and wetlands. Proposed structures are presented with associated Map ID in **Exhibit 2, Figure 2-1**.

## 6.3 INFRASTRUCTURE

**Table 6-2** lists proposed infrastructure (road and utilities) leading to and within the Project Area and includes infrastructure type, dimensions, and distances to roads, property lines, ponds/lakes, streams, and wetlands. Existing and proposed infrastructure is presented in **Exhibit 2, Figure 2-1**.

**Table 6-1: Existing and Proposed Structures or Development within the Project Area**

| Map ID | Type of Structure and Use (specify if temporary) | Duration in Place if Temporary (specify days or months) | *Current* Exterior Dimensions (LxWxH) in ft | *Proposed* Exterior Dimensions (LxWxH) in ft | | | Distance (in ft) of structure from nearest: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Length | Width | Height | Road | Property line | Lake or pond | River or stream | Wetland | Ocean/Coastal Wetland |
| **Existing Structures** | | | | | | | | | | | | |
| | No existing structures | NA | NA | NA | | | NA | NA | NA | NA | NA | NA |
| **Proposed Structures** | | | | | | | | | | | | |
| 1 | Solar Facility | 15 years plus | NA | 2290 | 885 | 5 to 8 | 0 | 430 | 3150 | 772 | 113 | NA |
| 2 | Low Grade Ore Storage Pad | 10–15 years | NA | 676 | 355 | 65 | 0 | 962 | 2840 | 1065 | 254 | NA |
| 3 | Snow Storage | 10–15 years | NA | 535 | 210 | 30 | 0 | 492 | 2726 | 1250 | 392 | NA |
| 4 | Pre-Treatment Water Storage Pond | 10–15 years | NA | 485 | 292 | 10 | 170 | 504 | 2339 | 957 | 272 | NA |
| 5 | Water Treatment Facility | 10–15 years | NA | 160 | 92 | 30 | 142 | 560 | 2608 | 1195 | 546 | NA |
| 6 | Electric Substation | 15 years plus | NA | 50 | 40 | 30 | 188 | 897 | 2633 | 1080 | 440 | NA |
| 7 | Back-up Power Generation (Diesel or Propane) | 10–15 years | NA | 30 | 20 | 10 | 120 | 993 | 2704 | 1060 | 357 | NA |
| 8 | Post-Treatment Water Storage Pond | 10–15 years | NA | 400 | 260 | 10 | 276 | 695 | 2354 | 633 | 109 | NA |
| 9 | Water Recharge Area #1 | 10–15 years | NA | 968 | 280 | -2 to 4 | 346 | 415 | 2047 | 340 | 206 | NA |
| 10 | Fire Water Pumphouse | 10–15 years | NA | 24 | 16 | 10 | 180 | 842 | 2338 | 570 | 230 | NA |
| 11 | Sanitary Subsurface Wastewater Disposal System | 10–15 years | NA | 66 | 42 | -2 to 4 | 0 | 988 | 2636 | 636 | 115 | NA |
| 12 | Parking Facility | 10–15 years | NA | 298 | 128 | 0 | 0 | 1030 | 2620 | 928 | 144 | NA |
| 13 | Warehouse | 10–15 years | NA | 100 | 60 | 30 | 0 | 403 | 2788 | 1620 | 465 | NA |
| 14 | Office and Mine Rescue Facility | 10–15 years | NA | 84 | 100 | 20 | 0 | 1428 | 2985 | 1024 | 268 | NA |
| 15 | Core Shack and Storage | 10–15 years | NA | 60 | 60 | 20 | 0 | 1580 | 3058 | 1024 | 486 | NA |
| 16 | Laydown (Equipment/Supplies Storage) | 10–15 years | NA | 157 | 155 | 0 | 68 | 1260 | 2755 | 753 | 102 | NA |
| 17 | Maintenance Shop | 10–15 years | NA | 80 | 60 | 30 | 158 | 1438 | 2940 | 880 | 370 | NA |
| 18 | Equipment Fueling Station | 10–15 years | NA | 50 | 40 | 12 | 132 | 1622 | 3120 | 1020 | 570 | NA |
| 19 | Water Recharge Area #2 | 10–15 years | NA | 1290 | 196 | -2 to 4 | 90 | 973 | 2600 | 580 | 107 | NA |
| 20 | Waste Rock Storage Pad #1 | 10–15 years | NA | 850 | 192 | 50 | 0 | 1463 | 3362 | 565 | 230 | NA |
| 21 | Backfill Plant | 10–15 years | NA | 50 | 50 | 20 | 122 | 1707 | 3202 | 860 | 517 | NA |
| 22 | Ore (Mill Feed) Storage Pad #1 | 10–15 years | NA | 436 | 125 | 35 | 140 | 1568 | 3077 | 430 | 222 | NA |
| 23 | Blast Shack | 10–15 years | NA | 30 | 30 | 12 | 322 | 1524 | 3072 | 780 | 370 | NA |
| 24 | Mine Access (Portal) | 10–15 years | NA | 280 | 60 | -32 | 300 | 1465 | 3030 | 660 | 274 | NA |

| Map ID | Type of Structure and Use (specify if temporary) | Duration in Place if Temporary (specify days or months) | *Current* Exterior Dimensions (LxWxH) in ft | *Proposed* Exterior Dimensions (LxWxH) in ft | | | Distance (in ft) of structure from nearest: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Length | Width | Height | Road | Property line | Lake or pond | River or stream | Wetland | Ocean/Coastal Wetland |
| 25 | East Ventilation Raise | 10–15 years | NA | 10 | 10 | 10 | 460 | 992 | 2745 | 665 | 309 | NA |
| 26 | Organics Storage | 10–15 years | NA | 456 | 425 | 15 | 566 | 430 | 4600 | 788 | 192 | NA |
| 27 | Water Recharge Area #3 | 10–15 years | NA | 366 | 206 | -2 to 4 | 690 | 731 | 4227 | 456 | 90 | NA |
| 28 | Headframe and Hoist | 10–15 years | NA | 62 | 52 | 120 | 464 | 1178 | 4088 | 922 | 152 | NA |
| 29 | Ore (Mill Feed) Storage Pad #2 | 10–15 years | NA | 305 | 145 | 40 | 360 | 916 | 4182 | 965 | 112 | NA |
| 30 | Waste Rock Storage Pad #2 | 10–15 years | NA | 305 | 145 | 40 | 360 | 982 | 4182 | 965 | 112 | NA |
| 31 | Temporary Explosives Storage | 10–15 years | NA | 60 | 30 | 8 | 75 | 620 | 4145 | 595 | 286 | NA |
| 32 | West Ventilation Raise | 10–15 years | NA | 10 | 10 | 10 | 728 | 558 | 4893 | 1422 | 238 | NA |
| 33 | Water Recharge Area #4 | 10–15 years | NA | 1345 | 100 | -2 to 4 | 197 | 424 | 3166 | 1852 | 223 | NA |
| 36 | Security Guard House/Gate | 10–15 years | NA | 20 | 10 | 10 | 0 | 356 | 2682 | 1659 | 290 | NA |
| 37 | Security fencing | 10–15 years | NA | NA | NA | 6 | 0 | 417 | 3150 | 772 | 113 | NA |
| 38 | Water Recharge Area #5 | 10–15 years | NA | 890 | 100 | -2 to 4 | 197 | 418 | 2616 | 794 | 110 | NA |
| 39 | Water Recharge Area #6 | 10–15 years | NA | 1236 | 100 | -2 to 4 | 0 | 989 | 3420 | 885 | 401 | NA |

Key: ft = feet; H = height; ID = identification number; L = length; NA = not applicable; W = width

### Table 6-2: Existing and Proposed Infrastructure within the Project Area

| Infrastructure Type and Use (specify if temporary) | Proposed Alterations (check all that apply) | | | | | | | Dimensions (WxL) in ft | Year Built or Duration (if temporary) | Average Slope (%) | Max. Sustain. Slope (%) | Distance (in ft) of infrastructure from nearest: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Change in Use | New Construction | Change Dimensions | Reconstruct or Replace | Relocate | Change Setbacks | Other | | | | | Road | Property line | Lake or pond | River or stream | Wetland | Ocean/Coastal Wetland |
| **Existing Infrastructure** | | | | | | | | | | | | | | | | | |
| Existing Gravel Logging Roads | X | □ | X | □ | □ | □ | □ | 15–25 W by 23,235 L | Unknown | 4.5% – To be verified with future survey data | 13% – To be verified with future survey data | 0 | 0 | 310 | 5 | 3 | NA |
| **Proposed Infrastructure** | | | | | | | | | | | | | | | | | |
| Proposed Site Roads | □ | X | □ | X | □ | □ | □ | 22–26 W by 27,320 L | | 4.5% – To be verified with future survey data | 13% – To be verified with future survey data | 0 | 0 | 310 | 5 | 3 | NA |
| Utility Line | □ | X | □ | □ | □ | □ | □ | 18 W by 23,2760 L – Follow existing gravel road from Route 11 | | 4.5% – To be verified with future survey data | 13% – To be verified with future survey data | 5 | 0 | 310 | 5 | 3 | NA |

Key: ft = feet; L = length; NA = not applicable; W = width

# EXHIBIT 6 FIGURES

Figure 6-1: Wolfden Parcel Map and Detailed Maps of Rezone Boundaries

Figure 6-2: Surficial Geology

Figure 6-3: Bedrock Geology

# EXHIBIT 6 ATTACHMENTS

Attachment 6-A: Wetland and Watercourse Delineation and Potential Vernal Pool Survey Report

## Figure 6-1: Wolfden Parcel Map and Detailed Maps of Rezone Boundaries

WOLFDEN

N/F Aroostook Timberlands, LLC
Tax Map 1, Lot 1
P.C. Book 6980, Page 329

N/F Aroostook Timberlands, LLC
Tax Map 1, Lot 1
P.C. Book 6980, Page 329

N/F Lakeville Shores, Inc.
Moro Tax Map 1, Lot 3
A.C. Book 4868, Page 93

Figure 6-1a

Figure 6-1b

Figure 6-1c

Figure 6-1d

Figure 6-1e

Permanent Bridge over Pickett Pond Outlet

N/F Herbert C. Haynes, Inc. & Lakeville Shores, Inc.
Moro Tax Map 1, Lot 1
A.C. Book 4230, Page 111

N/F Cassidy Timberlands, LLC
Mount Chase Tax Map 1, Lot 7
P.C. Book 9975, Page 337

N/F Gardner Land Company, Inc.
Mount Chase Tax Map 1, Lot 8
P.C. Book 13713, Page 223

N/F Herbert C. Haynes, Inc. & Lakeville Shores, Inc.
Hersey Tax Map 3, Lot 1
A.C. Book 4937, Page 184

Image Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

N

0 500 1,000 Feet

Prepared/Date: BRP 10-12-22 | Checked/Date: MAP 10-12-22

# Figure 6-1
# Existing & Proposed Site Conditions

## LEGEND

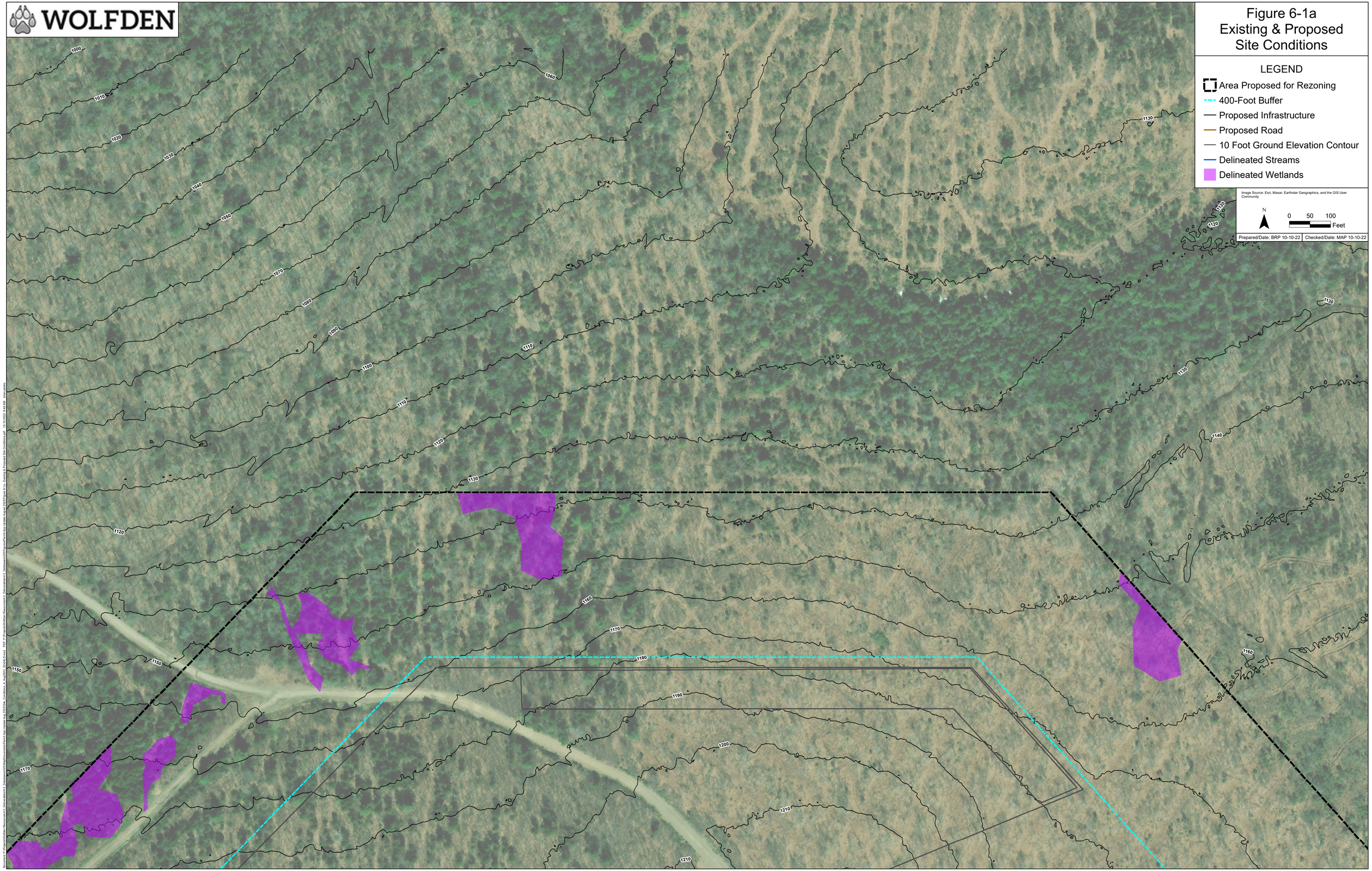
- Area Proposed for Rezoning
- Extent of 1 inch to 100 feet scale map
- 400-Foot Buffer
- Proposed Infrastructure
- Proposed Road
- Existing Gravel Access Road (Private Property)
- Existing Road
- Approximate Property Line
- Abutters Property Line
- 20 Foot Ground Elevation Contour
- Delineated Streams
- Delineated Wetlands
- Vernal Pool
- Potential Vernal Pool
- Waterbody

LUPC Wetlands:

- P-WL1: Wetlands of Special Significance
- P-WL2: Scrub-shrub Wetlands
- P-WL3: Forested Wetlands

WOLFDEN

# Figure 6-1a
# Existing & Proposed Site Conditions




LEGEND

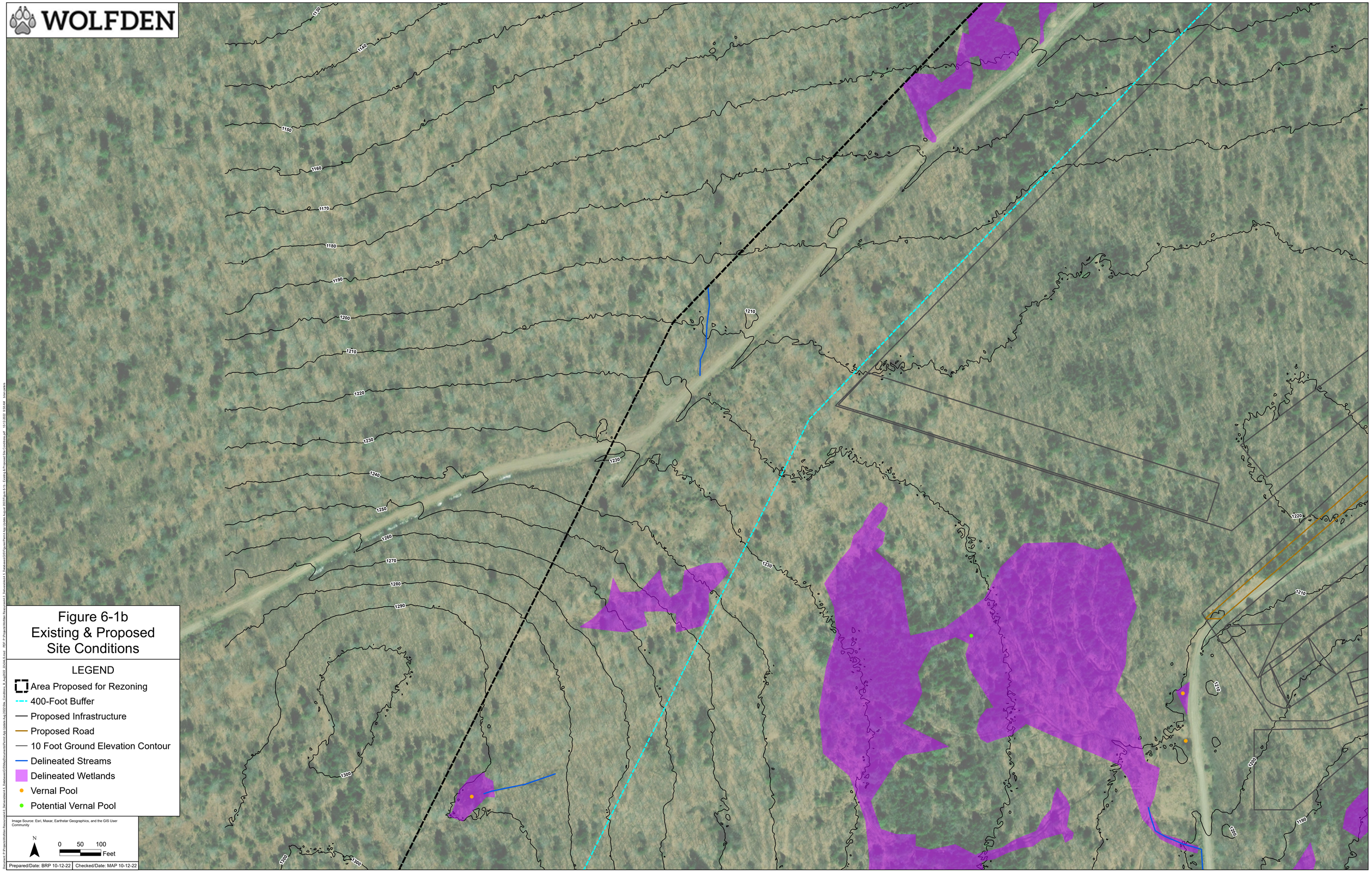
- Area Proposed for Rezoning
- 400-Foot Buffer
- Proposed Infrastructure
- Proposed Road
- 10 Foot Ground Elevation Contour
- Delineated Streams
- Delineated Wetlands

Image Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

N

0 50 100 Feet

Prepared/Date: BRP 10-10-22 | Checked/Date: MAP 10-10-22


WOLFDEN
Figure 6-1b
Existing & Proposed
Site Conditions
LEGEND
Area Proposed for Rezoning
400-Foot Buffer
Proposed Infrastructure
Proposed Road
10 Foot Ground Elevation Contour
Delineated Streams
Delineated Wetlands
Vernal Pool
Potential Vernal Pool
Image Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
N
0 50 100
Feet
Prepared/Date: BRP 10-12-22
Checked/Date: MAP 10-12-22

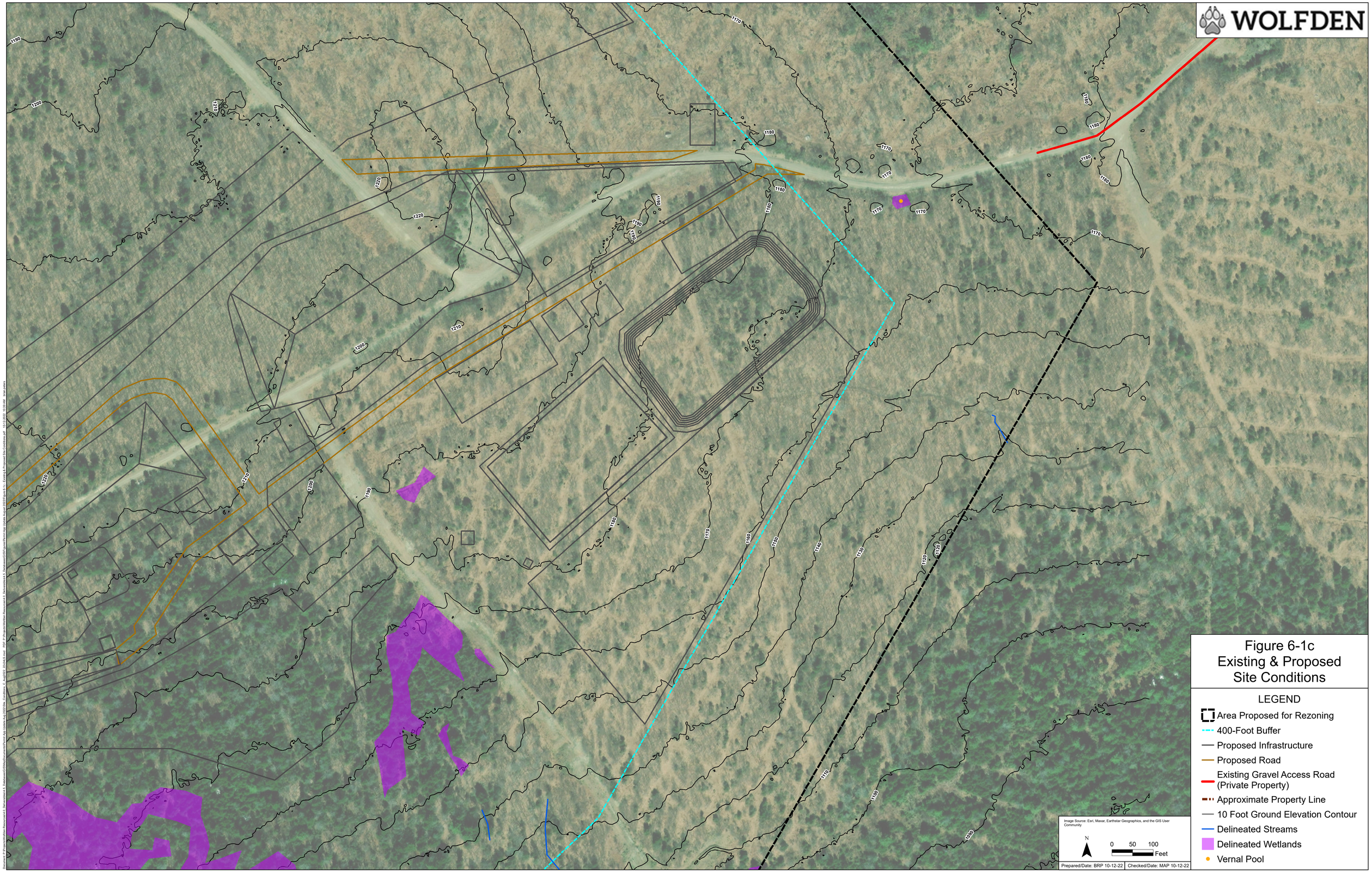



Figure 6-1c
Existing & Proposed
Site Conditions

LEGEND

- Area Proposed for Rezoning
- 400-Foot Buffer
- Proposed Infrastructure
- Proposed Road
- Existing Gravel Access Road (Private Property)
- Approximate Property Line
- 10 Foot Ground Elevation Contour
- Delineated Streams
- Delineated Wetlands
- Vernal Pool

WOLFDEN

# Figure 6-1d
# Existing & Proposed Site Conditions

LEGEND

- Area Proposed for Rezoning
- 400-Foot Buffer
- Proposed Infrastructure
- Proposed Road
- 10 Foot Ground Elevation Contour
- Delineated Streams
- Delineated Wetlands
- Vernal Pool
- Potential Vernal Pool

LUPC Wetlands:

- P-WL3: Forested Wetlands

Image Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

N

0 50 100 Feet

Prepared/Date: BRP 10-12-22 | Checked/Date: MAP 10-12-22

Designed P:\Projects\Wolfden Resources LLC Generation II & Database\GIS\Maps\Documents\Frame Adj Updates Aug 2022\Site Conditions_Q Aug2022_22A3x4.mxd PDF P:\Projects\Wolfden Resources LLC Generation II & Database\GIS\Exports\Permit App Update August 2022\Figure 6-1d | Existing & Proposed Site Conditions.pdf 10-12-2022 10:13 AM kevin.waters

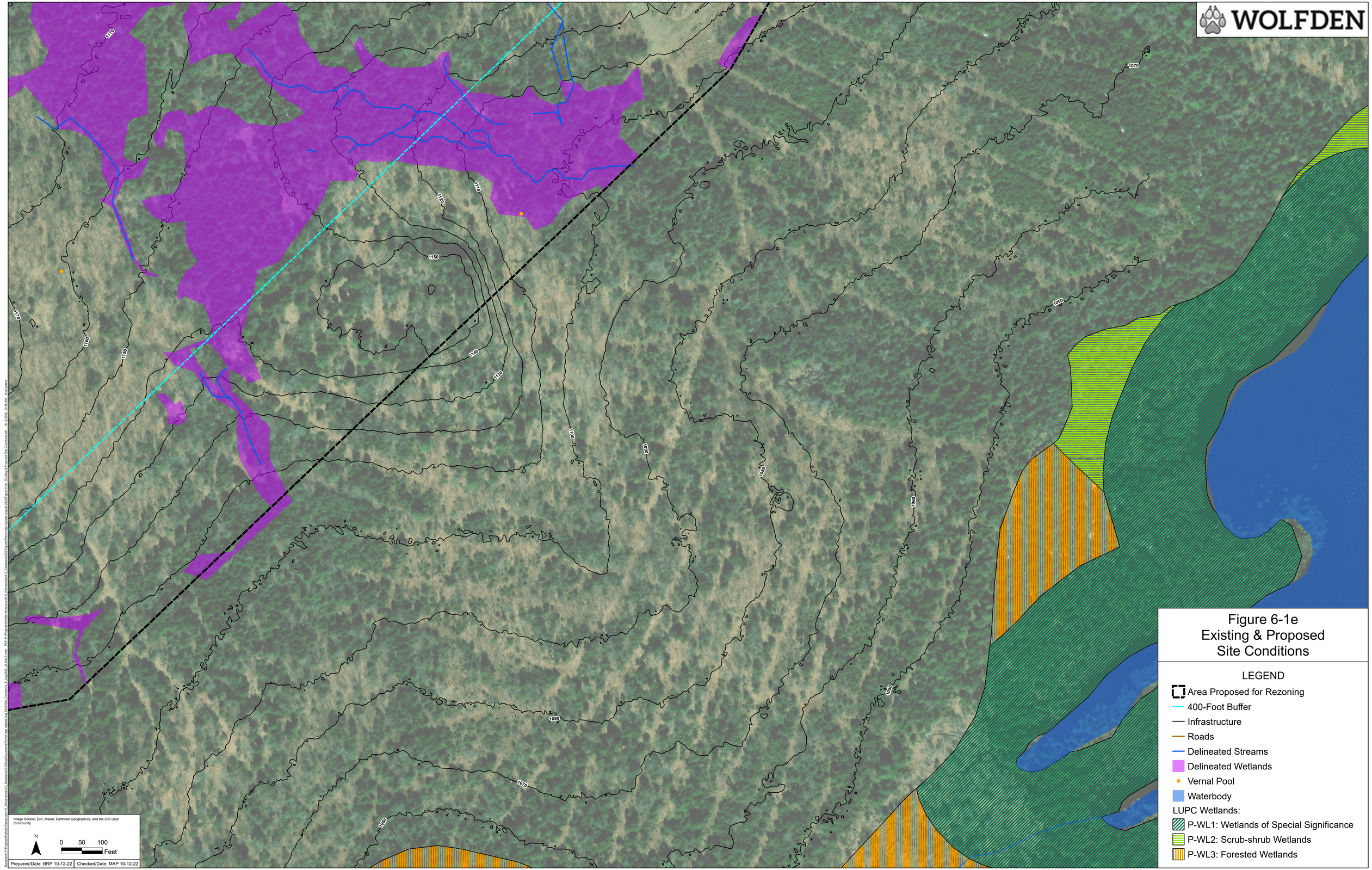

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Figure 6-1e
Existing & Proposed
Site Conditions
LEGEND
Area Proposed for Rezoning
400-Foot Buffer
Infrastructure
Roads
Delineated Streams
Delineated Wetlands
Vernal Pool
Waterbody
LUPC Wetlands:
P-WL1: Wetlands of Special Significance
P-WL2: Scrub-shrub Wetlands
P-WL3: Forested Wetlands

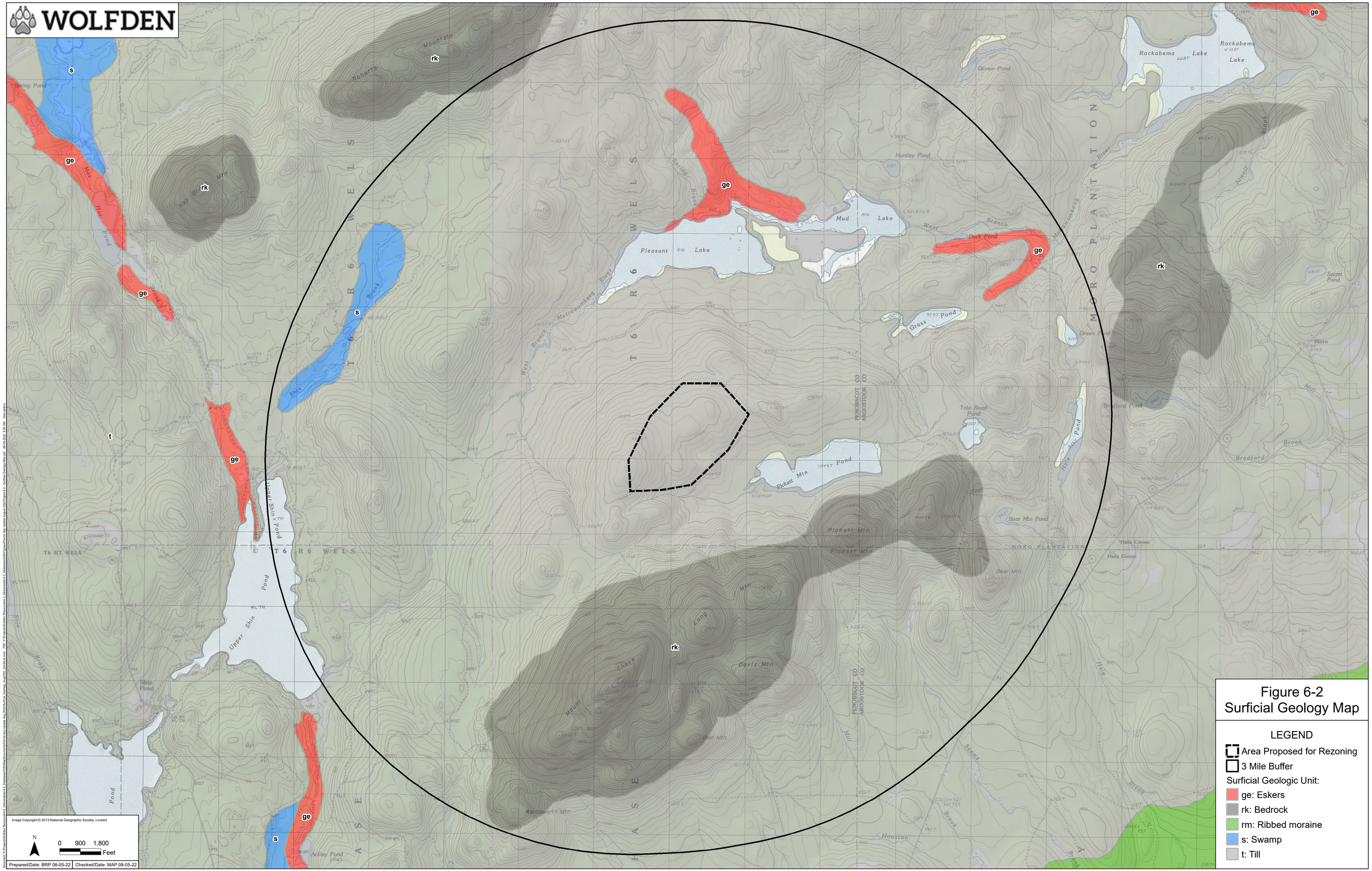
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Figure 6-2
Surficial Geology Map
LEGEND
Area Proposed for Rezoning
3 Mile Buffer
Surficial Geologic Unit:
ge: Eskers
rk: Bedrock
rm: Ribbed moraine
s: Swamp
t: Till
Image Copyright © 2013 National Geographic Society, i-cubed
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Pleasant Lake
Mud Lake
Huntley Pond
Duck Pond
Grass Pond
Tote Road Pond
Pickett Mtn Pond
Bear Mtn Pond
Upper Shin Pond
Shin Pond
Ackley Pond
Rockabema Lake
Gilman Pond
Bradford Pond
Green Pond
Secret Pond
Hot Pond
Spring Pond
Pickett Mtn
Davis Mtn
Bear Mtn
Long Mtn
Wardsworth Mtn
Roberts Mountain
Halls Corner
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MORO PLANTATION
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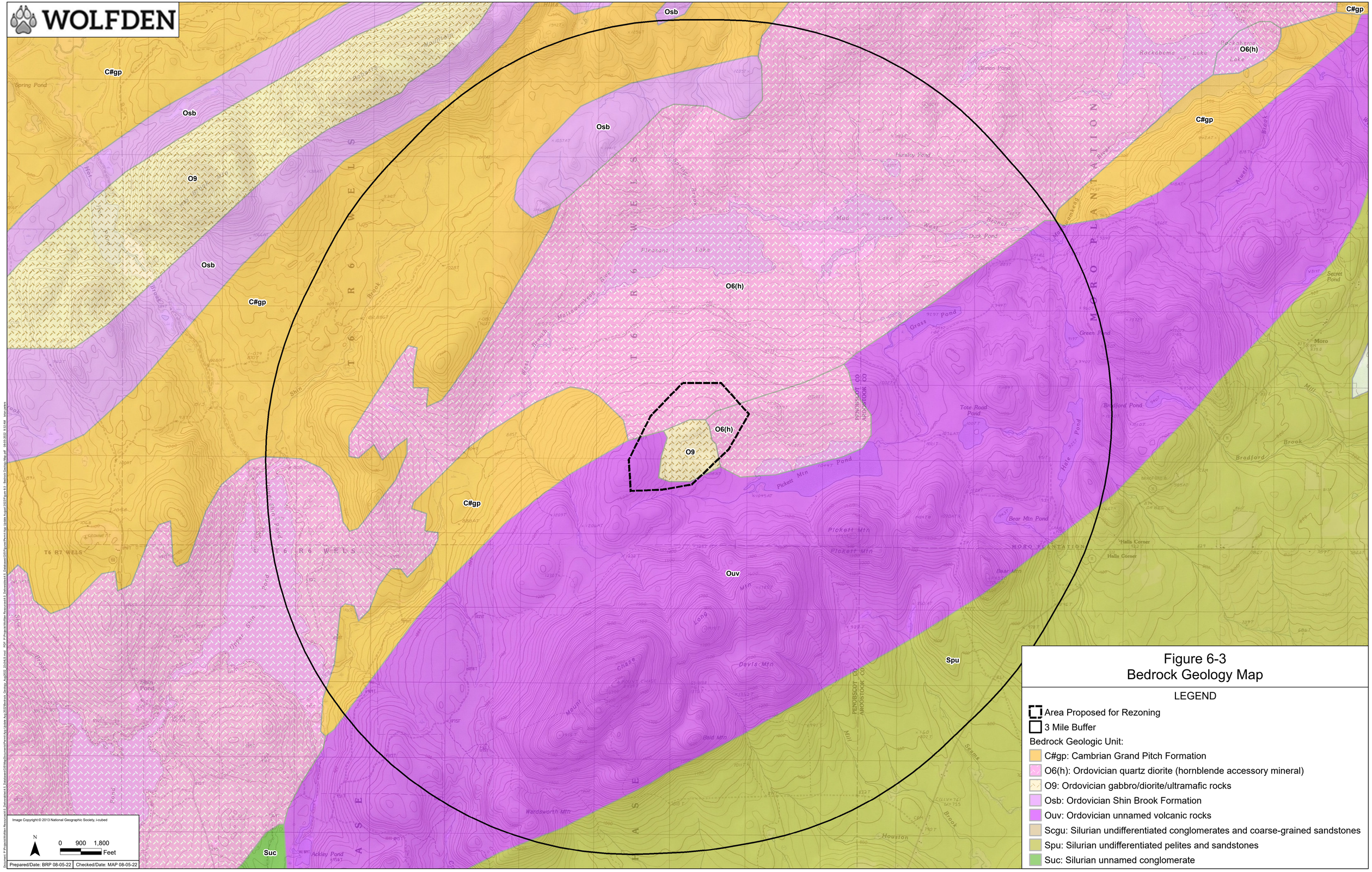


Figure 6-3
Bedrock Geology Map

LEGEND

- Area Proposed for Rezoning
- 3 Mile Buffer

Bedrock Geologic Unit:

- C#gp: Cambrian Grand Pitch Formation
- O6(h): Ordovician quartz diorite (hornblende accessory mineral)
- O9: Ordovician gabbro/diorite/ultramafic rocks
- Osb: Ordovician Shin Brook Formation
- Ouv: Ordovician unnamed volcanic rocks
- Scgu: Silurian undifferentiated conglomerates and coarse-grained sandstones
- Spu: Silurian undifferentiated pelites and sandstones
- Suc: Silurian unnamed conglomerate

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 6-A: Wetland and Watercourse Delineation and Potential Vernal Pool Survey Report

# Wetland and Watercourse Delineation and Potential Vernal Pool Survey Report

Pickett Mountain Mine – T6 R6 WELS, Maine

July 28, 2022

Prepared for:

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Prepared by:

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Topsham, ME 04086

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# 1.0 INTRODUCTION

Wolfden Resources Corporation (Wolfden) contracted Stantec Consulting Services Inc. (Stantec) to perform a wetland and watercourse verification and delineation, and potential vernal pool (PVP) survey, on a parcel in T6 R6 WELS in Penobscot County, Maine (Project Site). The Project Site is located west of Pickett Mountain Pond, approximately 10 miles north of Patten, Maine (Appendix A: Figure 1. Wetland and Watercourse Delineation Map).

Between June 14 and June 16, 2022, Stantec performed an on-site wetland and watercourse delineation, verification of previous wetland and stream boundaries delineated by others, which is further described in Section 2.0 below, and a PVP survey at the Project Site. This report includes descriptions of the wetland and watercourse delineation and verification methods, PVP survey methods, survey results, and an overview of relevant federal and state regulations.

# 2.0 METHODS

## 2.1 WETLAND AND WATERCOURSE DELINEATION

Wetlands and watercourses within the Project Site were previously identified by others in May and June 2020. These data were provided to Stantec prior to conducting our fieldwork in 2022 and are provided for reference in Appendix B. As part of considering a proposed mining operation within the Project Site, Stantec was tasked with verifying the work previously completed and documenting any new jurisdictional resources. Stantec's work and this report supports the previously completed delineation and serves as the updated and official record of delineated wetlands and other watercourses at the Project Site. Note that previously delineated boundaries were verified or altered by Stantec as necessary based on current site conditions.

In Maine's unorganized territories, the Land Use Planning Commission (LUPC) regulates impacts to wetlands and watercourses under Chapter 10 of LUPC's Land Use Districts and Standards,[1] which are also consistent with the definitions detailed in Maine State Statute 38 M.R.S.A. Sec. 480-B of the Natural Resources Protection Act (NRPA).[2] Stantec followed 38 M.R.S.A Sec. 480-B when reviewing the Project Site. Wetland boundaries were determined using the technical criteria described in the United States Army Corps of Engineers (Corps) *Corps of Engineers Wetlands Delineation Manual*[3] and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0).*[4] Wetland communities were classified according to the *Classification of*

[1] https://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Ch10_SubchapterI.pdf
[2] Title 38: Waters and Navigation, Chapter 3: Protection and Improvement of Waters, Subchapter 1: Environmental Protection Board, Article 5-a: Natural Resources Protection Act. LUPC administers the NRPA in LUPC jurisdiction under delegated authority (38 M.R.S.A. Se. 480-E-1).
[3] Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.
[4] U.S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0),* ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

*Wetlands and Deepwater Habitats of the United States.*[5] Hydric soil determinations were made in accordance with the Corps wetland delineation manuals and the *Field Indicators for Identifying Hydric Soils in New England (Version 4).*[6] Wetlands of Special Significance (WoSS; P-WL1) were identified based on criteria in Chapter 310 of the NRPA[7] , Chapter 335 Significant Wildlife Habitat,[8] and Chapter 10 of the LUPC Land Use Districts and Standards[1]. Identification of WoSS was limited to observable conditions within the Project Site Wetland delineation verifications were conducted under seasonally appropriate conditions.

Mapped watercourses (e.g., river, stream, or brook) were identified based on the technical guidance available from the Corps on the identification of an ordinary high water mark,[9] definition of a tributary as described in the Clean Water Act,[10] and as detailed in the Maine Department of Environmental Protection (MDEP) watercourse identification guidance document.[11] Data was collected on flow regime, bankfull and ordinary high water mark width, dominant substrates, and evidence of biological use to determine jurisdictional streams under NRPA and LUPC Chapter 10[1].

Each delineated resource was assigned a unique alpha-numeric code. A Global Positioning System (GPS) receiver capable of sub-meter accuracy was used to locate the wetland and watercourse boundaries. No flagging was used to mark delineated resources. Photographs were taken of each wetland and watercourse and representative photographs are included in Appendix C.

## 2.2 POTENTIAL VERNAL POOL SURVEY

Similar to wetlands and watercourses, vernal pools within the Project Site were previously identified by others in May and June 2020 during recommended survey periods identified by the Maine Department of Inland Fisheries and Wildlife (MDIFW)[12]. These data were provided to Stantec prior to conducting our fieldwork in 2022 and are provided for reference in Appendix B. During the previous surveys, eight vernal pools were identified during visits in May and June with observations made on the presence of diagnostic vernal pool characteristics (i.e., egg masses). Stantec's work and this report supports the previously completed vernal pool survey effort and serves as a supplement to the previously identified vernal pools at the Project Site.

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[5] *Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.*
[6] New England Hydric Soils Technical Committee. 2017. Field Indicators for Identifying Hydric Soils in New England (Version 4).
[7] Maine Department of Environmental Protection. 26 January 2009. Natural Resources Protection Act Chapter 310: Wetlands and Waterbodies Protection Rules. Bureau of Land and Water Quality, DEPLW0297-D2009.
[8] Maine Department of Environmental Protection. 7 January 2014. Natural Resources Protection Act Chapter 335: Significant Wildlife Habitat.
[9] U.S. Army Corps of Engineers. 2005. Regulatory Guidance Letter: Ordinary High Water Mark Identification. December 8, 2005. No. 05-05.
[10] U.S. Army Corps of Engineers. 2020. *85 Code of Federal Regulations 22250, "Waters of the United States"*. April 21, 2020.
[11] Danielson, T. J. 2018. Natural Resource Protection Act Streams, Rivers, and Brooks. Maine Department of Environmental Protection, Augusta, ME.
[12] Recommended Periods for Vernal Pool Egg Mass Survey by Geographic Region. https://www.maine.gov/dep/land/nrpa/vernalpools/timing.pdf

Stantec visited seven of the previously identified vernal pools but did not make any changes to the previously collected data. Note that previously delineated vernal pool boundaries were not verified or altered by Stantec due to the PVP survey being conducted outside the appropriate vernal pool survey periods identified by MDIFW. One of the previous vernal pool locations was outside of Stantec's area of survey. Two additional, unnatural PVPs were identified by Stantec during the wetland and watercourse delineation due to the observed presence of vernal pool species (i.e., assumed wood frog tadpoles).

Stantec conducted PVP surveys in accordance with the Maine Association of Wetland Scientists' 2014 Vernal Pool Survey Protocol (April 2014), as well as the definitions set forth in Chapter 335, Significant Wildlife Habitat, of the NRPA and the Corps General Permit (GP). PVP surveys differ from a vernal pool survey because they are performed outside the spring amphibian breeding area survey window. The PVP survey identified site features that could hold water during spring where vernal pool indicator species (e.g., Wood frogs [*Lithobates sylvaticus*] or spotted salamanders [Ambystoma maculatum]) could breed and deposit eggs, or that could contain fairy shrimp (*Eubranchipus sp.*). A GPS receiver capable of sub-meter accuracy was used to locate PVP approximate boundaries. Representative photographs were taken of PVPs and are included. Vernal pools identified during the previous 2020 survey effort were visited during the wetland delineation, but their classifications and mapped boundaries were left unaltered because Stantec's wetland delineation occurred outside the appropriate vernal pool survey season.

# 3.0 SURVEY RESULTS

## 3.1 GENERAL SITE DESCRIPTION

The Project Site surveyed by Stantec is approximately 374 acres and is located northwest of Pickett Mountain Pond and south of Pleasant Lake in T6 R6 WELS, Maine. The Project Site includes a network of logging access roads. Much of the Project Site has been logged at various points in the past, and remnants of old skidder trails are present. The Project Site is dominated by forested upland, with several large, forested wetland complexes and many smaller wetlands throughout. There is a large hill in the southwest portion of the Project Site, and topography slopes up to the north and to the east through much of the Project Site. The crest and side slopes of the hill are characterized by moderately shallow soils. Tree species in the upland forested areas include American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), gray birch (*Betula populifolia*), paper birch (*Betula papyrifera*), eastern white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), and balsam fir (*Abies balsamea*). The upland sapling and shrub layer is dominated by regenerating species present in the forest canopy, as well as striped maple (*Acer pensylcanicum*) and hobblebush (*Viburnum lantanoides*). The upland herbaceous layer is dominated by evergreen wood fern (*Dryopteris intermidia*), Canada mayflower (*Maianthemum canadense*), and Canadian bunchberry (*Cornus canadensis*).

The U.S. Department of Agriculture (USDA) Soil Survey of Penobscot County, Maine[13] depicts five major soil types within the Project Site: Dixmont very stony silt loam, Thorndike channery silt loam,

[13] Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Available at: http://websoilsurvey.nrcs.usda.gov/. Accessed July 2022.

Thorndike-Winnecook complex, Plaisted loam, and Rock outcrop-Thorndike association. The Dixmont very stony silt loam covers approximately 45% of the Project Site and stretches from the eastern border to the western border. It has a drainage class of somewhat poorly drained. Thorndike channery silt loam (22.9% of the Project Site) is a somewhat excessively drained soil and is located in the southeast section of the Project Site. The southwestern extent of the Project site consists of Thorndike-Winnecook complex (15.4%; somewhat excessively drained), and the north extent is covered by Plaisted loam (12.9%; well drained). A small section along the southeastern border is comprised of Rock outcrop Thorndike association (3.8%; excessively drained). The USDA soil report for the Project Site is included in Appendix D.

## 3.2 WETLAND, WATERCOURSE DELINEATION AND VERNAL POOL SURVEY

During the on-site fieldwork conducted between June 14 and June 16, 2022, 29 wetlands, 27 watercourses, and 2 PVPs were identified within the Project Site. As previously noted, Stantec revisited seven of the eight vernal pools previously recorded by others but did not change data related to these features geographic boundaries. Six P-WL1 (W01TTA, W01TTE, W01TTK, W02TTB, W01LPA, and W02TTK) were identified within the Project Site because they are located within 25 feet of a stream. Resources were GPS-located and are depicted on Figure 1 (Appendix A). These results are characterized in Table 1. Summary of Delineated Wetlands, Table 2. Summary of Delineated Watercourses, and Table 3. Summary of Potential Vernal Pool Surveys. Representative Corps wetland determination data forms were prepared at three locations and are included in Appendix E. Representative photographs are included in Appendix C.

## Table 1. Summary of Delineated Wetlands

| Wetland Resource Identifier | Wetland Classification[1] | Dominant Vegetation | Hydric Soil Criteria and Indicator | Evidence of Hydrology | LUPC Wetlands Protection District | Wetland of Special Significance (WoSS/P-WL1) | Additional Comments |
|---|---|---|---|---|---|---|---|
| W01TTA | PFO | **Trees:** yellow birch (*Betula allenghanis*), balsam fir (*Abies balsamica*), red spruce (*Picea rubens*), red maple (*Acer rubrum*)<br>**Saplings / Shrubs:** yellow birch, red maple, black ash (*Fraxinus nigra*)<br>**Herbs:** wood horsetail (*Equisetum sylvaticum*), sensitive fern (*Onoclea sensibilis*), lady fern (*Athyrium angustum*) | A1: Histosol | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL1 within 25-feet of stream; remainder P-WL3 | Yes, portions within 25-feet of stream | Contains intermittent stream S02TT. Continues off-site to the south. |
| W01TTB | PFO/PEM | **Trees:** red maple, yellow birch<br>**Saplings / Shrubs:** none<br>**Herbs:** cottongrass bulrush (*Scirpus cyperinus*), fowl manna grass (*Glyceria striata*), sensitive fern, spotted touch-me-not (*Impatians capensis*), nodding sedge (*Carex gynandra*) | F3: Depleted Matrix | Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | Continues off-site to the south. |
| W01TTC | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** cottongrass bulrush, fowl manna grass, sensitive fern, spotted touch-me-not, nodding sedge | F3: Depleted Matrix | Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | Continues off-site to the south. |
| W01TTD | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** cottongrass bulrush, fowl manna grass, sensitive fern, spotted touch-me-not, nodding sedge | F3: Depleted Matrix | Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | Continues off-site to the south. |
| W01TTE | PFO | **Trees:** yellow birch, red spruce, balsam fir, red maple<br>**Saplings / Shrubs:** yellow birch, red maple, black ash<br>**Herbs:** Woolgrass, fowl manna grass, sensitive fern, spotted touch-me-not, nodding sedge | F3: Depleted Matrix<br>A2: Histic Epipedon | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Drainage Patters (B10) | P-WL1 within 25-feet of stream; remainder P-WL3 | Yes, portions within 25-feet of stream | Contains intermittent streams S02TT and S03TT. Contains previously surveyed VP-D. |
| W01TTF | PEM/PFO | **Trees:** yellow birch<br>**Saplings / Shrubs:** red maple, striped maple (*Acer pennsylvanicum*)<br>**Herbs:** wood horsetail, lady fern, interrupted fern (*Osmunda claytoniana*), sensitive fern, melic manna grass (*Glyceria melicaria*) | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Drainage Patters (B10)<br>Water Stained Leaves (B9) | P-WL2 | No | Receives drainage from gravel road. |
| W01TTG | PFO | **Trees:** yellow birch, red maple, balsam fir<br>**Saplings / Shrubs:** none<br>**Herbs:** nodding sedge, wood horsetail, sensitive fern, melic manna grass | A2: Histic Epipedon | High Water Table (A2)<br>Saturation (A3) | P-WL3 | No | Skidder ruts |

| Wetland Resource Identifier | Wetland Classification[1] | Dominant Vegetation | Hydric Soil Criteria and Indicator | Evidence of Hydrology | LUPC Wetlands Protection District | Wetland of Special Significance (WoSS/P-WL1) | Additional Comments |
|---|---|---|---|---|---|---|---|
| W01TTH | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** interrupted fern, nodding sedge, melic manna grass, wood horsetail | A1: Histosol<br>A2: Histic Epipedon | High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | Skidder rut area |
| W01TTI | PFO | **Trees:** red maple<br>**Saplings / Shrubs:** none<br>**Herbs:** melic manna grass, fowl manna grass, interrupted fern, bristly dewberry (*Rubus hispidus*) | A2: Histic Epipedon | Saturation (A3) | P-WL3 | No | |
| W01TTJ | PFO | **Trees:** red maple<br>**Saplings / Shrubs: none**<br>**Herbs:** northeastern manna grass, fowl manna grass, interrupted fern, bristly dewberry | A2: Histic Epipedon | Saturation (A3) | P-WL3 | No | |
| W01TTK | PFO/PEM | **Trees:** red maple, yellow birch, black ash<br>**Saplings / Shrubs:** red maple, yellow birch, balsam firm<br>**Herbs:** sensitive fern, interrupted fern, nodding sedge, fowl manna grass | F3: Depleted Matrix | Saturation (A3)<br>Water Stained Leaves (B9) | P-WL1 within 25-feet of stream; remainder P-WL2 | Yes, portions within 25-feet of stream | Ephemeral stream S04TT flows from wetland. Contains previously surveyed VP-F. |
| W01TTY | PFO | **Trees:** balsam fir, eastern arbovitae (*Thuja occidentalis*), red spruce<br>**Saplings / Shrubs:** balsam fir, northern white cedar, red maple, eastern hemlock (*Tsuga canadensis*), yellow birch<br>**Herbs:** sensitive fern, bristly dewberry, melic manna grass, nodding sedge, interrupted fern, wood horsetail, crested woodfern (*Dryopteris cristata*) | F3: Depleted Matrix, | High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL3 | No | Receives drainage from gravel road. |
| W01TTZ | PFO | **Trees:** balsam fir, red maple<br>**Saplings / Shrubs:** none<br>**Herbs:** interrupted fern, melic manna grass, nodding sedge, sensitive fern | A2: Histic Epipedon | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL3 | No | Receives drainage from gravel road. |
| W02TTA | PFO/PEM | **Trees:** balsam fir, red maple<br>**Saplings / Shrubs:** none<br>**Herbs:** interrupted fern, melic manna grass, nodding sedge, sensitive fern | A2: Histic Epipedon | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL2 | No | Skidder rut and receives drainage from gravel road. |
| W02TTB | PFO | **Trees:** balsam fir, red maple, yellow birch<br>**Saplings / Shrubs:** speckled alder (*Alnus incana*), pussy willow (*Salix discolor*)<br>**Herbs:** interrupted fern, melic manna grass, nodding sedge, sensitive fern | A2: Histic Epipedon | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL1 within 25-feet of stream; remainder P-WL3 | Yes, portions within 25-feet of stream | Contains stream S11TT. |

| Wetland Resource Identifier | Wetland Classification[1] | Dominant Vegetation | Hydric Soil Criteria and Indicator | Evidence of Hydrology | LUPC Wetlands Protection District | Wetland of Special Significance (WoSS/P-WL1) | Additional Comments |
|---|---|---|---|---|---|---|---|
| W02TTC | PFO | **Trees:** red maple, balsam fir<br>**Saplings / Shrubs:** witch hazel (*Hamamelis virginiana*)<br>**Herbs:** interrupted fern, sensitive fern, cinnamon fern | A2: Histic Epipedon, | Saturation (A3) | P-WL3 | No | Continues off-site to the north. |
| W02TTD | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** nodding sedge, interrupted fern, wood horsetail | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL2 | No | Disturbed roadside depression. Contains previously surveyed VP-A. |
| W02TTE | PFO/PEM | **Trees:** red maple, balsam fir<br>**Saplings / Shrubs:** witch hazel<br>**Herbs:** interrupted fern, sensitive fern, cinnamon fern | A2: Histic Epipedon, | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL2 | No | Continues off-site to the northeast. |
| W02TTG | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** sensitive fern, nodding sedge, wrinkle-leaf goldenrod (*Solidago rugosa*), lady fern, interrupted fern, wood horsetail | A2: Histic Epipedon | Saturation (A3) | P-WL2 | No | |
| W02TTH | PEM | **Trees:** red spruce, yellow birch, hemlock, balsam fir, hemlock<br>**Saplings / Shrubs:** yellow birch, red maple, red spruce<br>**Herbs:** interrupted fern, nodding sedge, cottongrass bulrush, sensitive fern | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3) | P-WL2 | No | Small skid trail |
| W02TTI | PSS | **Trees:** none<br>**Saplings / Shrubs:** red maple, speckled alder<br>**Herbs:** sensitive fern, wrinkle-leaf goldenrod, interrupted fern, nodding sedge | F3: Depleted Matrix | Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | Small roadside excavation |
| W02TTJ | PFO | **Trees:** red spruce, yellow birch, hemlock, balsam fir<br>**Saplings / Shrubs:** yellow birch, red spruce, red maple<br>**Herbs:** interrupted fern, evergreen wood fern | A12: Thick Dark Surface | Surface Water (A1)<br>Saturation (A3)<br>Drainage Patterns (B10) | P-WL3 | No | |
| W02TTK | PFO | **Trees:** red maple, yellow birch, eastern arborvitae, red spruce, balsam fir<br>**Saplings / Shrubs:** red maple, speckled alder, yellow birch, balsam fir, eastern arborvitae<br>**Herbs:** nodding sedge, melic manna grass, fowl manna grass, spotted touch-me-not, cottongrass bulrush, sensitive fern, interrupted fern | F3: Depleted Matrix<br>A2: Histic Epipedon | Surface Water (A1) | P-WL1 within 25-feet of stream; remainder P-WL3 | Yes, portions within 25-feet of streams | Contains multiple intermittent and perennial streams. Contains previously surveyed VP-G. Extends off-site to the southeast. |

| Wetland Resource Identifier | Wetland Classification[1] | Dominant Vegetation | Hydric Soil Criteria and Indicator | Evidence of Hydrology | LUPC Wetlands Protection District | Wetland of Special Significance (WoSS/P-WL1) | Additional Comments |
|---|---|---|---|---|---|---|---|
| W02TTL | PEM | **Trees:** balsam fir, white ash (*Fraxinus americana*), American beech, red maple<br>**Saplings / Shrubs:** beaked hazel (*Corylus cornuta*)<br>**Herbs:** interrupted fern, spotted touch-me-not, northeastern manna grass, wood horsetail | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | |
| W02TTM | PFO | **Trees:** sugar maple (*Acer saccharum*), balsam fir, red maple, yellow birch<br>**Saplings / Shrubs:** striped maple, red maple, yellow birch, witch hazel<br>**Herbs:** three-seed sedge (*Carex trisperma*), false lily-of-the-valley (*Maianthemum canadense*), interrupted fern, wood horsetail | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Geomorphic position (D2) | P-WL3 | No | |
| W02TTN | PEM | **Trees:** none<br>**Saplings / Shrubs:** none<br>**Herbs:** necklace sedge (*Carex projecta*), spotted touch-me-not, melic manna grass, sensitive fern | F3: Depleted Matrix | High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL2 | No | |
| W01LPA | PFO/PEM | **Trees:** balsam fir, red maple, eastern arborvitae<br>**Saplings / Shrubs:** yellow birch, red spruce<br>**Herbs:** interrupted fern, wood horsetail, sensitive fern, cinnamon fern | A2: Histic Epipedon | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Water Stained Leaves (B9) | P-WL1 within 25-feet of stream; remainder P-WL2 | Yes, portions within 25-feet of stream | Large, forested wetland with multiple skidder rut crossings and disturbances. Stream S11TT flows from the wetland. Contains PVPs 03TT and 01LP. |
| W01LPB | PFO | **Trees:** red spruce, yellow birch, hemlock, balsam fir<br>**Saplings / Shrubs:** yellow birch, red spruce, red maple<br>**Herbs:** interrupted fern, evergreen wood fern | A12: Thick Dark Surface | Surface Water (A1)<br>Saturation (A3)<br>Drainage Patterns (B10) | P-WL3 | No | |
| W01LPC | PFO | **Trees:** red spruce, yellow birch, hemlock, balsam fir<br>**Saplings / Shrubs:** yellow birch, red spruce<br>**Herbs:** interrupted fern, red maple | F3: Depleted Matrix | Surface Water (A1)<br>High Water Table (A2)<br>Saturation (A3)<br>Drainage Patterns (B10) | P-WL3 | No | Extends off-site to the southeast. |

[1] Wetland classification follows Federal Geographic Data Committee. (2013):
PFO = Palustrine Forested
PEM = Palustrine Emergent
PSS = Palustrine Scrub-Shrub
PUB = Palustrine Unconsolidated Bottom

### Table 2. Summary of Delineated Watercourses

| Stream Identifier | Flow Type | Bankfull Width (ft) | Ordinary High Water Mark Width (ft) | Dominant Substrates | Additional Comments |
|---|---|---|---|---|---|
| S01TT | Perennial | 8 | 6 | Cobble gravel sand | Fed by constructed ditch flowing from off-site, then flows steeply off-site. |
| S02TT | Intermittent and ephemeral | 2-5 | 2-4 | Cobble boulder silt muck | Ephemeral flow in upland portion between wetlands W01TTA and W01TTE. Flows off-site to the south. |
| S03TT | Intermittent | 5-6 | 4-5 | Cobble gravel sand | Originates at culvert outlet. |
| S04TT | Ephemeral | 1-2 | 1 | Cobble | Ephemeral outlet of wetland W01TTK; dry at time of survey but recent scour evident. |
| S10TT | Intermittent | 4 | 3 | Cobble gravel silt | Originates at culvert outlet and flows off-site to the north. |
| S11TT | Ephemeral, Intermittent, Perennial | 5-10 | 4-6 | Cobble gravel | Ephemeral stream originating in wetland W02TTF, becomes intermittent in roadside ditch, then becomes perennial from culvert outlet. Portion downstream of the road is possibly excavated but naturalized. |
| S12TT | Intermittent | 3 | 2 | Cobble gravel silt | Intermittent stream from culvert outlet within wetland W02TTB. |
| S13TT | Intermittent | 2 | 1 | Cobble gravel silt | Intermittent stream within upland area. |
| S14TT | Intermittent | 2-3 | 2-3 | Cobble | Originates from steep valley portion of wetlandW 02TTK. |
| S15TT | Intermittent | 2-3 | 2-3 | Cobble muck | Originates from steep valley portion of wetland W02TTK. |
| S16TT | Intermittent | 2-4 | 2-4 | Cobble moss muck | Channelized flow in narrow portion of wetland W02TTK. |
| S17TT | Ephemeral | 3-4 | 2-3 | Cobble gravel | Channelized flow in upland area, bisected by old skidder roads. |
| S01LP | Perennial | 5 | 5 | Silt cobble boulders | Main channel of perennial stream through wetland W02TTK. |
| S02LP | Intermittent | 2 | 2 | Silt cobble | Tributary of stream S01LP. |
| S03LP | Intermittent | 1 | 1 | Silt | Small stretch of stream goes underground on either end |
| S04LP | Intermittent | 0.5 | 0.5 | Silt cobble | Tributary of stream S01LP. |
| S05LP | Intermittent | 1 | 1 | Silt cobble | Tributary of stream S04LP. |
| S06LP | Intermittent | 1.5 | 1.5 | Silt cobble | Tributary of stream S01LP. |
| S07LP | Intermittent | 0.5 | 0.5 | Silt | |
| S08LP | Intermittent | 1 | 1 | Silt cobble | Side channel of stream S01LP. |
| S09LP | Intermittent | 1 | 1 | Silt | |
| S10LP | Intermittent | 1-3 | 1-3 | Silt cobble | Dry steam bed at time of survey. |

### Table 3. Summary of Vernal Pool Surveys

| Vernal Pool Identifier[1] | Origin | Hydrology | Additional Comments |
|---|---|---|---|
| PVP03TT | Unnatural | Ephemeral | Skidder rut with wood frog tadpoles. |
| PVP01LP | Unnatural | Ephemeral | Skidder rut with wood frog tadpoles. |
| VP-A | Unnatural | Ephemeral | Roadside excavation, surveyed by others and marked as natural-modified in 2020. |
| VP-B | Unnatural | Ephemeral | Roadside upland excavation, surveyed by others and marked as natural-modified in 2020. |
| VP-C | Unnatural | Ephemeral | Roadside upland excavation, surveyed by others and marked as natural-modified in 2020. Remnant egg masses and tadpoles visible. |
| VP-D | Unnatural | Semi-permanent | Historic excavation, surveyed by others in 2020. Remnant egg masses visible. |
| VP-F | Natural | Ephemeral | Isolated PFO depression, surveyed by others in 2020. |
| VP-G | Unnatural | Ephemeral | Disturbed portion of wetland W02TTK, surveyed by others in 2020. Not a jurisdictional vernal pool based on no egg masses during 2020 survey. |
| VP-H | Unnatural | Ephemeral | Historic excavation within upland area, surveyed by others in 2020. Not a jurisdictional vernal pool based on no egg masses during 2020 survey. |

[1] Note: Vernal Pool E (VP-E), previously delineated by others in 2020, was outside of the Project Site surveyed by Stantec and is not included in the table.

# 4.0 WETLAND REGULATIONS

## 4.1 STATE AND FEDERAL REGULATIONS

The Corps, MDEP, and LUPC regulate the wetlands and waterbodies (e.g., streams) identified within the Project Site. Under the provisions of Section 404 of the Clean Water Act, the Corps regulates dredging or filling within Waters of the United States, which include navigable waters and all their tributaries, adjacent wetlands, and other waters or wetlands where degradation or destruction could affect interstate or foreign commerce. The Corps has recently reissued a GP for the State of Maine (October 13, 2020) that merges the federal and state permit review process for many projects.

In Maine, wetlands and waterbodies, as well as other protected natural resources, are regulated under 38 M.R.S.A. §§ 480-A – 480-JJ, the NRPA and Chapter 10 of LUPC's Land Use Districts and Standards in unorganized territories. Projects that do not impact a wetland or projects that impact less than 4,300 square feet of wetland are generally exempt from state NRPA Tier permitting requirements. This exemption does not apply if the impact is:

- in, on, or over a coastal wetland, great pond, river, stream, or brook;
- within 25 feet of those resources identified above, or is more than 25 feet and no erosion control is used;
- in a shoreland zone or a wetland protected by the shoreland zone;
- part of a wetland with more than 20,000 square feet of open water or emergent vegetation, except artificial impoundments;
- in a peatland;
- part of a larger project; or
- in Significant Wildlife Habitat.

Typically, projects with cumulative impacts to freshwater wetlands between 4,300 but less 15,000 square feet are eligible for review under the Tier 1 NRPA permitting process. Wetland alterations between 0 and 15,000 square feet require a Corps Self Verification Form submittal, assuming the project meets the thresholds for activities for this level of review. Alterations that affect between 15,000 and 43,560 square feet (1 acre) of freshwater wetlands are eligible for the NRPA Tier 2 review process and Corps Pre-Construction Notification. Cumulative freshwater wetland impacts that exceed 1 acre typically require a NRPA Tier 3 review. Impacts to WoSS, rivers, streams and brooks, great ponds, and Significant Wildlife Habitat typically require an Individual Corps Permit. Specifics of how the agencies will regulate this Project can be determined with preliminary plans and consultation with the agencies.

Six P-WL1/WoSS (W01TTA, W01TTE, W01TTK, W02TTB, W01LPA, W02TTK) were identified within the Project Site because they are located within 25 feet of a stream. Full identification of P-WL1 /WoSS involves contacting natural resource agencies such as the Maine Natural Areas Program, MDIFW, and MDEP to determine if there are any documented occurrences of rare, threatened, or endangered species (RTE) and communities within or in the vicinity of the Project Site. Stantec has initiated these consultations. To date, no RTE species or communities have been identified.

## 4.2 VERNAL POOLS

Maine NRPA Chapter 335, Significant Wildlife Habitat, regulates significant vernal pools (SVP) as Significant Wildlife Habitat. Chapter 335 details specific definitions and standards regarding characterization and protection of SVPs in Maine.

Certain development projects in Maine may also be regulated under Chapter 375, Site Location of Development Act (Site Law). Under Site Law, MDEP may regulate vernal pools that are ecologically significant on a landscape level but do not meet the definition of an SVP. Under some circumstances, MDEP will review and possibly limit development within or beyond 250 feet of these high-functioning vernal pools.

All vernal pools (with vernal pool indicator species) meet the Corps definition of a vernal pool. The Corps update to the GP, which went into effect in October 2020, indicates that the Corps only regulates impacts to vernal pools if (a) the pool is located within a jurisdictional wetland and (b) there is a discharge of dredged or fill material proposed for the vernal pool depression. Only in the case that both (a) and (b) are met would compensatory mitigation potentially be required.

Two PVPs were identified by Stantec that would not be considered SVPs because of their unnatural origin (see Table 3). According to the vernal pool survey results conducted by others in 2020 (See Table 2 in the June 30, 2020, report by Wood Environment & Infrastructure Solutions, Inc. – Appendix B) and vernal pool center point locations available on the Maine GIS database, none of the previously surveyed vernal pools were determined to be a SVP.

# APPENDICES

# APPENDIX A FIGURES

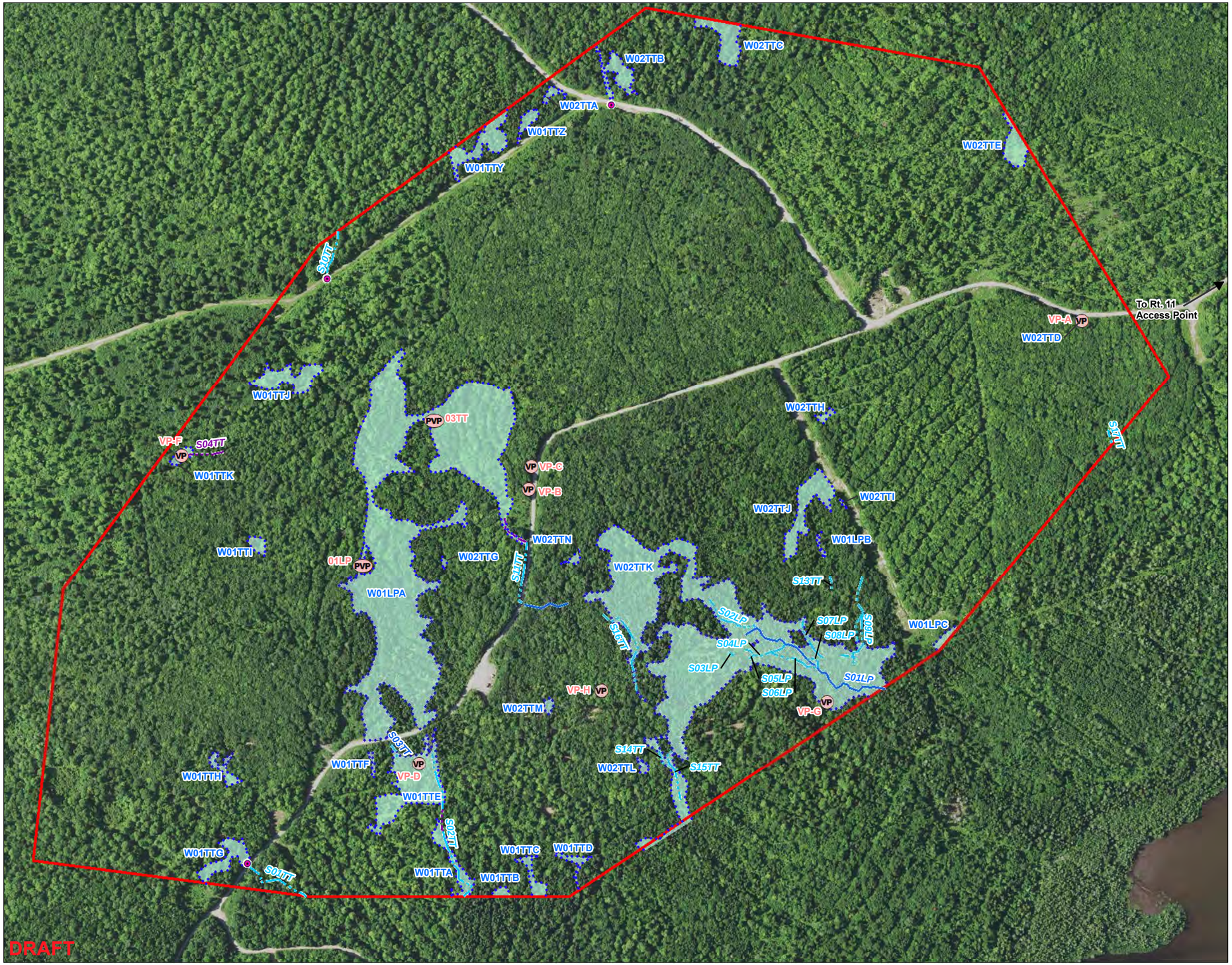



Figure No.
**1**

Title
**Delineated Wetlands and Streams Map**

Client/Project
Wolfden Resources Corporation
Pickett Mountain Metallic Mine Project

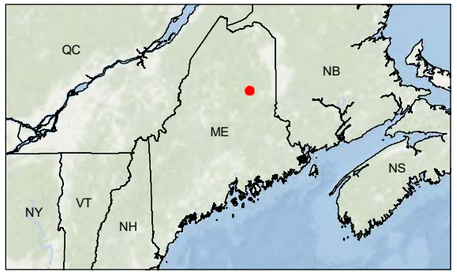
Project Location
T6 R6 WELS, Maine

195602317
Prepared by MM on 2022-07-11
TR by KH on 2022-07-12
IR Review by TT on 2022-07-12

N

0 500 Feet
(At original document size of 11x17)
1:6,000

- PVP Potential Vernal Pool
- VP Vernal Pool (Identified by Others)
- Culvert
- Delineated Perennial Stream
- Delineated Intermittent Stream
- Delineated Ephemeral Stream
- Delineated Wetland
- Approximate Survey Limits




**Notes**

1. Wetland boundaries and other features were located utilizing an EOS Arrow 100 GNSS GPS Receiver. The estimated average accuracy of GPS data is within 1-2 meters of the actual position.
2. Wetland boundaries delineated in accordance with the USACE Wetland Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement (Version 2.0).
3. Coordinate System: NAD 1983 StatePlane Maine East FIPS 1801 Feet
4. Data Source: Wolfden
5. Background: Maine NAIP 2018.

Stantec

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Citrix U:\195602317\03_data\gis_cad\gis\MXDs\Wetlands\02317_01_PicketMtnl_WetlandDelin.mxd Revised 2022-07-12 By: memason

# APPENDIX B WOOD WETLAND REPORT

July 2022 Revisions from Wood Infastructure and Broadwater Environmental, LLC Provided in Red

Wood Environment & Infrastructure Solutions, Inc.
511 Congress Street
Ste. 200
Portland, ME 04101
USA
T: 207-775-5401
**www.woodplc.com**

June 30, 2020

Mr. Jeremy Ouellette, P. Eng.
Wolfden Resources Corporation
Office Address:
1100 Russell Street,
Thunder Bay, ON P7B 5N2

**Subject: Wetland Delineation Survey**
**Pickett Mountain Site, Maine**

Dear Mr. Ouellette:

This letter report summarizes the wetland delineation survey that was conducted in response to the wetland, stream, and vernal pool survey requested by LUPC for the re-zoning petition for the Pickett Mountain Site in Maine.

**Scope of Work**

The 528 acre area proposed for re-zoning (the Site) was surveyed to identify and delineate wetlands, vernal pools and streams. Figure 1 shows an overview of the proposed rezoning boundary and the area surveyed. Figures 2-7 are provided at a scale of 1 inch = 100 feet, as requested by LUPC. The survey was conducted by certified wetland scientists (NH) from Wood Environment and Infrastructure Solutions, Inc. (Charles Lyman), and Broadwater Environmental, LLC (Ian Broadwater) and under the direction of professional wetland scientist from Atlantic Resources Consultants, LLC (Roger St. Amand).

**Wetlands Delineation**

Wetlands were delineated over two field events. The first event was May 18, 2020 through May 22, 2020. The second event was June 15, 2020 through June 19, 2020. Wetlands were delineated based on the presence of wetland hydrology, hydrophytic vegetation and hydric soils, following U.S. Army Corps of Engineers Wetland Delineation Manual (Wetlands Technical Report Y-87-1) and the Northcentral and Northeast Regional Supplement (ERDC/EL TR-12-1). In addition to delineating wetlands, streams and drainage features were also delineated. The streams on site were delineated following the Natural Resource Protection Act (NRPA) Identification Guide for Rivers, Streams, and Brooks (Danielson, 2018). Streams and drainages delineated are

shown on Figures 1-7. A summary of the wetlands delineated and pertinent information is included in Table 1. Representative plots and photographs of the wetlands delineated on Site are found in Attachment A.

**Vernal Pool Survey**

A vernal pool survey was conducted as the first step in the wetland delineation work. The initial vernal pool survey work, which included a survey of the entire Site, was done over a three-day period between May 17, 2020 and May 20, 2020 and was completed within the timeframe window for wood frog egg masses in Northern Maine. Vernal pools (VPs) were identified based on physical characteristics of the features including isolated water bodies, water stained leaves, water lines, sphagnum moss and the presence of hydrophytic vegetation. Egg mass counts of spotted salamanders and wood frogs were collected. A total of eight vernal pools were identified and surveyed during this initial survey. A second, follow up visit, to the vernal pools identified during the initial site visit, was conducted on May 28, 2020 and May 29, 2020. Egg mass counts of spotted salamanders and wood frogs were collected. The vernal pools identified on Site are shown on Figures 1-7. A summary of the vernal pools identified and pertinent information is included in Table 2.

**Other Observations**

As part of the initial zoning petition Wolfden sought input from Maine Natural Areas Program (MNAP) and Maine Department of Inland Fisheries and Wildlife (MDIFW) on the presence of significant wildlife habitats and/or plant communities in the area. Both agencies provided documentation back on species and habitats in the general area. Information provided indicated there were no known significant wildlife habitats or S1/S2 plant communities within the area proposed for rezoning. This information was reviewed by the wetland scientists conducting the survey and no significant wildlife habitats or S1/S2 plant communities within the area proposed for rezoning were observed during the field survey. A detailed survey of flora and fauna was not part of this survey.

**References:**

Danielson, T.J. 2018 Natural Resource Protection Act (NRPA) Streams, Rivers and Brooks, Maine Department of Environmental Protection, Augusta, Maine.

Sincerely,

**Wood Environment & Infrastructure Solutions, Inc.**

Peter Baker, C.G.
Project Manager

Charles Lyman, CWS, LSE
Certified Wetland Scientist (NH)'

# FIGURES

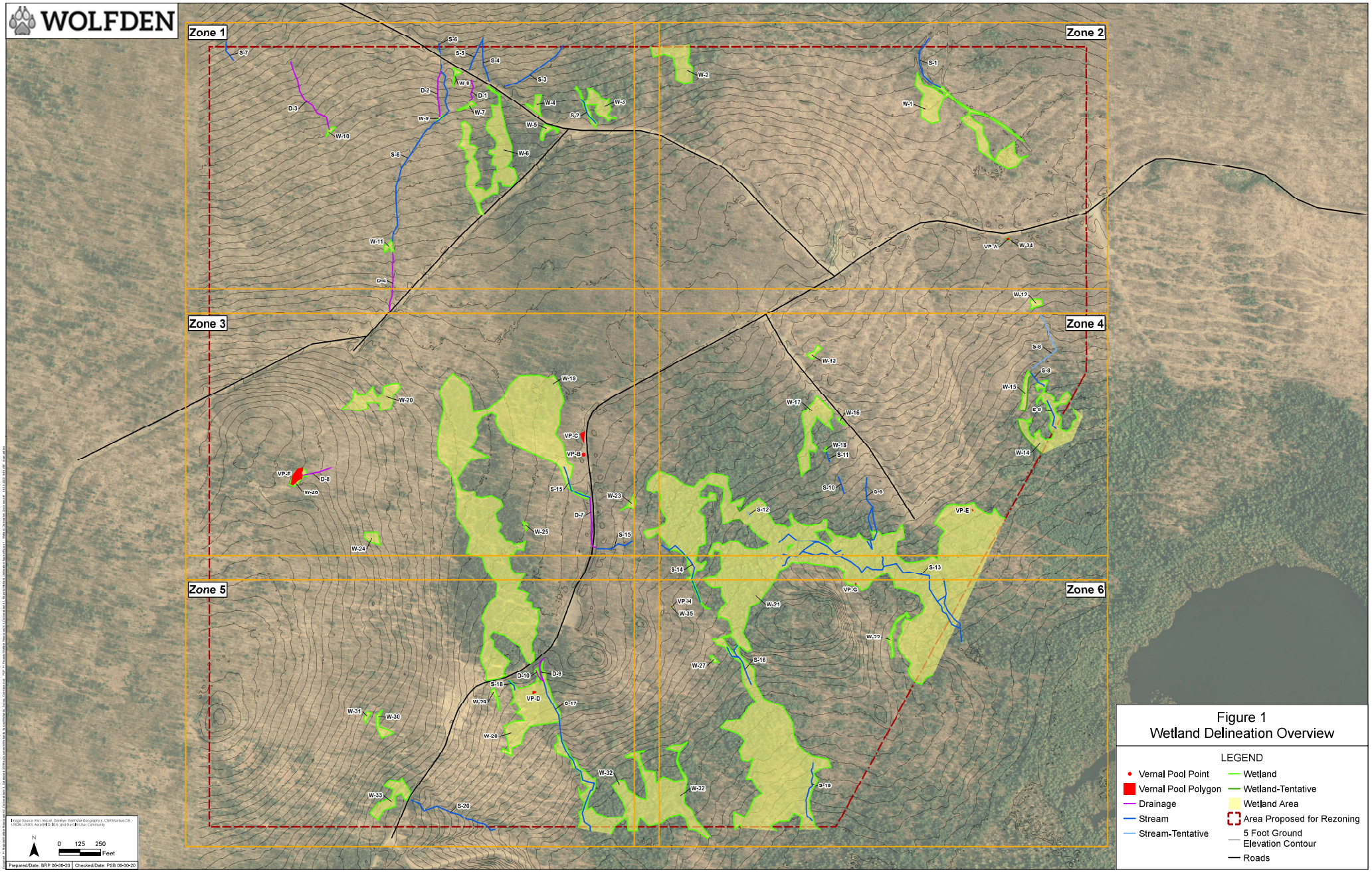



Figure 1
Wetland Delineation Overview

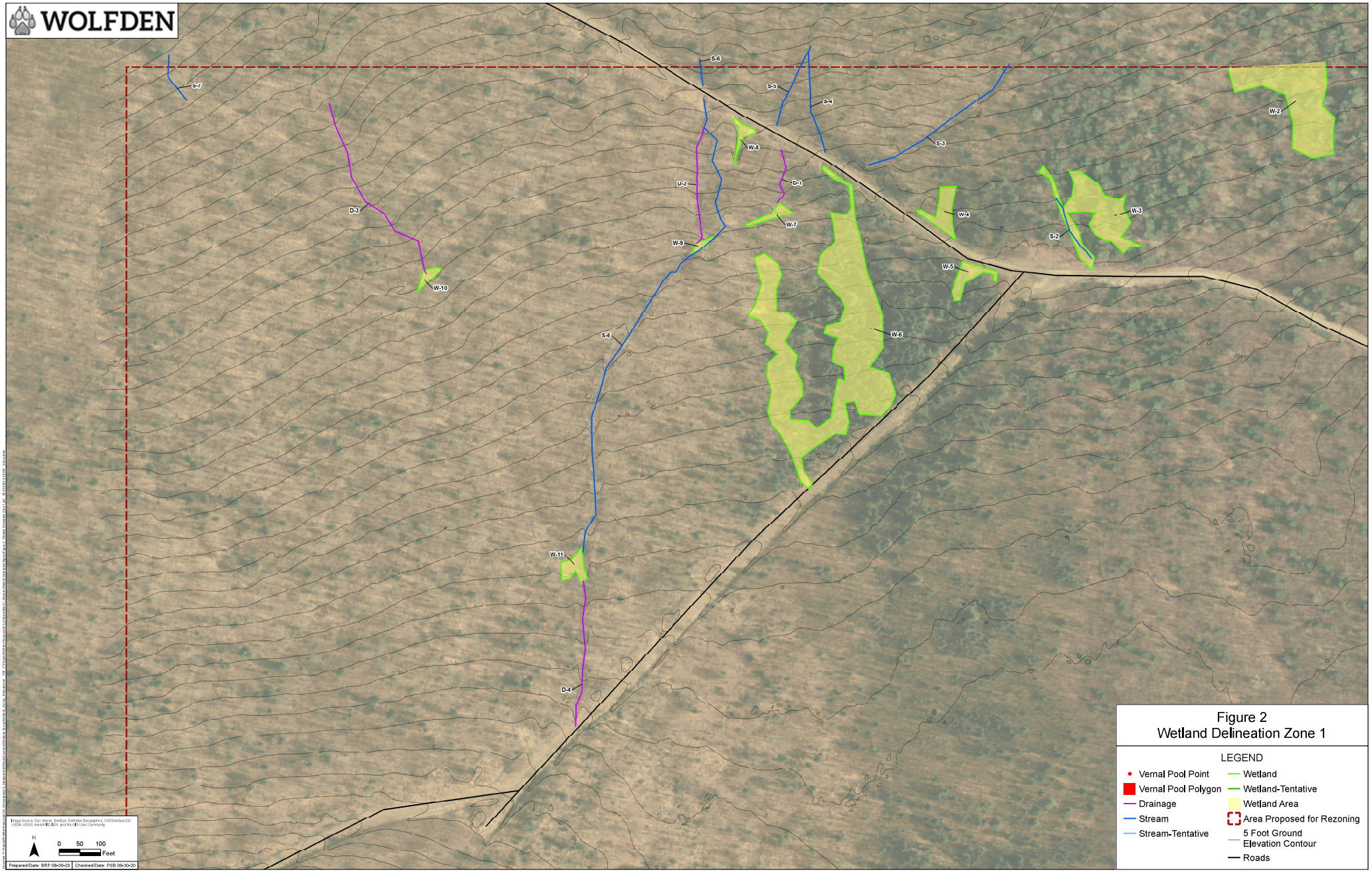
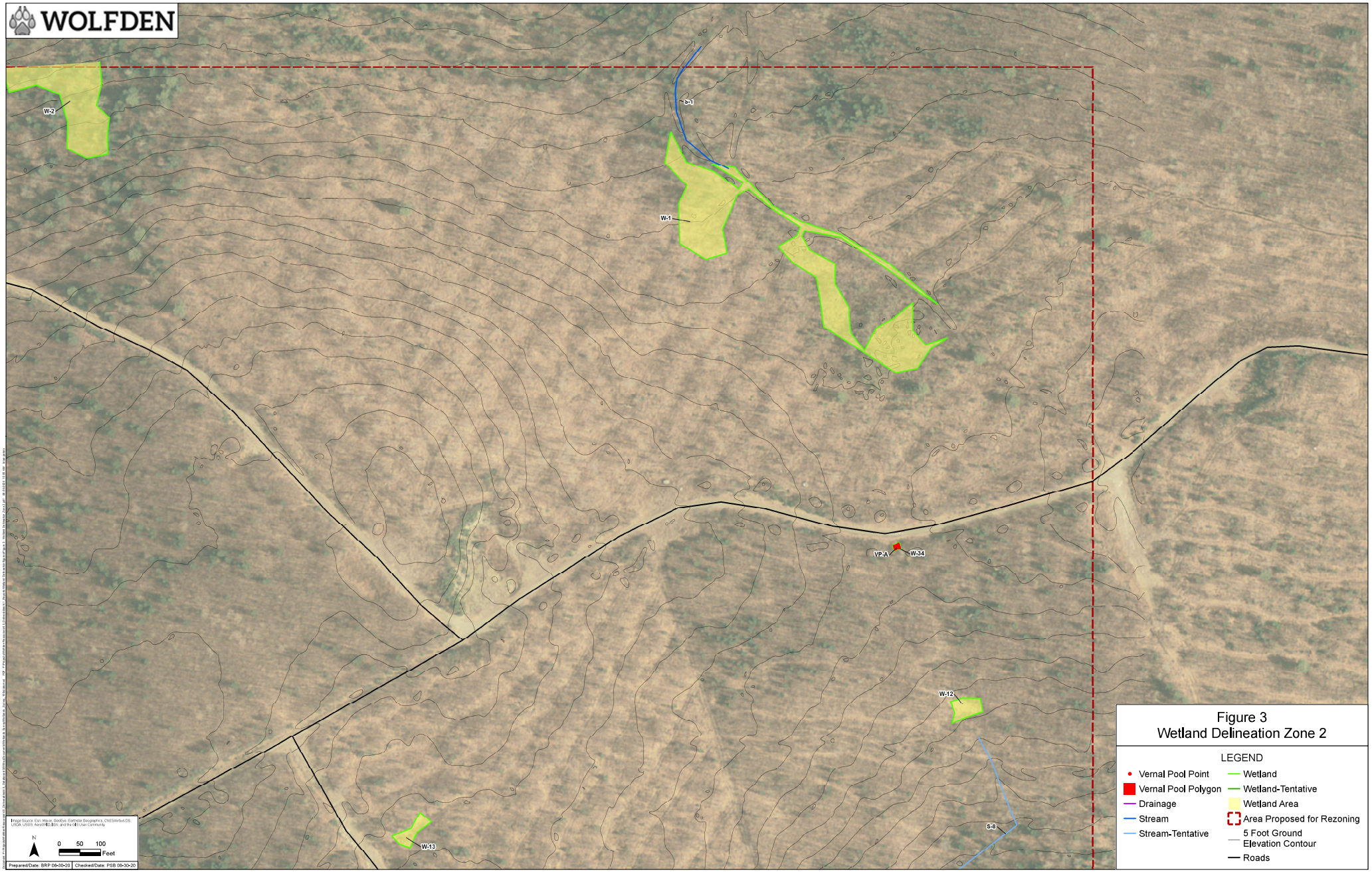



Figure 2
Wetland Delineation Zone 1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W-2
S-1
W-1
VP-A
W-34
W-12
S-8
W-13
Image Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
N
0 50 100
Feet
Prepared/Date: BRP 06-30-20
Checked/Date: PSB 06-30-20
Figure 3
Wetland Delineation Zone 2
LEGEND
Vernal Pool Point
Vernal Pool Polygon
Drainage
Stream
Stream-Tentative
Wetland
Wetland-Tentative
Wetland Area
Area Proposed for Rezoning
5 Foot Ground Elevation Contour
Roads

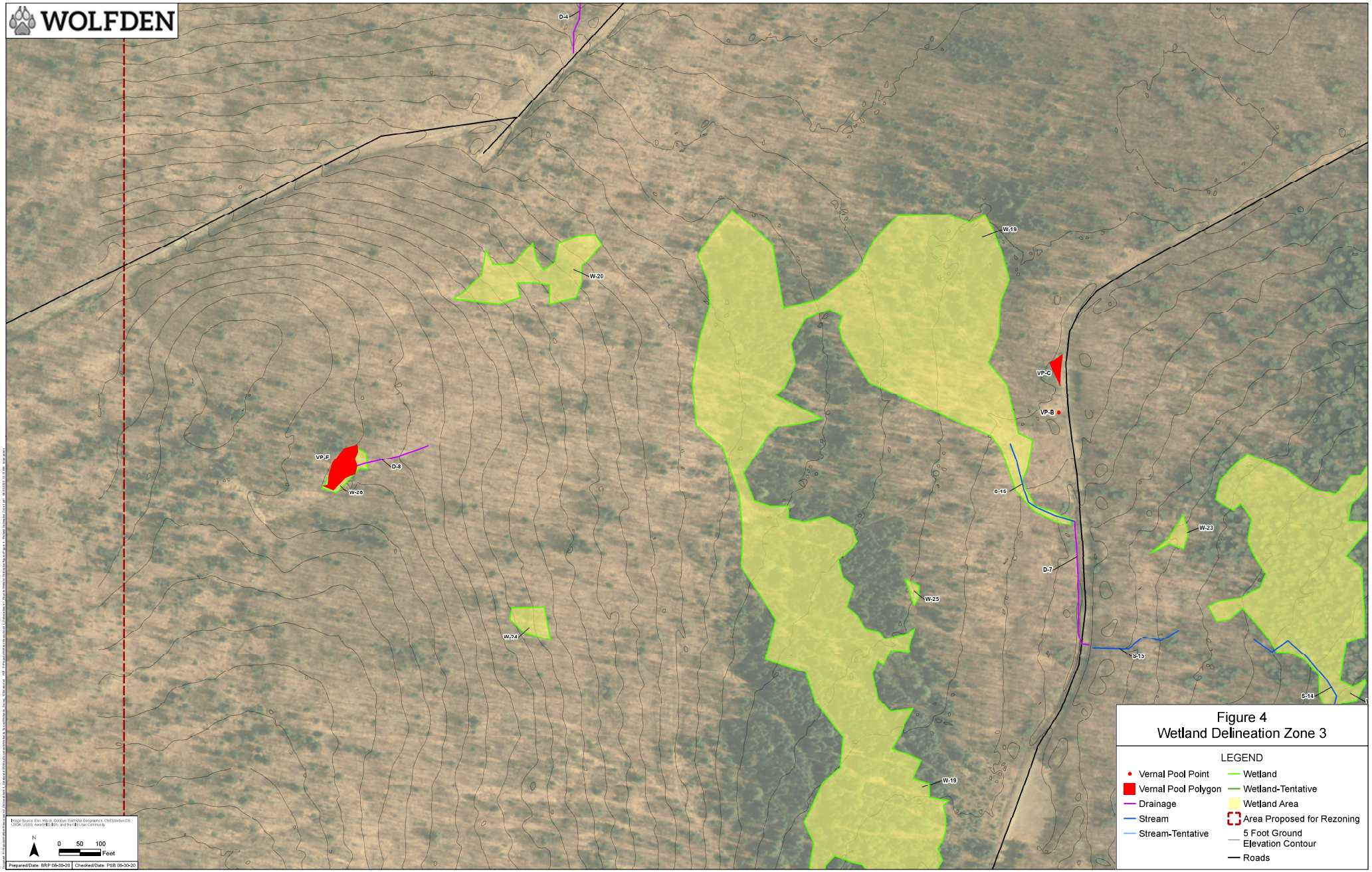
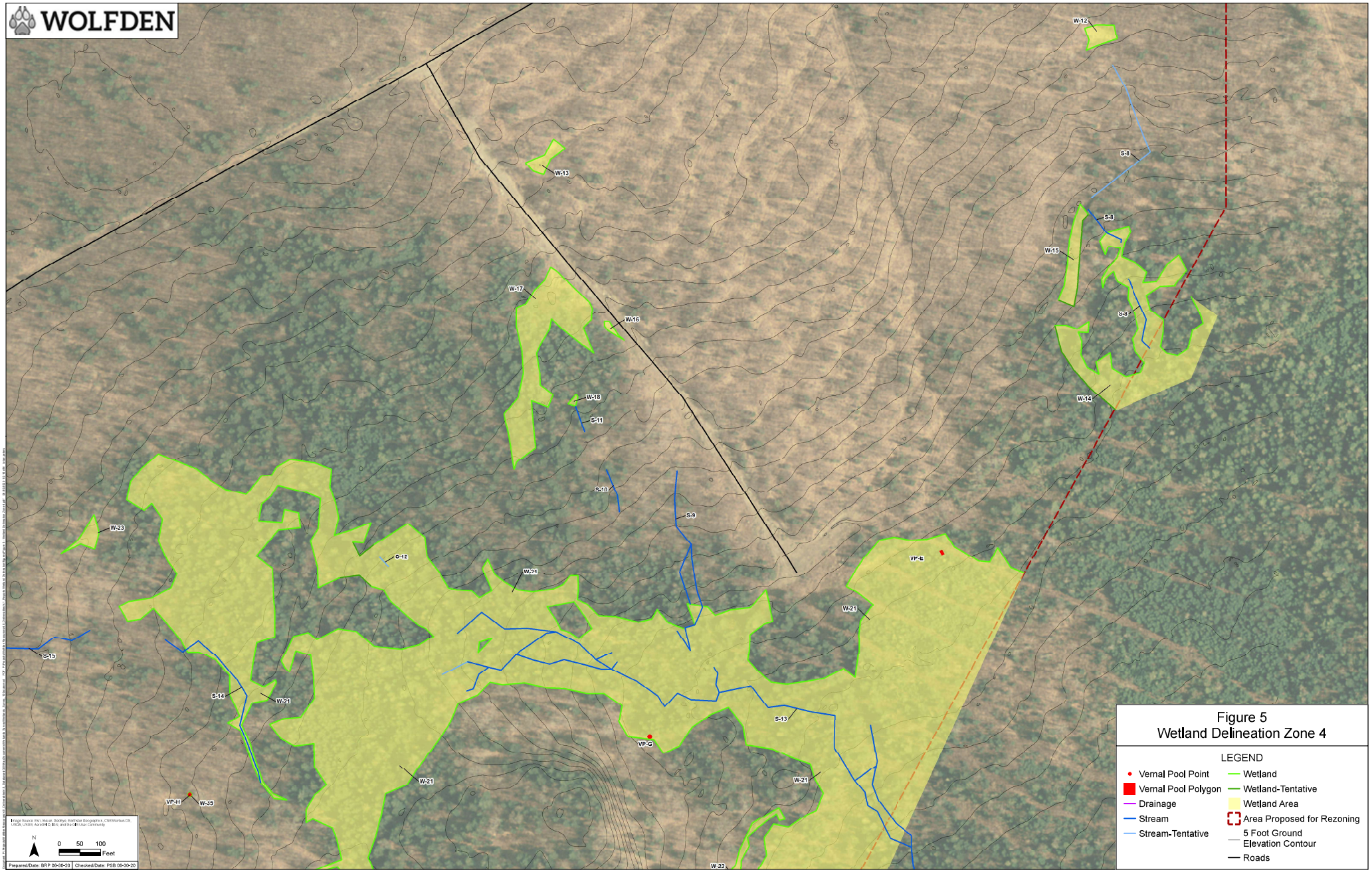



Figure 4
Wetland Delineation Zone 3

LEGEND

- Vernal Pool Point
- Vernal Pool Polygon
- Drainage
- Stream
- Stream-Tentative
- Wetland
- Wetland-Tentative
- Wetland Area
- Area Proposed for Rezoning
- 5 Foot Ground Elevation Contour
- Roads


WOLFDEN
W-12
W-13
S-8
S-8
W-15
W-17
W-16
S-8
W-18
S-11
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S-10
S-9
W-23
G-12
W-24
VP-E
W-21
S-13
S-14
W-21
VP-G
W-21
W-21
VP-H
W-35
W-22
Figure 5
Wetland Delineation Zone 4
LEGEND
Vernal Pool Point
Vernal Pool Polygon
Drainage
Stream
Stream-Tentative
Wetland
Wetland-Tentative
Wetland Area
Area Proposed for Rezoning
5 Foot Ground Elevation Contour
Roads
Image Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Feet
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Checked/Date: PSB 06-30-20

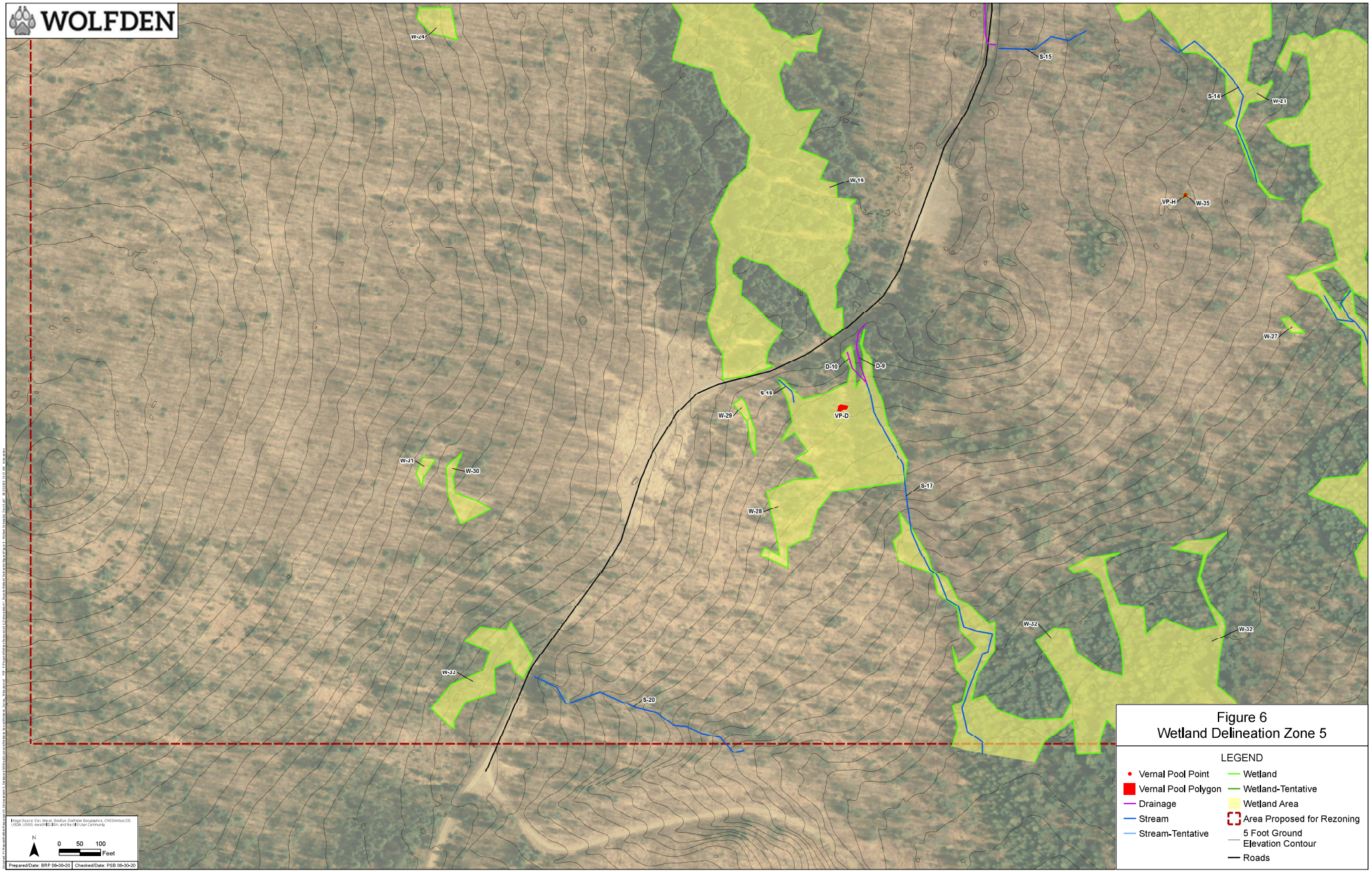



Figure 6
Wetland Delineation Zone 5

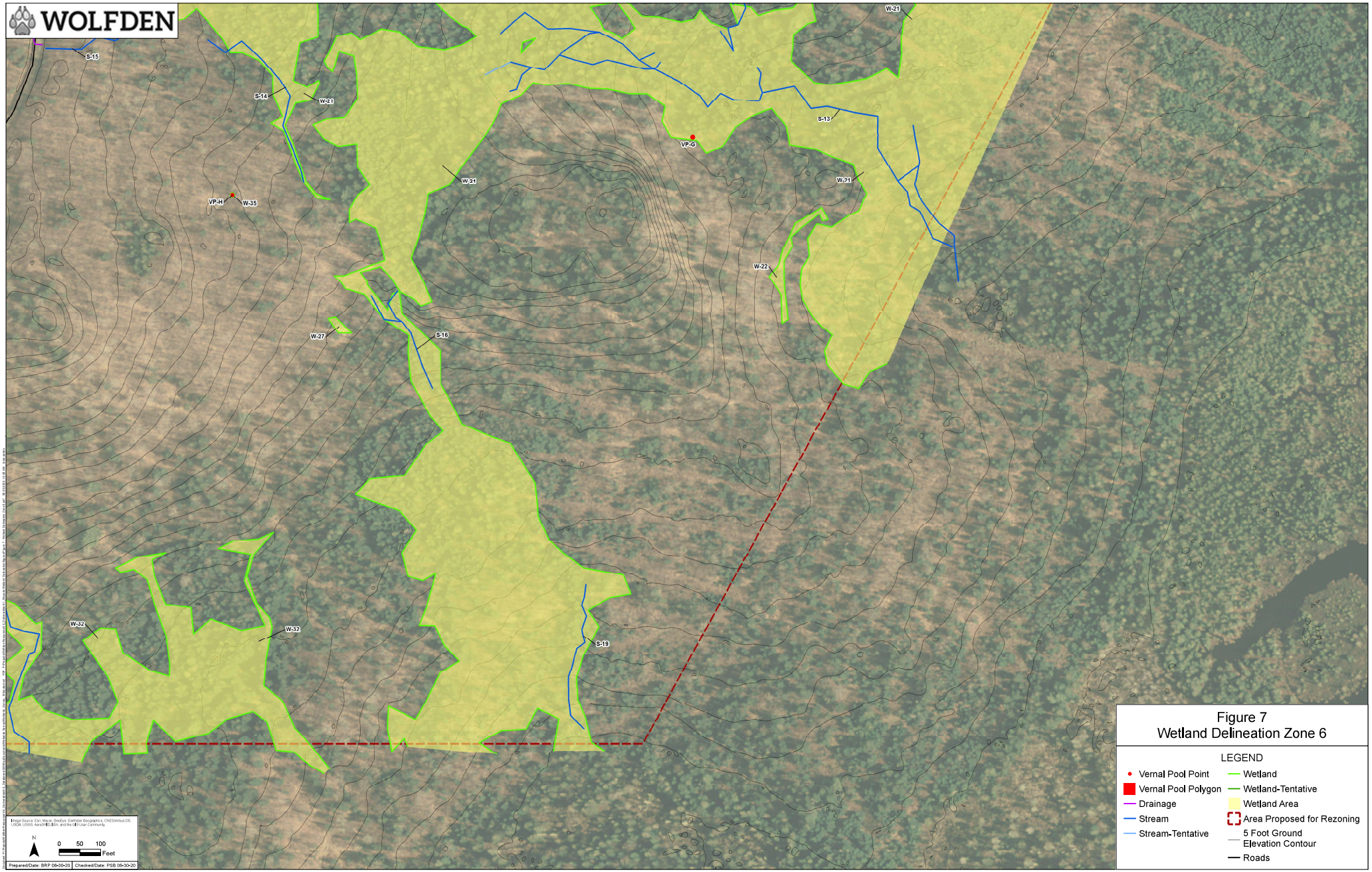



Figure 7
Wetland Delineation Zone 6

# TABLES

**TABLE 1 - Wetlands in Proposed Re-Zoning Area**

| Resource ID | Cowardin Classification[1] | Dominant Vegetation[2] | Hydric Soil Indicator[3] | Hydrology Indicators[3] | Preliminary MDEP Classification [4] |
|---|---|---|---|---|---|
| Wetland 1 | PFO4 | Balsam fir (Abies balsamea), red maple (Acer rubrum), sensetive fern (Onoclea sensibilis), dwarf raspberry (Rubus pubescens) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 2 | PFO1/4 | Red spruce (Picea rubens), yellow birch (Betula alleghaniensis), balsam fir (Abies balsamea), nodding sedge (Carex gynandra), interrupted fern (Osmunda claytoniana) | Depleted Below Dark Surface (A11), Depleted Matrix (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 3 | PSS1 | Yellow birch (Betula alleghaniensis), speckled alder (Alnus incana), red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), sensitive fern (Onoclea sensibilis), field horsetail (equisetum arvense) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 4 | PSS1 | Yellow birch (Betula alleghaniensis), red maple (Acer rubrum), beaked hazelnut (Corylus cornuta), bluejoint (Calamagrostis canadensis), greater bladder sedge (Carex intumescens) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 5 | PSS1 | Yellow birch (Betula alleghaniensis), green ash (Fraxinus pennsylvanica), Bebb's willow (Salix bebbiana), red maple (Acer rubrum), sensitive fern (Onoclea sensibilis), white edge sedge (Carex debilis), field horsetail (Equisetum arvense) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 6 | PFO1 | Red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), black ash (Fraxinus nigra), balsam fir (Abies balsamea), speckeled alder (Alnus incana), Bebb's willow (Salix bebbiana), steeplebush (Spiraea tomentosa), sensitive fern (Onoclea sensibilis), cinnamon fern (Osmunda cinnamomea), interrupted fern (Osmunda claytoniana) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 7 | PEM1 | Sensitive fern (Onoclea sensibilis), drooping woodland sedge (Carex arctata), jewelweed (Impatiens capensis), nodding sedge (Carex gynandra) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 8 | PSS1 | Bebb's willow (Salix bebbiana), steeplebush (Spiraea tomentosa), sensitive fern (Onoclea sensibilis), jewelweed (Impatiens capensis), field horsetail (Equisetum arvense) | Depleted matrix Redox (F3) | Surface Water (A1), High Water Table (A2), Saturation (A3) | WNSS |
| Wetland 9 | PEM1 | Sensitive fern (Onoclea sensibilis), drooping woodland sedge (Carex arctata), jewelweed (Impatiens capensis), nodding sedge (Carex gynandra) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 10 | PFO1 | Ostrich Fern (Matteuccia struthiopteris), Field Horsetail (Equisetum arvense), sensetive fern (Onoclea sensibilis), Carex sp. | | | WNSS |
| Wetland 11 | PFO1 | Ostrich Fern (Matteuccia struthiopteris), Fringed Sedge (Carex Crinita), Jewel Weed (Impatiens capensis), Sensitive fern (Onoclea sensibilis) | | | WNSS |

**TABLE 1 - Wetlands in Proposed Re-Zoning Area**

| Resource ID | Cowardin Classification[1] | Dominant Vegetation[2] | Hydric Soil Indicator[3] | Hydrology Indicators[3] | Preliminary MDEP Classification [4] |
|---|---|---|---|---|---|
| Wetland 12 | PEM | Cinnamon fern (Osmunda cinnamomea), Interrupted fern (Osmunda claytoniana), Nodding sedge (Carex gynandra | Loamy mucky mineral (F1) | High Water Table (A2), Saturation (A3) | WNSS |
| Wetland 13 | PEM | Nodding sedge (Carex gynandra), Wild mint (Mentha arvensis), Sensitive fern (Onoclea sensibilis) | Depleted matrix Redox (F3) | Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 14 | PFO | Balsam fir (Abies balsamea), Gray birch (Betula populifolia), Yellow birch (Betula alleghaniensis), Hobblebush (Viburnum lantanoides), Red maple (Acer rubrum), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea), Interrupted fern (Osmunda claytoniana) | Depleted matrix Redox (F3), Loamy mucky mineral (F1) | Saturation (A3), Waterstained leaves (B9), Microtopographic Relief (D4) | WOSS within 25' of stream |
| Wetland 15 | PEM | Sensitive fern (Onoclea sensibilis), Jewelweed (Impatiens capensis) | Loamy mucky mineral (F1) | Saturation (A3), Geomorphic Position (D2), Microtopographic Relief (D4) | WOSS within 25' of stream |
| Wetland 16 | PEM | Balsam fir (Abies balsamea), Sphagnum (Sphagnum capillifolium), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea) | Depleted matrix Redox (F3) | Saturation (A3), Geomorphic Position (D2), Microtopographic Relief (D4) | WNSS |
| Wetland 17 | PFO/PEM | Balsam fir (Abies balsamea), Yellow birch (Betula alleghaniensis), Gray birch (Betula populifolia), Hobblebush (Viburnum lantanoides), Sphagnum (Sphagnum capillifolium), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea), Nodding sedge (Carex gynandra) | Depleted matrix Redox (F3), Loamy mucky mineral (F1) | Saturation (A3), Geomorphic Position (D2), Microtopographic Relief (D4) | WNSS |
| Wetland 18 | PEM | Sphagnum (Sphagnum capillifolium), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea) | Depleted matrix Redox (F3), Loamy mucky mineral (F1) | Saturation (A3) | WOSS within 25' of stream |
| Wetland 19 | PEM | Balsam fir (Abies balsamea), Sphagnum (Sphagnum capillifolium), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea) | Depleted matrix Redox (F3) | Saturation (A3), Geomorphic Position (D2), Microtopographic Relief (D4) | WNSS |
| Wetland 20 | PEM1/PSS1/4 | Red maple (Acer rubrum), balsam fir (Abies balsamea), yellow birch (Betula alleghaniensis), green ash (Fraxinus pennsylvanica), red raspberry (Rubus idaeus), jewelweed (Impatiens capensis), sensitive fern (Onoclea sensibilis) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 21 | PFO | Balsam fir (Abies balsamea), Gray birch (Betula populifolia), Yellow birch (Betula alleghaniensis), Hobblebush (Viburnum lantanoides), Red maple (Acer rubrum), Sensitive fern (Onoclea sensibilis), Cinnamon fern (Osmunda cinnamomea), Interrupted fern (Osmunda claytoniana) | Depleted matrix Redox (F3), Loamy mucky mineral (F1), Histic epipedon (A2) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS within 25' of stream |
| Wetland 22 | PEM | Sensitive fern (Onoclea sensibilis), Jewelweed (Impatiens capensis) | Loamy mucky mineral (F1) | Saturation (A3), Geomorphic Position (D2), Microtopographic Relief (D4) | WNSS |
| Wetland 23 | PSS1 | Green ash (Fraxinus pennsylvanica), New York fern (Thelypteris noveboracensis), jewelweed (Impatiens capensis), sensitive fern (Onoclea sensibilis), nodding sedge (Carex gynandra) | Redox Dark Surface (F6) | Saturation (A3), Waterstained Leaves (B9) | WNSS |

**TABLE 1 - Wetlands in Proposed Re-Zoning Area**

| Resource ID | Cowardin Classification[1] | Dominant Vegetation[2] | Hydric Soil Indicator[3] | Hydrology Indicators[3] | Preliminary MDEP Classification[4] |
|---|---|---|---|---|---|
| Wetland 24 | PSS1 | Yellow birch (Betula alleghaniensis), wrinkleleaf goldenrod (Solidago rugosa), jewelweed (Impatiens capensis) | Depleted Below Dark Surface (A11), Depleted Matrix (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 25 | PSS1 | Fringed Sedge (Carex Crinita), Sensitive fern (Onoclea sensibilis), Speckeled Alder (Alnus Incana), Red raspberry (Rubus idaeus), dwarf raspberry (Rubus pubescens) | Depleted matrix Redox (F3) | | WNSS |
| Wetland 26 | PFO1/4 | Balsam fir (Abies balsamea), red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), red spruce (Picea rubens), speckeled alder (Alnus incana), New York fern (Thelypteris noveboracensis), Jack in the pulpit (Artisaema triphyllum), greater bladder sedge (Carex intumescens) | Histic Epipedon (A2), | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 27 | PEM1 | New York fern (Thelypteris noveboracensis), jewelweed (Impatiens capensis), Jack in the pulpit (Arisaema triphyllum), field horsetail (Equisetum arvense), interrupted fern (Osmunda claytoniana) | Depleted Below Dark Surface (A11), Depleted Matrix (F3) | Saturation (A3), Microtopographic Relief (D4 | WNSS |
| Wetland 28 | PFO1/4 | Red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), black ash (Fraxinus nigra), balsam fir (Abies balsamea), sensitive fern (Onoclea sensibilis), cinnamon fern (Osmunda cinnamomea), fringed sedge (Carex crinita), red raspberry (Rubus idaeus) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 29 | PEM1 | Reed canarygrass (Phalaris arundinacea), sensitive fern (Onoclea sensibilis), jewelweed (Impatiens capensis),interrupted fern (Osmunda clatoniana), field horsetail (Equisetum arvense) | Redox Dark Surface (F6) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 30 | PEM1 | Fox sedge (Carex vulpinoidea), fringed sedge (Carex crinita), jewelweed (Impatiens capensis), field horsetail (Equisetum arvense) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 31 | PEM2 | Fox sedge (Carex vulpinoidea), fringed sedge (Carex crinita), jewelweed (Impatiens capensis), field horsetail (Equisetum arvense) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |
| Wetland 32 | PFO1/4 | Yellow birch (Betula allegheniensis), green ash (Fraxinus pennsylvanica), balsam fir (Abies balsamea), northern white cedar (Thuja occidentalis), red spruce (Picea rubens), cinnamon fern (Osmunda cinnamomea), interrupted fern (Osmunda claytoniana), sensitive fern (Onoclea sensibilis), royal fern (Osmunda regalis) | Histic Epipedon (A2), Black Histic (A3), Depleted Matrix (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WOSS (stream) |
| Wetland 33 | PEM1/PSS1/4 | Green ash (Fraxinus pennsylvanica), red maple (Acer rubrum), balsam fir (Abies balsamea), New York fern (Thelypteris noveboracensis), jewelweed (Impatiens capensis), sensitive fern (Onoclea sensibilis), nodding sedge (Carex gynandra) | Depleted matrix Redox (F3) | High Water Table (A2), Saturation (A3), Waterstained leaves (B9) | WNSS |

**TABLE 1 - Wetlands in Proposed Re-Zoning Area**

| Resource ID | Cowardin Classification[1] | Dominant Vegetation[2] | Hydric Soil Indicator[3] | Hydrology Indicators[3] | Preliminary MDEP Classification [4] |
|---|---|---|---|---|---|
| Wetland 34 | PEM1/PSS1/4 | Sensitive fern (Onoclea sensibilis), three-seeded sedge (Carex trisperma), fox sedge (Carex vulpinoidea), drooping wood sedge (Carex debilis) | Depleted Below Dark Surface (A11), Depleted Matrix (F3) | Water-Stained Leave (B9), Shallow Aquitard (D3), Microtopographic Relief (D4), FAC-Neutral Test (D5) | WNSS (mapped as wetland T1U (not yet assigned number) |

1 - Cowardin, et al. 1979. United States, Fish and Wildlife Service, evaluated during winter conditions
2 - Representative species in
3 - U.S. Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual:Northcentral and Northeast Region (Version 2
4 - State of Maine, Department of Environmental Protection, Natural Resources Protection Act Statute - **Preliminary Classification**

07/18/22 Revisions - Charles Lyman, Wood Infrastructure

**Table 2. Vernal Pools in Proposed Re-Zoning Area**

| Resource ID | First Visit Date | Second Visit Date | Pool Origin | # Spotted Salamander Egg Masses | # Wood Frog Egg Masses | Length (ft) | Width (ft) | Pool Hydroperiod (Estimated) | Soils | Notes | Corps Jurisdictional | MDEP Jurisdictional |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VP-A | 5/18/2020 | 5/28/2020 | Nat-Mod | ~~1~~ 0 | ~~1~~ 0 | ~~1~~ 20 | ~~1~~ 14 | Ephemeral - | Organic | Skid ruts | Yes | Yes |
| VP-B | 5/18/2020 | 5/28/2020 | Nat-Mod | 0 | ~~2~~ 2 [a] | 20 | 40 | Ephemeral - | Organic | Edge of PVP bordered by woods road | Yes | Yes |
| VP-C | 5/18/2020 | 5/28/2020 | Nat-Mod | ~~3~~ 3[b] | ~~35~~ 35[a] | ~~10~~ 20 | ~~20~~ 10 | Ephemeral - | Organic | Edge of PVP bordered by woods road | Yes | Yes |
| VP-D | 5/18/2020 | 5/28/2020 | Nat-Mod | ~~20~~ 7[a]; 13[b] | ~~26~~ 26[a] | 20 | 20 | Semi-Permanent | Organic | Appears to be old cellar hole | Yes | Yes |
| VP-E | 5/17/2020 | 5/28/2020 | Natural | 0 | 0 | 12 | 7 | Ephemeral | Organic/ mineral | Edge of skidder road | Yes | Yes |
| VP-F | 5/19/2020 | 5/28/2020 | Nat-Mod | ~~14~~ 14[a]; 1[b] | ~~10~~ 10[a] | 40 | 60 | Semi-Permanent | Organic | skidder trails and old test pit observed | Yes | Yes |
| VP-G | 5/17/2020 | 5/28/2020 | Natural | 0 | 0 | 12 | 12 | Ephemeral | Organic | | Yes | Yes |
| VP-H | 5/18/2020 | 5/28/2020 | Natural | 0 | 0 | 10 | 10 | Ephemeral | Organic | | Yes | Yes |

**Note:**
[a] Vernal Pool Survey Site Visit #1
[b] Vernal Pool Survey Site Visit #2

# ATTACHMENT A

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/17/2020

Applicant/Owner: Wolfden State: ME Sampling Point: Plot 1 up

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): LRR Lat: 46.1352003 Long: -68.4597421 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No x (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes _____ | No x | **Is the Sampled Area within a Wetland?** **Yes** _____ **No** x |
| Hydric Soil Present? | Yes _____ | No x | |
| Wetland Hydrology Present? | Yes _____ | No x | If yes, optional Wetland Site ID: _____ |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes _____ | No x | Depth (inches): |
| Water Table Present? | Yes _____ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes _____ | No x | Depth (inches): |

**Wetland Hydrology Present?** **Yes** _____ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 1 up

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Red spruce (*Picea rubens*) | 30 | Y | FACU |
| 2. American beech (*Fagus grandifolia*) | 20 | N | FACU |
| 3. Balsam fir (*Abies balsamea*) | 15 | N | FAC |
| 4. Paper birch (*Betula papyrifera*) | 5 | N | FACU |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 70 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Red spruce (*Picea rubens*) | 15 | Y | FACU |
| 2. American beech (*Fagus grandifolia*) | 5 | N | FACU |
| 3. Sugar maple (*Acer saccharum*) | 5 | N | FACU |
| 4. Hobblebush (*Viburnum lantanoides*) | 5 | N | FAC |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 30 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. White trillium (*Trillium grandiflorum*) | 30 | Y | NA |
| 2. Sugar maple seedlings (*Acer saccharum*) | 3 | N | FACU |
| 3. Hobblebush seedlings (*Viburnum lantanoides*) | 3 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 36 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** _____ **No** x

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 1 up

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | various | | | | | | organic | Oe horizon; dry |
| 3-5 | 10YR 4/4 | 99 | | | | | Fine sandy loam | no redox features |
| 5" | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 5"

Depth (inches): ___

**Hydric Soil Present?** **Yes** ___ **No** x

Remarks:

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/17/2020

Applicant/Owner: Wolfden State: ME Sampling Point: T2 Plot 1 wet

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): Gentle slope Local relief (concave, convex, none): 1.5' deep skidder ruts Slope (%): 1

Subregion (LRR or MLRA): LRR Lat: 46.1352899 Long: -68.4596319 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes ___ No x

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes x | No | **Is the Sampled Area within a Wetland?** **Yes** x **No** |
| Hydric Soil Present? | Yes x | No | If yes, optional Wetland Site ID: W-21 |
| Wetland Hydrology Present? | Yes x | No | |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- x Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- x Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No x | Depth (inches): |
| Water Table Present? | Yes ___ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes x | No ___ | Depth (inches): 4 |

**Wetland Hydrology Present?** **Yes** x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 1 wet

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Red spruce (*Picea rubens*) | 20 | Y | FACU |
| 2. Gray birch (*Betula populifolia*) | 15 | Y | FAC |
| 3. Balsam fir (*Abies balsamea*) | 10 | N | FAC |
| 4. Hobblebush (*Viburnum lantanoides*) | 10 | N | FAC |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 55 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Balsam fir (*Abies balsamea*) | 15 | Y | FAC |
| 2. Red spruce (*Picea rubens*) | 15 | Y | FACU |
| 3. Hobblebush (*Viburnum lantanoides*) | 10 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 40 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. Cinnamon fern (*Osmunda cinnamomea*) | 30 | Y | FACW |
| 2. Lady fern (*Athyrium angustum*) | 15 | N | FAC |
| 3. Hobblebush seedlings (*Viburnum lantanoides*) | 5 | N | FAC |
| 4. *Unidentified carex (no fruit)* | 5 | N | NA |
| 5. Unidentified grass (no fruit) | 5 | N | NA |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 60 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** x **No**

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 1 wet

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10YR 2/1 | | | | | | organic | saturated |
| 5-8 | 10YR5/1 | 95 | 7.5YR 6/8 | 5 | c | m | Loamy sand | 10% gravel; saturated |
| 8+ | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) (**LRR R, MLRA 149B**)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
x Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Dark Surface (S7) (**LRR K, L, M**)
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 8"

Depth (inches): _____

**Hydric Soil Present?** **Yes** x **No** _____

Remarks:

Area disturbed by past logging operations.

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/19/2020

Applicant/Owner: Wolfden State: ME Sampling Point: T2 Plot 2 up

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): convex Slope (%): 5

Subregion (LRR or MLRA): LRR Lat: 46.1384932 Long: -68.4620572 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No x (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes _____ | No x | **Is the Sampled Area within a Wetland?** **Yes** _____ **No** x |
| Hydric Soil Present? | Yes _____ | No x | |
| Wetland Hydrology Present? | Yes _____ | No x | If yes, optional Wetland Site ID: _____ |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes _____ | No x | Depth (inches): |
| Water Table Present? | Yes _____ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes _____ | No x | Depth (inches): |

**Wetland Hydrology Present?** **Yes** _____ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 2 up

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. American beech *(Fagus grandifolia)* | 40 | Y | FACU |
| 2. Sugar maple *(Acer saccharum)* | 25 | N | FACU |
| 3. Balsam fir (*Abies balsamea*) | 15 | N | FAC |
| 4. Gray birch *(Betula populifolia)* | 10 | N | FAC |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 90 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Red spruce *(Picea rubens)* | 10 | Y | FACU |
| 2. American beech (*Fagus grandifolia*) | 10 | N | FACU |
| 3. Sugar maple (*Acer saccharum*) | 10 | N | FACU |
| 4. Stripped maple (*Acer pensylvanicum*) | 10 | N | FACU |
| 5. Hobblebush *(Viburnum lantanoides)* | 5 | N | FAC |
| 6. | | | |
| 7. | | | |
| | 45 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. Lady fern *(Athyrium angustum)* | 3 | Y | FAC |
| 2. *American beech seedlings* | 3 | N | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 6 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** _____ **No** x

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 2 up

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | various | | | | | | organic | Oe horizon; dry |
| 3-4 | 7.5YR 6/2 | 99 | | | | | Fine sandy loam | |
| 4-7 | 7.5YR 4/6 | 99 | | | | | Sandy loam | no redox features |
| 7+ | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 7"

Depth (inches): _____

**Hydric Soil Present?** **Yes** _____ **No** x

Remarks:

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/19/2020

Applicant/Owner: Wolfden State: ME Sampling Point: T2 Plot 2 wet

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): Gentle slope Local relief (concave, convex, none): 1.5' deep skidder ruts Slope (%): 1

Subregion (LRR or MLRA): LRR Lat: 46.1384449 Long: -68.4619157 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes ___ No x

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes x | No | **Is the Sampled Area within a Wetland?** **Yes** x **No** |
| Hydric Soil Present? | Yes x | No | If yes, optional Wetland Site ID: _____ |
| Wetland Hydrology Present? | Yes x | No | |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- x Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- x Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No x | Depth (inches): |
| Water Table Present? | Yes ___ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes x | No ___ | Depth (inches): 2 |

**Wetland Hydrology Present?** **Yes** x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Presence of sphagnum sp. in wetland area.

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 2 wet

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Gray birch *(Betula populifolia)* | 15 | Y | FAC |
| 2. Balsam fir (*Abies balsamea*) | 5 | N | FAC |
| 3. Sugar maple (Acer saccharum) | 5 | N | FACU |
| 4. | | | |
| 5. Note: Sugar maple located outside of wetland. | | | |
| 6. | | | |
| 7. | | | |
| | 25 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Red cedar *(Juniperus virginiana)* | 20 | Y | FACU |
| 2. Gray birch (*Betula populifolia*) | 10 | Y | FAC |
| 3. *Balsam fir (Abies balsamea)* | 10 | N | FAC |
| 4. *Sugar maple (Acer saccharum)* | 5 | N | FACU |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 45 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. Sphagnum (Sphagnum capillifolium) | 60 | N | NA |
| 2. Nodding sedge (Carex gynandra) | 30 | Y | FACW |
| 3. Interrupted fern (*Osmunda claytoniana*) | 10 | N | FAC |
| 4. Wild mint *(Mentha arvensis)* | 5 | N | FACW |
| 5. Dwarf raspberry (*Rubus pubescens*) | 5 | N | FACW |
| 6. Unidentified grass (no fruit) | 5 | N | NA |
| 7. | | | |
| 8. Sphagnum not counted on cover % as other plants were growing through it. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 55 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** x **No**

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 2 wet

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 4/2 | | 7.5 YR 6/8 | 5 | c | m | Loam | 10% gravel; saturated |
| 6+ | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- x Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 6"

Depth (inches): _____

**Hydric Soil Present?** **Yes** x **No** _____

Remarks:

Area disturbed by past logging operations.

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/19/2020

Applicant/Owner: Wolfden State: ME Sampling Point: T2 Plot 3 up

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): convex Slope (%): 3

Subregion (LRR or MLRA): LRR Lat: 46.1393147 Long: -68.4621396 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No x (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes _____ | No x | **Is the Sampled Area within a Wetland?** | **Yes** _____ **No** x |
| Hydric Soil Present? | Yes _____ | No x | | |
| Wetland Hydrology Present? | Yes _____ | No x | If yes, optional Wetland Site ID: _____ | |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes _____ | No x | Depth (inches): |
| Water Table Present? | Yes _____ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes _____ | No x | Depth (inches): |

**Wetland Hydrology Present?** **Yes** _____ **No** x

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 3 up

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. American beech *(Fagus grandifolia)* | 50 | Y | FACU |
| 2. Gray birch *(Betula populifolia)* | 20 | N | FAC |
| 3. Balsam fir (*Abies balsamea*) | 15 | N | FAC |
| 4. Eastern cottonwood (*Populus deltoides*) | 10 | N | FAC |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 95 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Stripped maple (*Acer pensylvanicum*) | 20 | Y | FACU |
| 2. Sugar maple (*Acer saccharum*) | 10 | N | FACU |
| 3. Balsam fir (*Abies balsamea*) | 5 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 35 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. Lady fern *(Athyrium angustum)* | 2 | N | FAC |
| 2. *American beech seedlings* | 2 | Y | FACU |
| 3. Sugar maple (Acer saccharum) | 2 | N | FACU |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 6 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** _____ **No** x

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 3 up

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | various | | | | | | organic | Oe horizon; dry |
| 3-4 | 7.5YR 6/2 | 99 | | | | | Fine sandy loam | |
| 4-7 | 7.5YR 4/6 | 99 | | | | | Sandy loam | no redox features |
| 7+ | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 5"

Depth (inches): ___

**Hydric Soil Present?** **Yes** ___ **No** x

Remarks:

# WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Wolfden Pickett Mountain City/County: Aroostook Sampling Date: 6/19/2020

Applicant/Owner: Wolfden State: ME Sampling Point: T2 Plot 3 wet

Investigator(s): Ian Broadwater Section, Township, Range: Moro Plantation

Landform (hillslope, terrace, etc.): Gentle slope Local relief (concave, convex, none): 1.5' deep skidder ruts Slope (%): 1

Subregion (LRR or MLRA): LRR Lat: 46.1392500 Long: -68.4621266 Datum: 1984 WGS

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No x (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology x significantly disturbed? Are "Normal Circumstances" present? Yes ___ No x

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes x | No | **Is the Sampled Area within a Wetland?** **Yes** x **No** |
| Hydric Soil Present? | Yes x | No | If yes, optional Wetland Site ID: _____ |
| Wetland Hydrology Present? | Yes x | No | |

Remarks: (Explain alternative procedures here or in a separate report.)

Lack of rain over the past few weeks has resulted in abnormally dry conditions. Area has been forested and there is evidence of disturbance from this activity. Old skidder roads are present that appear to have been bulldozed as they have oil piles along the road edges. Sometimes they contain wetlands in an otherwise upland setting.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- x Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- x Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No x | Depth (inches): |
| Water Table Present? | Yes ___ | No x | Depth (inches): |
| Saturation Present? (includes capillary fringe) | Yes x | No ___ | Depth (inches): 3 |

**Wetland Hydrology Present?** **Yes** x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION –** Use scientific names of plants.

Sampling Point: T2 Plot 3 wet

| Tree Stratum (Plot size: 30') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Balsam fir (*Abies balsamea*) | 25 | Y | FAC |
| 2. Gray birch (*Betula populifolia*) | 10 | N | FAC |
| 3. | | | |
| 4. American beech (*Fagus grandifolia*) | 20 | N | FACU |
| 5. Note: Beech located outside of wetland so not counted in total cover. | | | |
| 6. | | | |
| 7. | | | |
| | 35 = Total Cover | | |

| Sapling/Shrub Stratum (Plot size: 15') | | | |
|---|---|---|---|
| 1. Gray birch (*Betula populifolia*) | 20 | Y | FAC |
| 2. American beech (*Fagus grandifolia*) | 15 | N | FACU |
| 3. | | | |
| 4. *Note: Beech located outside of wetland so not counted in total cover.* | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 20 = Total Cover | | |

| Herb Stratum (Plot size: 5') | | | |
|---|---|---|---|
| 1. Nodding sedge (Carex gynandra) | 25 | Y | OBL |
| 2. Wild mint (*Mentha arvensis*) | 25 | Y | FACW |
| 3. Dwarf raspberry (*Rubus pubescens*) | 5 | N | FACW |
| 4. Cinnamon fern (*Osmunda cinnamomea*) | 2 | N | FACW |
| 5. Sensitive fern (Onoclea sensibilis | 2 | N | FACW |
| 6. Unidentified grass (no fruit) | 2 | N | NA |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 59 = Total Cover | | |

| Woody Vine Stratum (Plot size: 30') | | | |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 0 = Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree –** Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub –** Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** x **No**

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point: T2 Plot 3 wet

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR 4/2 | | | | | | Sandy loam | |
| 3-7 | 10YR 4/6 | 97 | 7.5YR 6/8 | 2 | c | m | Fine sandy loam | very moist |
| 7+ | Refusal on cobbles | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- x Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L, M**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: very stony layer at 7"

Depth (inches): _____

**Hydric Soil Present?** **Yes** x **No** ___

Remarks:

Area disturbed by past logging operations.

## Site Photographs

| | | | |
|---|---|---|---|
| ***Client:*** | Wolfden | ***Project Number:*** | **3617197478.4.1** |
| ***Site Name:*** | Pickett Mountain | ***Site Location:*** | Patten, Maine |

***Photographer:***

Ian Broadwater

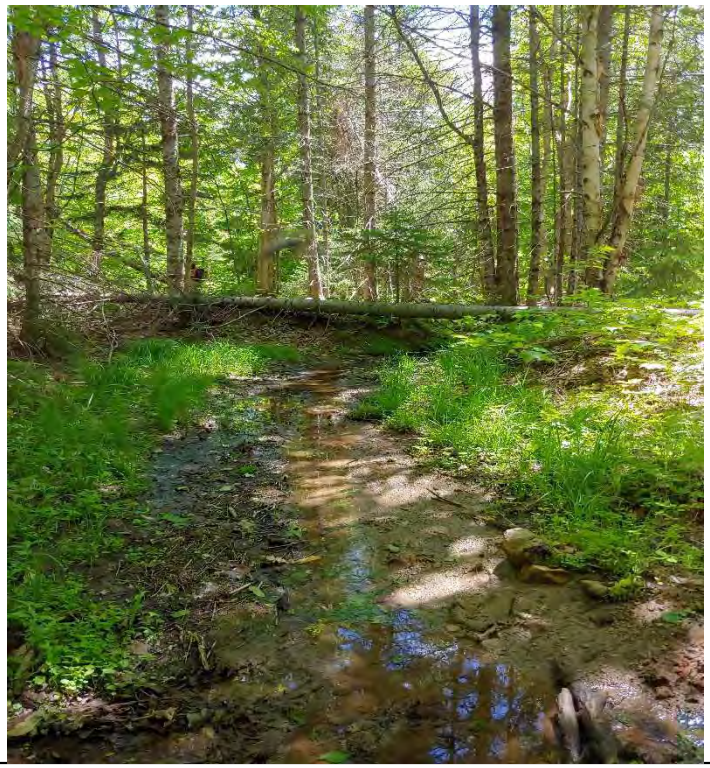
***Date:***
05/18/2020

***Photograph:*** 1

***Direction:***
Northwest

***Description:***

Branch of Stream 14 that developed in a skidder road



***Photographer:***

Ian Broadwater

***Date:***
05/18/2020

***Photograph:*** 2

***Direction:***
South

***Description:***

Branch of Stream 14

| Site Photographs | | | |
|---|---|---|---|
| ***Client:*** | Wolfden | ***Project Number:*** | **3617197478.4.1** |
| ***Site Name:*** | Pickett Mountain | ***Site Location:*** | Patten, Maine |

| | |
|---|---|
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 3<br>***Direction:*** West<br>***Description:*** Natural portion of Stream 14 uninterrupted by skidder trails. | |
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 4<br>***Direction:*** South<br>***Description:*** Emergent wetland that formed in an old logging road. Notice banks of soil on the left possibly from a dozer. | |

| Site Photographs | | | |
|---|---|---|---|
| ***Client:*** | Wolfden | ***Project Number:*** | **3617197478.4.1** |
| ***Site Name:*** | Pickett Mountain | ***Site Location:*** | Patten, Maine |

| | |
|---|---|
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 22020<br>***Photograph:*** 5<br>***Direction:*** Southeast<br>***Description:*** T2 Plot 1 upland | |
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 6<br>***Direction:*** South<br>***Description:*** T2 Plot 1 wetland | |

| Site Photographs | | | |
|---|---|---|---|
| ***Client:*** | Wolfden | ***Project Number:*** | **3617197478.4.1** |
| ***Site Name:*** | Pickett Mountain | ***Site Location:*** | Patten, Maine |

| | |
|---|---|
| ***Photographer:*** Ian Broadwater<br>***Date:*** 05/18/2020<br>***Photograph:*** 7<br>***Direction:*** Southeast<br>***Description:*** T2 Plot 2 upland | |
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 8<br>***Direction:*** South<br>***Description:*** T2 Plot 2 wetland | |

| Site Photographs | | | |
|---|---|---|---|
| ***Client:*** | Wolfden | ***Project Number:*** | **3617197478.4.1** |
| ***Site Name:*** | Pickett Mountain | ***Site Location:*** | Patten, Maine |

| | |
|---|---|
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 9<br>***Direction:*** Southeast<br>***Description:*** T2 Plot 3 upland | |
| ***Photographer:*** Ian Broadwater<br>***Date:*** June 2020<br>***Photograph:*** 10<br>***Direction:*** South<br>***Description:*** T2 Plot 3 wetland | |

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-A

**MDIFW Pool ID:** _____

### 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Ian Broadwater

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

### 2. PROJECT CONTACT INFORMATION

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain Mine

### 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ◉ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: 807-624-1134

Street Address: 1100 Russell Street City: Thunder Bay State: ON Zip: P7B 5N2

Canada

c. ☐ Large Projects: check if separate project landowner data file submitted

### 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11, take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 550' from landing at a bearing of 250 deg along road.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: _____ Latitude/Northing: _____

Coordinate system: _____

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

◉ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

○ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** _____

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ⦿ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☐ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☑ Other: isolated pool

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ○ Natural ⦿ Natural-Modified ○ Unnatural ○ Unknown Language added in this revision.

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

Because this feature is adjacent to dirt road, it may have been constructed or modified during road construction or maintenance.

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ○ Permanent
- ⦿ Semi-permanent (drying partially in all years and completely in drought years)
- ○ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

Dried up to no free water in late May.

■ Maximum depth at survey: ⦿ 0-12" (0-1 ft.) ○ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 14 ○ m ⦿ ft Length: 20 ○ m ⦿ ft

■ Predominate substrate in order of increasing hydroperiod:

- ⦿ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ○ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☑ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☐ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☐ Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ⦿ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** May 18 and May 28, 2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Blue-spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Fairy Shrimp[3] | 0 | 0 | | 3 | 3 | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Bear, Moose and Deer scat and tracks observed in area.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP A is along a dirt road (May 18, 2020).

VP A was dry on May 28, 2020.

07/18/22 Revisions -Charles Lyman, Wood Infrastructure

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-B

**MDIFW Pool ID:** _____

**1. PRIMARY OBSERVER INFORMATION**

a. Observer name: Charles Lyman

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

Selections updated

**2. PROJECT CONTACT INFORMATION**

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain

**3. LANDOWNER CONTACT INFORMATION**

a. Are you the landowner? ○ Yes ○ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: (807) 624-1134

Street Address: 1100 Russell St City: Thunder Bay State: ONT Zip: P7B5

c. ☐ Large Projects: check if separate project landowner data file submitted

**4. VERNAL POOL LOCATION INFORMATION**

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11, take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 3,250' west southwest from landing along road.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 992484 Latitude/Northing: 900800

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** 5/18/2020

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ◉ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☑ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☐ Other: _____

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ○ Natural ◉ Natural-Modified ○ Unnatural ○ Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

The southern edge of the pool is bordered by a woods road, feature is not a ditch.

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ○ Permanent
- ◉ Semi-permanent (drying partially in all years and completely in drought years)
- ○ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

■ Maximum depth at survey: ○ 0-12" (0-1 ft.) ◉ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 20 ○ m ◉ ft Length: 40 ○ m ◉ ft

■ Predominate substrate in order of increasing hydroperiod:

- ○ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ◉ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☑ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☐ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☐ Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ◉ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** 5/18/2020; 5/28/2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 2 | 0 | | 3 | 3 | | F | | | | | | | | |
| Spotted Salamander | | | | | | | | | | | | | | | |
| Blue-spotted Salamander | | | | | | | | | | | | | | | |
| Fairy Shrimp[3] | | | | | | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP-B; 5/18/2020

VP-B; 5/28/2020

07/18/22 Revisions -Charles Lyman, Wood Infrastructure

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-C

**MDIFW Pool ID:** _____

### 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Charles Lyman

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

Selections updated

### 2. PROJECT CONTACT INFORMATION

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain

### 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ○ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: _____

Street Address: 1100 Russell St City: Thunder Bay State: Ont Zip: P7B5

c. ☐ Large Projects: check if separate project landowner data file submitted

### 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11, take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 3,250' west southwest from landing along road.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 992480 Latitude/Northing: 900910

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** 5/18/2020

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ⦿ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☑ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☐ Other: _____

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ○ Natural ⦿ Natural-Modified ○ Unnatural ○ Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

The southern edge of the pool is bordered by a woods road, feature is not a ditch.

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ○ Permanent
- ⦿ Semi-permanent (drying partially in all years and completely in drought years)
- ○ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

Significant decrease in water level between reconnaissance trips to the pool (5/18/2020; 5/28/2020)

■ Maximum depth at survey: ⦿ 0-12" (0-1 ft.) ○ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 10 ○ m ⦿ ft Length: 20 ○ m ⦿ ft

■ Predominate substrate in order of increasing hydroperiod:

- ○ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ⦿ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☑ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☐ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☐ Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ⦿ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** 5/18/2020; 5/28/2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 35 | 0 | | 3 | 3 | | F&A | | | | | | | | |
| Spotted Salamander | 0 | 3 | | 3 | 3 | | | F&A | | | | | | | |
| Blue-spotted Salamander | | | | | | | | | | | | | | | |
| Fairy Shrimp[3] | | | | | | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☐ Non Significant VP ☑ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Pool had significantly dried up between visits, skidder ruts in pool observed at low water.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP-C; 5/18/2020

VP-C; 5/28/2020

07/18/22 Revisions - Charles Lyman, Wood Infrastructure

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-D

**MDIFW Pool ID:** _____

### 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Charles Lyman

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

Selections updated

### 2. PROJECT CONTACT INFORMATION

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain

### 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ○ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: _____

Street Address: 1100 Russell St City: Thunder Bay State: Ont Zip: 7B5N

c. ☐ Large Projects: check if separate project landowner data file submitted

### 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11, take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 4,750' west southwest from landing along road, then turn south and go 250' into woods.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 992183 Latitude/Northing: 899358

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** 5/18/2020

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ◉ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☑ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☐ Other: _____

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ○ Natural ○ Natural-Modified ◉ Unnatural ○ Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

This feature appears to be an old cellar hole, has long been naturalized.

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ◉ Permanent
- ○ Semi-permanent (drying partially in all years and completely in drought years)
- ○ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

No significant change in water level between visits

■ Maximum depth at survey: ○ 0-12" (0-1 ft.) ◉ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 20 ○ m ◉ ft Length: 20 ○ m ◉ ft

■ Predominate substrate in order of increasing hydroperiod:

- ○ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ◉ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☑ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☐ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☑ Other: green frogs

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ◉ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** 5/18/2020; 5/28/2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 26 | 0 | | 3 | 3 | | A/H | | | | | | | | |
| Spotted Salamander | 7 | 13 | | 3 | 3 | | F | A | | | | | | | |
| Blue-spotted Salamander | | | | | | | | | | | | | | | |
| Fairy Shrimp[3] | | | | | | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Observed (7) green frogs in PVP-D during second pool visit.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP-D; 5/19/2020

VP-D; 5/28/2020

07/21/22 Revisions - Ian Broadwater, Broadwater Environmental, LLC

# Maine State Vernal Pool Assessment Form

**INSTRUCTIONS: Complete all 3 pages of form as thoroughly as possible. Most fields are required for pool registration.**

**Observer's Pool ID:** VP-E **MDIFW Pool ID:** _____

## 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Ian Broadwater

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ☒ Yes

## 2. PROJECT CONTACT INFORMATION

a. Contact name: ☒ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ○ Yes

c. Project Name: Wolfden Pickett Mountain Mine

***NOTE:*** ***Clear photographs or digital images of a) the pool and b) the indicators (one example of each species egg mass) are required for nonprofessional observers and encouraged for all observers.***

## 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ☒ No If no, was landowner permission obtained for survey? ☒ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: 207-283-1186

Street Address: 1100 Russell Street City: Thunder Bay State: ON Zip: P7B 5N2 Canada

c. ☐ Large Projects: check if separate project landowner data file submitted

## 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: _____

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. Ay Scenic Highway Marker Mile11 take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located approximately 1920' from landing at a bearing of 210 deg

**b. Mapping Requirements:** At least 2 of the 3 must be submitted (check those submitted):

☐ USGS topographic map with pool clearly marked.

☒ Large scale aerial photograph with pool clearly marked.

☒ GPS data (complete section below).

**GPS location of vernal pool**

Longitude/Easting: -68.45822 Latitude/Northing: 46.13664

Check Datum: ○ NAD27 ☒ NAD83 / WGS84 Coordinate system: _____

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (best)

○ The pool perimeter is delineated by multiple GPS points. (excellent)
- Include map or spreadsheet with coordinates.

☒ The above GPS point is at the center of the pool. (good)

○ The center of the pool is approximately _____ m ○ /ft ○ in the compass direction of _____ degrees from the above GPS point. (acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):**_____

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- (X) Isolated depression
- ( ) Floodplain depression
- ( ) Pool associated with larger wetland complex
- ( ) Other: _____

■ Check all wetland types that best apply to this pool:

- [x] Forested swamp
- [ ] Shrub swamp
- [ ] Peatland (fen or bog)
- [ ] Emergent marsh
- [ ] Wet meadow
- [ ] Lake or Pond Cove
- [ ] Abandoned beaver flowage
- [ ] Active beaver flowage
- [ ] Slow stream
- [ ] Floodplain
- [ ] Isolated pool
- [ ] Other: _____

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ( ) Natural (X) Natural-Modified ( ) Unnatural ( ) Unknown Language added

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (required):

Skidder road is adjacent to the pool and a boulder on the edge of the pool may have encouraged erosion to form the depression.

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale for opinion.

- ( ) Permanent
- ( ) Semi-permanent (drying partially in all years and completely in drought years)
- (X) Ephemeral (drying out completely in most years)
- ( ) Unknown

Explain:

Pool was shallow to start making it susceptible to drying in most years.

■ Maximum depth at survey: ( ) 0-12" (0-1 ft.) (X) 12-36" (1-3 ft.) ( ) 36-60" (3-5 ft.) ( ) >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 7 ( ) m (X) ft Length: 12 ( ) m (X) ft

■ Predominate substrate in order of increasing hydroperiod:

- ( ) Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- (X) Mineral soil (sphagnum moss present)
- ( ) Organic matter (peat/muck) shallow or restricted to deepest portion
- ( ) Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- [ ] Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- [ ] Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- [ ] Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- [ ] Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- [x] Sphagnum moss (anchored or suspended)
- [ ] Wet site ferns (e.g. royal fern, marsh fern)
- [ ] Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- [ ] Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- [ ] Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- [ ] Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- [ ] No vegetation in pool

■ Faunal indicators (check all that apply):

- [ ] Fish
- [ ] Bullfrog or Green Frog tadpoles
- [ ] Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- (X) No inlet or outlet
- ( ) Intermittent inlet or outlet
- ( ) Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ( ) Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** May 17 and May 28, 2020

**b. Indicator abundance criteria**

- Was the entire pool surveyed for egg masses? (X) Yes ( ) No; what % of pool surveyed?_____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | | | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | | |
| Wood Frog | 0 | 0 | 0 | 3 | 3 | 3 | | | | 0 | 0 | 0 | 3 | 3 | 3 | |
| Spotted Salamander | 0 | 0 | 0 | 3 | 3 | 3 | | | | 0 | 0 | 0 | 3 | 3 | 3 | |
| Blue-spotted Salamander | 0 | 0 | 0 | 3 | 3 | 3 | | | | 0 | 0 | 0 | 3 | 3 | 3 | |
| Fairy Shrimp[3] | 0 | 0 | 0 | 3 | 3 | 3 | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy Shrimp: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs (labeled with observer name, pool location, and date).

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☒ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Bear, Moose and Deer scat and tracks observed in area.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE:** Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials:_____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ( ) does not meet biological criteria. ( ) does not meet MDEP vernal pool criteria.

Comments:

PVP E May 17, 2020.  No egg masses were present.

PVPE was dried up on May 28, 2020.

07/18/22 Revisions -Charles Lyman, Wood Infrastructure

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-F

**MDIFW Pool ID:** _____

**1. PRIMARY OBSERVER INFORMATION**

a. Observer name: Charles Lyman

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

**2. PROJECT CONTACT INFORMATION**

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain Mine

Selections updated

**3. LANDOWNER CONTACT INFORMATION**

a. Are you the landowner? ○ Yes ○ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: (807) 624-1134

Street Address: 1100 Russell St City: Thunder Bay State: Ont Zip: 7B5N

c. ☐ Large Projects: check if separate project landowner data file submitted

**4. VERNAL POOL LOCATION INFORMATION**

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11, take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 5000' west southwest from landing
.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 990748 Latitude/Northing: 900669

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** 5/18/2020

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- (●) Isolated depression
- ( ) Floodplain depression
- ( ) Pool associated with larger wetland complex
- ( ) Other: _____

■ Check all wetland types that best apply to this pool:

- [x] Forested swamp
- [ ] Shrub swamp
- [ ] Peatland (fen or bog)
- [ ] Emergent marsh
- [ ] Wet meadow
- [ ] Lake or pond cove
- [ ] Abandoned beaver flowage
- [ ] Active beaver flowage
- [ ] Slow stream
- [ ] Floodplain
- [ ] Mostly unvegetated pool
- [ ] ATV or skidder rut
- [ ] Dug pond or borrow pit
- [ ] Roadside ditch
- [ ] Other: _____

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ( ) Natural (●) Natural-Modified ( ) Unnatural ( ) Unknown

Language added

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

Observed old test pit and skidder ruts in and around pool

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ( ) Permanent
- (●) Semi-permanent (drying partially in all years and completely in drought years)
- ( ) Ephemeral (drying out completely in most years)
- ( ) Unknown

Explain:

Significant decrease in water level between reconnaissance trips to the pool (5/18/2020; 5/28/2020)

■ Maximum depth at survey: (●) 0-12" (0-1 ft.) ( ) 12-36" (1-3 ft.) ( ) 36-60" (3-5 ft.) ( ) >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 40 ( ) m ( ) ft Length: 60 ( ) m ( ) ft

■ Predominate substrate in order of increasing hydroperiod:

- ( ) Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ( ) Mineral soil (sphagnum moss present)
- (●) Organic matter (peat/muck) shallow or restricted to deepest portion
- ( ) Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- [ ] Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- [ ] Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- [ ] Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- [ ] Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- [ ] Sphagnum moss (anchored or suspended)
- [ ] Wet site ferns (e.g. royal fern, marsh fern)
- [ ] Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- [x] Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- [ ] Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- [ ] Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- [ ] No vegetation in pool

■ Faunal indicators (check all that apply):

- [ ] Fish
- [ ] Bullfrog or Green Frog tadpoles
- [ ] Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- (●) No inlet or outlet
- ( ) Intermittent inlet or outlet
- ( ) Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ( ) Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** 5/19/2020; 5/28/20200

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 10 | 0 | | 3 | 3 | | A/H | | | | X | | | 3 | |
| Spotted Salamander | 14 | 1 | | 3 | 3 | | M | H | | | | | | | |
| Blue-spotted Salamander | | | | | | | | | | | | | | | |
| Fairy Shrimp[3] | | | | | | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP-F; 5/19/2020

VP-F; 5/28/2020

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-G

**MDIFW Pool ID:** _____

### 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Ian Broadwater

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

### 2. PROJECT CONTACT INFORMATION

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain Mine

### 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ◉ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: 807-624-1134

Street Address: 1100 Russell Street City: Thunder Bay State: ON Zip: P7B 5N2

Canada

c. ☐ Large Projects: check if separate project landowner data file submitted

### 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11 take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 2680' from landing at a bearing of 225 deg.

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 994132 Latitude/Northing: 900015

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** _____

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ⦿ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☐ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☑ Other: isolated pool

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ⦿ Natural ○ Natural-Modified ○ Unnatural ○ Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ○ Permanent
- ○ Semi-permanent (drying partially in all years and completely in drought years)
- ⦿ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

Pool was shallow to start making it susceptible to drying in most years.

■ Maximum depth at survey: ○ 0-12" (0-1 ft.) ⦿ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 12 ○ m ⦿ ft Length: 12 ○ m ⦿ ft

■ Predominate substrate in order of increasing hydroperiod:

- ⦿ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ○ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☐ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☑ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☐ Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ⦿ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** May 17 and May 28, 2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Blue-spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Fairy Shrimp[3] | 0 | 0 | | 3 | 3 | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Bear, Moose and Deer scat and tracks observed in area.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

PVP G on May 17, 2020.

VP G on May 28, 2020.  Only a few inches of free water remain.

# Maine State Vernal Pool Assessment Form

## INSTRUCTIONS:

- **Complete all 3 pages of form thoroughly. Most fields are required for pool registration.**
- **Clear photographs of a) the pool AND b) the indicators (one example of each species egg mass) are required for all observers.**

**Observer's Pool ID:** VP-H

**MDIFW Pool ID:** _____

### 1. PRIMARY OBSERVER INFORMATION

a. Observer name: Ian Broadwater

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

### 2. PROJECT CONTACT INFORMATION

a. Contact name: ◉ same as observer ○ other _____

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Wolfden Pickett Mountain Mine

### 3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ◉ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Wolfden Resources Corporation Phone: 807-624-1134

Street Address: 1100 Russell Street City: Thunder Bay State: ON Zip: P7B 5N2

Canada

c. ☐ Large Projects: check if separate project landowner data file submitted

### 4. VERNAL POOL LOCATION INFORMATION

**a. Location** Township: T6R6

Brief site directions to the pool (using mapped landmarks):

Drive approximately 10 miles north of Patten on Rt 11. At Highway Marker Mile11 take a left into woods road. Drive to Mile 4.5 and there is a cleared landing on the left. Pool is located 3500' from landing at a bearing of 235 deg

**b. Mapping Requirements**

**i.** USGS topographic map OR aerial photograph with pool clearly marked.

**ii. GPS location of vernal pool (use Datum NAD83 / WGS84)**

Longitude/Easting: 993017 Latitude/Northing: 899875

Coordinate system: NAD 83, east, ft

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (Best)

○ The pool perimeter is delineated by multiple GPS points. (Excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (Good)

○ The center of the pool is approximately _____ m ○ ft ○ in the compass direction of _____ degrees from the above GPS point. (Acceptable)

## 5. VERNAL POOL HABITAT INFORMATION

**a. Habitat survey date (only if different from indicator survey dates on page 3):** _____

**b. Wetland habitat characterization**

■ Choose the best descriptor for the landscape setting:

- ⦿ Isolated depression
- ○ Floodplain depression
- ○ Pool associated with larger wetland complex
- ○ Other: _____

■ Check all wetland types that best apply to this pool:

- ☐ Forested swamp
- ☐ Shrub swamp
- ☐ Peatland (fen or bog)
- ☐ Emergent marsh
- ☐ Wet meadow
- ☐ Lake or pond cove
- ☐ Abandoned beaver flowage
- ☐ Active beaver flowage
- ☐ Slow stream
- ☐ Floodplain
- ☐ Mostly unvegetated pool
- ☐ ATV or skidder rut
- ☐ Dug pond or borrow pit
- ☐ Roadside ditch
- ☑ Other: isolated pool

**c. Vernal pool status under the Natural Resources Protection Act (NRPA)**

**i. Pool Origin:** ⦿ Natural ○ Natural-Modified ○ Unnatural ○ Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (**required**):

**ii. Pool Hydrology**

■ Select the pool's estimated hydroperiod AND provide rationale in box (**required**):

- ○ Permanent
- ○ Semi-permanent (drying partially in all years and completely in drought years)
- ⦿ Ephemeral (drying out completely in most years)
- ○ Unknown

Explain:

Pool was shallow to start making it susceptible to drying in most years.

■ Maximum depth at survey: ⦿ 0-12" (0-1 ft.) ○ 12-36" (1-3 ft.) ○ 36-60" (3-5 ft.) ○ >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 10 ○ m ⦿ ft Length: 10 ○ m ⦿ ft

■ Predominate substrate in order of increasing hydroperiod:

- ⦿ Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- ○ Mineral soil (sphagnum moss present)
- ○ Organic matter (peat/muck) shallow or restricted to deepest portion
- ○ Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- ☐ Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- ☐ Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- ☐ Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- ☐ Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- ☐ Sphagnum moss (anchored or suspended)
- ☐ Wet site ferns (e.g. royal fern, marsh fern)
- ☐ Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- ☐ Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- ☐ Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- ☐ Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- ☑ No vegetation in pool

■ Faunal indicators (check all that apply):

- ☐ Fish
- ☐ Bullfrog or Green Frog tadpoles
- ☐ Other: _____

**iii. Inlet/Outlet Flow Permanency**

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- ⦿ No inlet or outlet
- ○ Intermittent inlet or outlet
- ○ Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ○ Other or Unknown (explain): _____

# Maine State Vernal Pool Assessment Form

## 6. VERNAL POOL INDICATOR INFORMATION

**a. Indicator survey dates:** May 18 and May 28, 2020

**b. Indicator abundance criteria and pool survey effort**

- Is pool depression bisected by 2 ownerships (straddler pool)? ○ Yes ◉ No
- Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of entire pool surveyed? _____
- For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

| INDICATOR SPECIES | Egg Masses (or adult Fairy Shrimp) | | | | | | | | | Tadpoles/Larvae[4] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Visit #1 | Visit #2 | Visit #3 | Confidence Level[1] | | | Egg Mass Maturity[2] | | | Observed | | | Confidence Level[1] | | |
| Wood Frog | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Blue-spotted Salamander | 0 | 0 | | 3 | 3 | | | | | 0 | 0 | | 3 | 3 | |
| Fairy Shrimp[3] | 0 | 0 | | 3 | 3 | | | | | | | | | | |

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%
2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching
3-Fairy shrimp: X = present
4-Tadpoles/larvae: X = present

**c. Rarity criteria**

- Note any rare species associated with vernal pools. Observations should be accompanied by photographs.

| SPECIES | Method of Verification* | | | CL** | SPECIES | Method of Verification* | | | CL** |
|---|---|---|---|---|---|---|---|---|---|
| | P | H | S | | | P | H | S | |
| Blanding's Turtle | ☐ | ☐ | ☐ | | Wood Turtle | ☐ | ☐ | ☐ | |
| Spotted Turtle | ☐ | ☐ | ☐ | | Ribbon Snake | ☐ | ☐ | ☐ | |
| Ringed Boghaunter | ☐ | ☐ | ☐ | | Other: | ☐ | ☐ | ☐ | |

*Method of verification: P = Photographed, H = Handled, S = Seen
**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

**d. Optional observer recommendation:**

☐ SVP ☐ Potential SVP ☑ Non Significant VP ☐ Indicator Breeding Area

**e. General vernal pool comments and/or observations of other wildlife:**

Bear, Moose and Deer scat and tracks observed in area.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

**NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.**

**For MDIFW use only** Reviewed by MDIFW Date:_____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

VP H on May 18, 2020

VP H on May 28, 2020.

# APPENDIX C REPRESENTATIVE PHOTOGRAPHS

Photo 1. Representative upland forest.
Stantec, June 2022.

Photo 2. Representative PFO wetland.
Stantec, June 2022.

Photo 3. Representative PEM wetland.
Stantec, June 2022.

Photo 4. Representative perennial stream.
Stantec, June 2022.

Photo 5. Representative intermittent stream.
Stantec, June 2022.

Photo 6. Representative stretch of ephemeral stream.
Stantec, June 2022.

Photo 7. Representative unnatural PVP identified by Stantec.
Stantec, June 2022.

# APPENDIX D USDA SOIL REPORT

United States Department of Agriculture

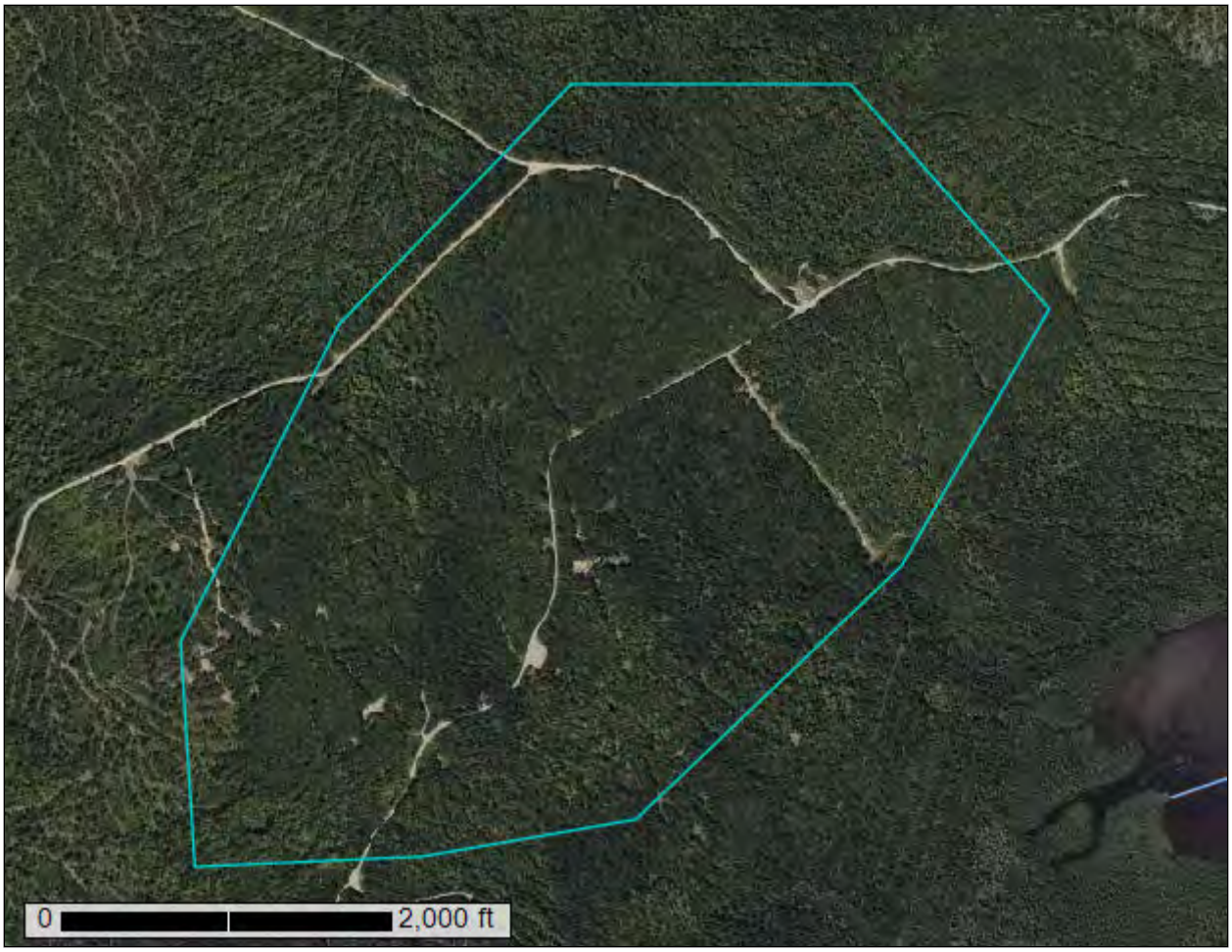
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# Penobscot County, Maine

## Pickett Mountain Mine – T6 R6 WELS, ME




July 7, 2022

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report
## Soil Map

Map Scale: 1:12,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine
Survey Area Data: Version 20, Aug 30, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2021—Oct 5, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | 168.0 | 45.0% |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony | 48.0 | 12.9% |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony | 14.2 | 3.8% |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky | 85.7 | 22.9% |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky | 2.9 | 0.8% |
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky | 54.6 | 14.6% |
| **Totals for Area of Interest** | | **373.5** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Penobscot County, Maine

## DyB—Dixmont very stony silt loam, 2 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 9ks9
*Elevation:* 10 to 1,000 feet
*Mean annual precipitation:* 34 to 46 inches
*Mean annual air temperature:* 41 to 46 degrees F
*Frost-free period:* 100 to 150 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Dixmont and similar soils:* 91 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Dixmont

#### Setting

*Landform:* Drumlins, ridges, till plains
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Concave
*Parent material:* Coarse-loamy supraglacial meltout till derived from phyllite and/or coarse-loamy supraglacial meltout till derived from slate

#### Typical profile

*H1 - 0 to 7 inches:* silt loam
*H2 - 7 to 23 inches:* silt loam
*H3 - 23 to 65 inches:* silt loam

#### Properties and qualities

*Slope:* 2 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.6 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.60 in/hr)
*Depth to water table:* About 12 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 10.1 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* C/D
*Ecological site:* F143XY502ME - Loamy Till Toeslope
*Hydric soil rating:* No

## PrC—Plaisted loam, 8 to 15 percent slopes, very stony

### Map Unit Setting

*National map unit symbol:* 2w3yk
*Elevation:* 120 to 2,500 feet
*Mean annual precipitation:* 35 to 52 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 80 to 140 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Plaisted and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Plaisted

#### Setting

*Landform:* Drumlinoid ridges, drumlins
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Coarse-loamy lodgment till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* loam
*Bs - 5 to 19 inches:* gravelly silt loam
*BC - 19 to 28 inches:* gravelly silt loam
*Cd - 28 to 65 inches:* gravelly silt loam

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 22 to 34 inches to densic material
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low (0.01 to 0.14 in/hr)
*Depth to water table:* About 26 to 41 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 5.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* C
*Ecological site:* F143XY501ME - Loamy Slope
*Hydric soil rating:* No

## RmD—Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony

### Map Unit Setting

*National map unit symbol:* 2w3zq
*Elevation:* 300 to 2,500 feet
*Mean annual precipitation:* 35 to 46 inches
*Mean annual air temperature:* 37 to 43 degrees F
*Frost-free period:* 90 to 130 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Rock outcrop:* 50 percent
*Thorndike and similar soils:* 35 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Rock Outcrop

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Crest, free face
*Down-slope shape:* Convex
*Across-slope shape:* Convex

#### Typical profile

*R - 0 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 15 to 25 percent
*Depth to restrictive feature:* 0 inches to lithic bedrock
*Drainage class:* Excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8s
*Hydric soil rating:* No

### Description of Thorndike

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material

*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 15 to 25 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F143XY701ME - Shallow Till
*Hydric soil rating:* No

## ThC—Thorndike channery silt loam, 8 to 15 percent slopes, rocky

**Map Unit Setting**

*National map unit symbol:* 2t0k6
*Elevation:* 300 to 2,500 feet
*Mean annual precipitation:* 35 to 52 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 130 days
*Farmland classification:* Farmland of statewide importance

**Map Unit Composition**

*Thorndike and similar soils:* 80 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Thorndike**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* channery silt loam

*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F146XY061ME - Shallow Loamy Till
*Hydric soil rating:* No

## TvB—Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky

**Map Unit Setting**

*National map unit symbol:* 2wqn4
*Elevation:* 200 to 2,500 feet
*Mean annual precipitation:* 35 to 48 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 160 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Thorndike and similar soils:* 50 percent
*Winnecook and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Thorndike**

**Setting**

*Landform:* Ground moraines
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam

*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 3 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F143XY701ME - Shallow Till
*Hydric soil rating:* No

## Description of Winnecook

**Setting**

*Landform:* Ground moraines
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oe - 0 to 3 inches:* moderately decomposed plant material
*E - 3 to 8 inches:* channery loam
*Bs1 - 8 to 12 inches:* very channery loam
*Bs2 - 12 to 27 inches:* very channery loam
*R - 27 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 3 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 21 to 43 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* B
*Ecological site:* F143XY701ME - Shallow Till

*Hydric soil rating:* No

## TvC—Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky

### Map Unit Setting

*National map unit symbol:* 2wqn5
*Elevation:* 200 to 2,500 feet
*Mean annual precipitation:* 35 to 48 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 160 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Thorndike and similar soils:* 55 percent
*Winnecook and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Thorndike

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F144BY701ME - Shallow Till

*Hydric soil rating:* No

### Description of Winnecook

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oe - 0 to 3 inches:* moderately decomposed plant material
*E - 3 to 8 inches:* channery loam
*Bs1 - 8 to 12 inches:* very channery loam
*Bs2 - 12 to 27 inches:* very channery loam
*R - 27 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 21 to 43 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* B
*Ecological site:* F144BY701ME - Shallow Till
*Hydric soil rating:* No

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# APPENDIX E CORPS WETLAND DETERMINATION DATA FORMS

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Side Slope Local relief (concave, convex, none): Convex Slope (%) 2 - 5

Subregion (LRR or MLRA): LRR R Lat: 46.132300 Long: -68.467385 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** Yes ____ No X |
| Hydric Soil Present? | Yes ____ | No X | if yes, optional Wetland Site ID: _____ |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | | |
|---|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ | No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ | No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W01TTA**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Abies balsamea | 25 | X | FAC |
| Picea rubens | 20 | X | FACU |
| Acer rubrum | 15 | | FAC |
| Fagus grandifolia | 15 | | FACU |
| Betula alleghaniensis | 10 | | FAC |
| | 85 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 15 | X | FACU |
| Acer rubrum | 15 | X | FAC |
| Acer pensylvanicum | 5 | | FACU |
| Abies balsamea | 5 | | FAC |
| | 40 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Dryopteris intermedia | 10 | X | FAC |
| Acer rubrum | 5 | X | FAC |
| Aralia nudicaulis | 5 | X | FACU |
| Maianthemum canadense | 3 | | FACU |
| | 23 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 57.1% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 0 | x 2 | 0 | |
| FAC species | 85 | x 3 | 255 | |
| FACU species | 63 | x 4 | 252 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 148 | (A) | 507 | (B) |

Prevalence Index = B/A = 3.43

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- ____ 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W01TTA**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 10YR 2/2 | 100 | | | | | Loam | |
| 1-6 | 10YR 3/2 | 100 | | | | | Loam | |
| 6-12 | 7.5YR 4/4 | 100 | | | | | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock

Depth (inches): 12

Hydric Soil Present? Yes ____ No X

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Floodplain Local relief (concave, convex, none): Linear Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.132277 Long: -68.467478 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PFO

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ___ (if no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | **Is the Sampled Area within a Wetland?** | Yes X No ___ |
| Hydric Soil Present? | Yes X No ___ | if yes, optional Wetland Site ID: | W01TTA |
| Wetland Hydrology Present? | Yes X No ___ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| | Surface Water (A1) | X | Water-Stained Leaves (B9) | | Surface Soil Cracks (B6) |
| X | High Water Table (A2) | | Aquatic Fauna (B13) | | Drainage Patterns (B10) |
| X | Saturation (A3) | | Marl Deposits (B15) | | Moss Trim Lines (B16) |
| | Water Marks (B1) | | Hydrogen Sulfide Odor (C1) | | Dry-Season Water Table (C2) |
| | Sediment Deposits (B2) | | Oxidized Rhizospheres on Living Roots (C3) | | Crayfish Burrows (C8) |
| | Drift Deposits (B3) | | Presence of Reduced Iron (C4) | | Saturation Visible in Aerial Imagery (C9) |
| | Algal Mat or Crust (B4) | | Recent Iron Reduction in Tilled Soils (C6) | | Stunted or Stressed Plants (D1) |
| | Iron Deposits (B5) | | Thin Muck Surface (C7) | | Geomorphic Position (D2) |
| | Inundation Visible on Aerial Imagery (B7) | | Other (Explain in Remarks) | | Shallow Aquitard (D3) |
| | Sparsley Vegetated Concave Surface (B8) | | | | Microtopographic Relief (D4) |
| | | | | | FAC-Neutral Test (D5) |

Secondary Indicators (minimum of two required)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ No X | Depth (inches) ___ | |
| Water Table Present? | Yes X No ___ | Depth (inches) 2 | Wetland Hydrology Present? Yes X No ___ |
| Saturation Present? | Yes X No ___ | Depth (inches) 0 | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W01TTA**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Betula alleghaniensis | 40 | X | FAC |
| Abies balsamea | 40 | X | FAC |
| Acer rubrum | 10 | | FAC |
| Picea rubens | 5 | | FACU |
| | 95 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Betula alleghaniensis | 30 | X | FAC |
| Acer spicatum | 20 | X | FACU |
| Fraxinus nigra | 5 | | FACW |
| | 55 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Osmunda claytoniana | 25 | X | FAC |
| Acer rubrum | 10 | X | FAC |
| Equisetum sylvaticum | 10 | X | FACW |
| Onoclea sensibilis | 10 | X | FACW |
| Carex gynandra | 3 | | OBL |
| | 58 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 87.5% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 3 | x 1 | 3 | |
| FACW species | 25 | x 2 | 50 | |
| FAC species | 155 | x 3 | 465 | |
| FACU species | 25 | x 4 | 100 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 208 | (A) | 618 | (B) |

Prevalence Index = B/A = 2.97

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- X 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W01TTA**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-16 | 10YR 2/1 | 100 | | | | | Muck | |

**Hydric Soil Indicators:**

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (B15)
- ___ Thin Dark Surface (S9)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matric (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ___ 2 cm Muck (A10)
- ___ Coast Prarie Redox (A16)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Mesic Spodic (TA6)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock

Depth (inches): 16

Hydric Soil Present? Yes X No ___

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Side Slope Local relief (concave, convex, none): Convex Slope (%) 2 - 3

Subregion (LRR or MLRA): LRR R Lat: 46.133551 Long: -68.469678 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | if yes, optional Wetland Site ID: | _____ |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W01TTF**

| **Tree Stratum** (Plot Size: 30'radius ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 25 | X | FACU |
| Betula alleghaniensis | 5 | | FAC |
| Abies balsamea | 5 | | FAC |
| Picea rubens | 5 | | FACU |
| | 40 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 30 | X | FACU |
| Picea rubens | 10 | X | FACU |
| Viburnum lantanoides | 5 | | FACU |
| | 45 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Maianthemum canadense | 2 | | FACU |
| | 2 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 0 | x 2 | 0 | |
| FAC species | 10 | x 3 | 30 | |
| FACU species | 77 | x 4 | 308 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 87 | (A) | 338 | (B) |

Prevalence Index = B/A = 3.89

**Hydrophytic Vegetation Indicators:**

____ 1- Rapid Test For Hydrophytic Vegetation

____ 2- Dominance Test is > 50%

____ 3- Prevalence Index is =< 3.0

____ 4- Morphological Adaptations

____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W01TTF**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 10YR 2/1 | 100 | | | | | Loam | |
| 1-4 | 10YR 3/2 | 100 | | | | | Loam | |
| 4-20 | 7.5YR 4/6 | 100 | | | | | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Depression Local relief (concave, convex, none): Concave Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.133593 Long: -68.469637 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PEM

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ___ (if no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | **Is the Sampled Area within a Wetland?** | Yes X No ___ |
| Hydric Soil Present? | Yes X No ___ | if yes, optional Wetland Site ID: | W01TTF |
| Wetland Hydrology Present? | Yes X No ___ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| X | Surface Water (A1) | X | Water-Stained Leaves (B9) | X | Drainage Patterns (B10) |
| X | High Water Table (A2) | | Aquatic Fauna (B13) | | Moss Trim Lines (B16) |
| X | Saturation (A3) | | Marl Deposits (B15) | | Dry-Season Water Table (C2) |
| | Water Marks (B1) | | Hydrogen Sulfide Odor (C1) | | Crayfish Burrows (C8) |
| | Sediment Deposits (B2) | | Oxidized Rhizospheres on Living Roots (C3) | | Saturation Visible in Aerial Imagery (C9) |
| | Drift Deposits (B3) | | Presence of Reduced Iron (C4) | | Stunted or Stressed Plants (D1) |
| | Algal Mat or Crust (B4) | | Recent Iron Reduction in Tilled Soils (C6) | | Geomorphic Position (D2) |
| | Iron Deposits (B5) | | Thin Muck Surface (C7) | | Shallow Aquitard (D3) |
| | Inundation Visible on Aerial Imagery (B7) | | Other (Explain in Remarks) | | Microtopographic Relief (D4) |
| | Sparsley Vegetated Concave Surface (B8) | | | | FAC-Neutral Test (D5) |

Secondary Indicators (minimum of two required)

| | |
|---|---|
| | Surface Soil Cracks (B6) |
| X | Drainage Patterns (B10) |
| | Moss Trim Lines (B16) |
| | Dry-Season Water Table (C2) |
| | Crayfish Burrows (C8) |
| | Saturation Visible in Aerial Imagery (C9) |
| | Stunted or Stressed Plants (D1) |
| | Geomorphic Position (D2) |
| | Shallow Aquitard (D3) |
| | Microtopographic Relief (D4) |
| | FAC-Neutral Test (D5) |

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes X No ___ | Depth (inches) | 1 |
| Water Table Present? | Yes X No ___ | Depth (inches) | 0 |
| Saturation Present? | Yes X No ___ | Depth (inches) | 0 |

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W01TTF**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Betula alleghaniensis | 60 | X | FAC |
| | 60 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Acer spicatum | 30 | X | FACU |
| Betula alleghaniensis | 15 | X | FAC |
| Acer pensylvanicum | 5 | | FACU |
| | 50 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Onoclea sensibilis | 15 | X | FACW |
| Equisetum sylvaticum | 10 | X | FACW |
| Athyrium angustum | 10 | X | FAC |
| Dryopteris intermedia | 10 | X | FAC |
| | 45 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85.7% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 25 | x 2 | 50 | |
| FAC species | 95 | x 3 | 285 | |
| FACU species | 35 | x 4 | 140 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 155 | (A) | 475 | (B) |

Prevalence Index = B/A = 3.06

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- ____ 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W01TTF**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR 2/1 | 100 | | | | | Muck | |
| 3-6 | 10YR 4/2 | 95 | 10YR 4/4 | 5 | C | M | Silt Loam | |
| 6-12 | 10YR 4/1 | 85 | 10YR 4/4 | 15 | C | M | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Side Slope Local relief (concave, convex, none): Convex Slope (%) 3 - 4

Subregion (LRR or MLRA): LRR R Lat: 46.142317 Long: -68.469075 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes ____ No X |
| Hydric Soil Present? | Yes X No ____ | if yes, optional Wetland Site ID: | _____ |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W01TTY**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Picea rubens | 25 | X | FACU |
| Acer rubrum | 15 | X | FAC |
| Abies balsamea | 15 | X | FAC |
| Betula papyrifera | 5 | | FACU |
| | 60 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Picea rubens | 20 | X | FACU |
| Acer pensylvanicum | 15 | X | FACU |
| Abies balsamea | 10 | X | FAC |
| Acer rubrum | 5 | | FAC |
| | 50 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Aralia nudicaulis | 15 | X | FACU |
| Dryopteris intermedia | 10 | X | FAC |
| Cornus canadensis | 5 | | FAC |
| Maianthemum canadense | 5 | | FACU |
| Acer rubrum | 2 | | FAC |
| | 37 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 0 | x 2 | 0 | |
| FAC species | 62 | x 3 | 186 | |
| FACU species | 85 | x 4 | 340 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 147 | (A) | 526 | (B) |

Prevalence Index = B/A = 3.58

**Hydrophytic Vegetation Indicators:**

____ 1- Rapid Test For Hydrophytic Vegetation

____ 2- Dominance Test is > 50%

____ 3- Prevalence Index is =< 3.0

____ 4- Morphological Adaptations

____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W01TTY**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 10YR 2/1 | 100 | | | | | Loam | |
| 1-3 | 10YR 4/3 | 100 | | | | | Silt Loam | |
| 3-9 | 10YR 4/2 | 90 | 10YR 4/4 | 10 | C | M | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 9

Hydric Soil Present? Yes X No ____

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Depression Local relief (concave, convex, none): Concave Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.142251 Long: -68.469223 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PFO

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | **Is the Sampled Area within a Wetland?** | Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | if yes, optional Wetland Site ID: | W01TTY |
| Wetland Hydrology Present? | Yes X No ____ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| | Surface Water (A1) | X | Water-Stained Leaves (B9) | | Secondary Indicators (minimum of two required) |
| X | High Water Table (A2) | | Aquatic Fauna (B13) | | Surface Soil Cracks (B6) |
| X | Saturation (A3) | | Marl Deposits (B15) | | Drainage Patterns (B10) |
| | Water Marks (B1) | | Hydrogen Sulfide Odor (C1) | | Moss Trim Lines (B16) |
| | Sediment Deposits (B2) | | Oxidized Rhizospheres on Living Roots (C3) | | Dry-Season Water Table (C2) |
| | Drift Deposits (B3) | | Presence of Reduced Iron (C4) | | Crayfish Burrows (C8) |
| | Algal Mat or Crust (B4) | | Recent Iron Reduction in Tilled Soils (C6) | | Saturation Visible in Aerial Imagery (C9) |
| | Iron Deposits (B5) | | Thin Muck Surface (C7) | | Stunted or Stressed Plants (D1) |
| | Inundation Visible on Aerial Imagery (B7) | | Other (Explain in Remarks) | | Geomorphic Position (D2) |
| | Sparsley Vegetated Concave Surface (B8) | | | | Shallow Aquitard (D3) |
| | | | | | Microtopographic Relief (D4) |
| | | | | | FAC-Neutral Test (D5) |

| | | | | |
|---|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches) ____ | Wetland Hydrology Present? Yes X No ____ |
| Water Table Present? | Yes X | No ____ | Depth (inches) 0 | |
| Saturation Present? | Yes X | No ____ | Depth (inches) 0 | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W01TTY**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Abies balsamea | 50 | X | FAC |
| Thuja occidentalis | 15 | X | FACW |
| Picea rubens | 5 | | FACU |
| | 70 = Total Cover | | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Abies balsamea | 20 | X | FAC |
| Thuja occidentalis | 15 | X | FACW |
| Acer rubrum | 15 | X | FAC |
| Betula alleghaniensis | 5 | | FAC |
| Tsuga canadensis | 3 | | FACU |
| | 58 = Total Cover | | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Glyceria melicaria | 20 | X | OBL |
| Carex gynandra | 15 | X | OBL |
| Onoclea sensibilis | 10 | | FACW |
| Rubus hispidus | 10 | | FACW |
| Dryopteris intermedia | 3 | | FAC |
| Dryopteris cristata | 3 | | OBL |
| | 61 = Total Cover | | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | = Total Cover | | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 38 | x 1 | 38 | |
| FACW species | 50 | x 2 | 100 | |
| FAC species | 93 | x 3 | 279 | |
| FACU species | 8 | x 4 | 32 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 189 | (A) | 449 | (B) |

Prevalence Index = B/A = 2.38

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- X 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W01TTY**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/1 | 100 | | | | | Muck | |
| 6-12 | 10YR 5/1 | 95 | 10YR 4/4 | 5 | C | M | Silt | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 12

Hydric Soil Present? Yes X No ____

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Side Slope Local relief (concave, convex, none): Linear Slope (%) 2 - 4

Subregion (LRR or MLRA): LRR R Lat: 46.137816 Long: -68.462274 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | if yes, optional Wetland Site ID: | _____ |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W02TTJ**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Picea rubens | 65 | X | FACU |
| Tsuga canadensis | 40 | X | FACU |
| Acer saccharum | 5 | | FACU |
| Abies balsamea | 5 | | FAC |
| | 115 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Viburnum lantanoides | 20 | X | FACU |
| Acer pensylvanicum | 15 | X | FACU |
| Betula alleghaniensis | 10 | X | FAC |
| Picea rubens | 5 | | FACU |
| | 50 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Osmorhiza claytonii | 70 | X | FACU |
| Gaultheria hispidula | 5 | | FACW |
| Trillium erectum | 5 | | FACU |
| Coptis trifolia | 5 | | FACW |
| Dryopteris intermedia | 3 | | FAC |
| Sorbus decora | 1 | | FACU |
| Maianthemum canadense | 1 | | FACU |
| Cornus canadensis | 1 | | FAC |
| | 91 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 16.7% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 10 | x 2 | 20 | |
| FAC species | 19 | x 3 | 57 | |
| FACU species | 227 | x 4 | 908 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 256 | (A) | 985 | (B) |

Prevalence Index = B/A = 3.85

**Hydrophytic Vegetation Indicators:**

____ 1- Rapid Test For Hydrophytic Vegetation

____ 2- Dominance Test is > 50%

____ 3- Prevalence Index is =< 3.0

____ 4- Morphological Adaptations

____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W02TTJ**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | 10YR 2/1 | 100 | | | | | Loam | |
| 2-6 | 7.5YR 3/3 | 100 | | | | | Silt Loam | |
| 6-14 | 7.5YR 4/4 | 100 | | | | | Silt Loam | |
| 14-20 | 10YR 5/3 | 100 | | | | | Silt Loam | |

**Hydric Soil Indicators:**

____ Histosol (A1)
____ Histic Epipedon (A2)
____ Black Histic (A3)
____ Hydrogen Sulfide (A4)
____ Stratified Layers (A5)
____ Depleted Below Dark Surface (A11)
____ Thick Dark Surface (A12)
____ Sandy Mucky Mineral (S1)
____ Sandy Gleyed Matrix (S4)
____ Sandy Redox (S5)
____ Stripped Matrix (S6)
____ Dark Surface (S7)
____ Polyvalue Below Surface (B15)
____ Thin Dark Surface (S9)
____ Loamy Mucky Mineral (F1)
____ Loamy Gleyed Matric (F2)
____ Depleted Matrix (F3)
____ Redox Dark Surface (F6)
____ Depleted Dark Surface (F7)
____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

____ 2 cm Muck (A10)
____ Coast Prarie Redox (A16)
____ 5 cm Mucky Peat or Peat (S3)
____ Dark Surface (S7)
____ Polyvalue Below Surface (S8)
____ Thin Dark Surface (S9)
____ Iron-Manganese Masses (F12)
____ Piedmont Floodplain Soils (F19)
____ Mesic Spodic (TA6)
____ Red Parent Material (F21)
____ Very Shallow Dark Surface (TF12)
____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 20

Hydric Soil Present? Yes ____ No X

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Depression Local relief (concave, convex, none): Concave Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.137820 Long: -68.462144 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PFO

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | if yes, optional Wetland Site ID: | W02TTJ |
| Wetland Hydrology Present? | Yes X No ____ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| | Surface Water (A1) | X | Water-Stained Leaves (B9) | | Surface Soil Cracks (B6) |
| X | High Water Table (A2) | | Aquatic Fauna (B13) | | Drainage Patterns (B10) |
| X | Saturation (A3) | | Marl Deposits (B15) | | Moss Trim Lines (B16) |
| | Water Marks (B1) | | Hydrogen Sulfide Odor (C1) | | Dry-Season Water Table (C2) |
| | Sediment Deposits (B2) | | Oxidized Rhizospheres on Living Roots (C3) | | Crayfish Burrows (C8) |
| | Drift Deposits (B3) | | Presence of Reduced Iron (C4) | | Saturation Visible in Aerial Imagery (C9) |
| | Algal Mat or Crust (B4) | | Recent Iron Reduction in Tilled Soils (C6) | X | Stunted or Stressed Plants (D1) |
| | Iron Deposits (B5) | | Thin Muck Surface (C7) | | Geomorphic Position (D2) |
| | Inundation Visible on Aerial Imagery (B7) | | Other (Explain in Remarks) | | Shallow Aquitard (D3) |
| | Sparsley Vegetated Concave Surface (B8) | | | | Microtopographic Relief (D4) |
| | | | | | FAC-Neutral Test (D5) |

Secondary Indicators (minimum of two required)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes X No ____ |
| Water Table Present? | Yes X No ____ | Depth (inches) 0 | |
| Saturation Present? | Yes X No ____ | Depth (inches) 0 | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W02TTJ**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Picea rubens | 65 | X | FACU |
| Abies balsamea | 35 | X | FAC |
| Tsuga canadensis | 30 | X | FACU |
| Betula alleghaniensis | 10 | | FAC |
| | 140 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Betula alleghaniensis | 25 | X | FAC |
| Picea rubens | 25 | X | FACU |
| Acer rubrum | 5 | | FAC |
| | 55 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Dryopteris intermedia | 30 | X | FAC |
| Osmorhiza claytonii | 30 | X | FACU |
| Oxalis montana | 5 | | FACU |
| Thelypteris palustris | 2 | | FACW |
| Acer rubrum | 2 | | FAC |
| | 69 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 42.9% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 2 | x 2 | 4 | |
| FAC species | 107 | x 3 | 321 | |
| FACU species | 155 | x 4 | 620 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 264 | (A) | 945 | (B) |

Prevalence Index = B/A = 3.58

**Hydrophytic Vegetation Indicators:**

____ 1- Rapid Test For Hydrophytic Vegetation

____ 2- Dominance Test is > 50%

____ 3- Prevalence Index is =< 3.0

____ 4- Morphological Adaptations

____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W02TTJ**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/1 | 100 | | | | | Muck | |
| 6-12 | 2.5Y 5/1 | 100 | | | | | Silt | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 12

Hydric Soil Present? Yes X No ____

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Rise Local relief (concave, convex, none): Linear Slope (%) 2 - 3

Subregion (LRR or MLRA): LRR R Lat: 46.134138 Long: -68.464500 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | if yes, optional Wetland Site ID: | _____ |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W02TTL**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 20 | X | FACU |
| Acer saccharum | 20 | X | FACU |
| Betula alleghaniensis | 15 | X | FAC |
| Abies balsamea | 15 | X | FAC |
| | 70 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 15 | X | FACU |
| Viburnum lantanoides | 10 | X | FACU |
| Acer pensylvanicum | 5 | | FACU |
| Betula alleghaniensis | 5 | | FAC |
| Picea rubens | 5 | | FACU |
| | 40 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Dryopteris intermedia | 5 | X | FAC |
| Acer saccharum | 5 | X | FACU |
| Sorbus decora | 2 | | FACU |
| | 12 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 37.5% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 0 | x 2 | 0 | |
| FAC species | 40 | x 3 | 120 | |
| FACU species | 82 | x 4 | 328 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 122 | (A) | 448 | (B) |

Prevalence Index = B/A = 3.67

**Hydrophytic Vegetation Indicators:**

_____ 1- Rapid Test For Hydrophytic Vegetation

_____ 2- Dominance Test is > 50%

_____ 3- Prevalence Index is =< 3.0

_____ 4- Morphological Adaptations

_____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W02TTL**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 10YR 2/1 | 100 | | | | | Loam | |
| 1-2 | 10YR 5/1 | 100 | | | | | Loam | |
| 2-6 | 10YR 4/4 | 100 | | | | | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 6

Hydric Soil Present? Yes ____ No X

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Depression Local relief (concave, convex, none): Convex Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.134156 Long: -68.464406 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PEM

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | **Is the Sampled Area within a Wetland?** | Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | if yes, optional Wetland Site ID: | W02TTL |
| Wetland Hydrology Present? | Yes X No ____ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| X | Surface Water (A1) | X | Water-Stained Leaves (B9) | | Secondary Indicators (minimum of two required) |
| X | High Water Table (A2) | | Aquatic Fauna (B13) | | Surface Soil Cracks (B6) |
| X | Saturation (A3) | | Marl Deposits (B15) | | Drainage Patterns (B10) |
| | Water Marks (B1) | | Hydrogen Sulfide Odor (C1) | | Moss Trim Lines (B16) |
| | Sediment Deposits (B2) | | Oxidized Rhizospheres on Living Roots (C3) | | Dry-Season Water Table (C2) |
| | Drift Deposits (B3) | | Presence of Reduced Iron (C4) | | Crayfish Burrows (C8) |
| | Algal Mat or Crust (B4) | | Recent Iron Reduction in Tilled Soils (C6) | | Saturation Visible in Aerial Imagery (C9) |
| | Iron Deposits (B5) | | Thin Muck Surface (C7) | | Stunted or Stressed Plants (D1) |
| | Inundation Visible on Aerial Imagery (B7) | | Other (Explain in Remarks) | | Geomorphic Position (D2) |
| | Sparsley Vegetated Concave Surface (B8) | | | | Shallow Aquitard (D3) |
| | | | | | Microtopographic Relief (D4) |
| | | | | | FAC-Neutral Test (D5) |

| | | | | |
|---|---|---|---|---|
| Surface Water Present? | Yes X | No ____ | Depth (inches) | 0.5 |
| Water Table Present? | Yes X | No ____ | Depth (inches) | 0 |
| Saturation Present? | Yes X | No ____ | Depth (inches) | 0 |

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W02TTL**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Abies balsamea | 25 | X | FAC |
| Fagus grandifolia | 10 | X | FACU |
| Acer rubrum | 10 | X | FAC |
| Fraxinus americana | 5 | | FACU |
| Picea rubens | 5 | | FACU |
| | 55 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Corylus cornuta | 5 | X | FACU |
| | 5 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Dryopteris intermedia | 20 | X | FAC |
| Impatiens capensis | 15 | X | FACW |
| Glyceria melicaria | 15 | X | OBL |
| Equisetum sylvaticum | 10 | | FACW |
| Galium tinctorium | 3 | | OBL |
| | 63 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 18 | x 1 | 18 | |
| FACW species | 25 | x 2 | 50 | |
| FAC species | 55 | x 3 | 165 | |
| FACU species | 25 | x 4 | 100 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 123 | (A) | 333 | (B) |

Prevalence Index = B/A = 2.71

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- X 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W02TTL**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR 2/1 | 100 | | | | | Muck | |
| 4-6 | 10YR 4/2 | 95 | 10YR 4/4 | 5 | C | M | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock/Till

Depth (inches): 6

Hydric Soil Present? Yes X No ____

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Upland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Terrace Local relief (concave, convex, none): Convex Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.134695 Long: -68.466538 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: UPL

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | if yes, optional Wetland Site ID: | _____ |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsley Vegetated Concave Surface (B8)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible in Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- ____ FAC-Neutral Test (D5)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ No X | Depth (inches) ____ | Wetland Hydrology Present? Yes ____ No X |
| Water Table Present? | Yes ____ No X | Depth (inches) ____ | |
| Saturation Present? | Yes ____ No X | Depth (inches) ____ | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Upland-W02TTM**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Acer saccharum | 20 | X | FACU |
| Acer rubrum | 20 | X | FAC |
| Fagus grandifolia | 10 | | FACU |
| Abies balsamea | 5 | | FAC |
| | 55 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Fagus grandifolia | 25 | X | FACU |
| Acer pensylvanicum | 15 | X | FACU |
| Fraxinus nigra | 5 | | FACW |
| Acer rubrum | 5 | | FAC |
| | 50 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Dryopteris intermedia | 15 | X | FAC |
| Acer pensylvanicum | 15 | X | FACU |
| Maianthemum canadense | 15 | X | FACU |
| | 45 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 28.6% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 0 | x 1 | 0 | |
| FACW species | 5 | x 2 | 10 | |
| FAC species | 45 | x 3 | 135 | |
| FACU species | 100 | x 4 | 400 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 150 | (A) | 545 | (B) |

Prevalence Index = B/A = 3.63

**Hydrophytic Vegetation Indicators:**

____ 1- Rapid Test For Hydrophytic Vegetation

____ 2- Dominance Test is > 50%

____ 3- Prevalence Index is =< 3.0

____ 4- Morphological Adaptations

____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Upland-W02TTM**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | 10YR 2/1 | 100 | | | | | Loam | |
| 2-4 | 10YR 4/3 | 100 | | | | | Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: Rock

Depth (inches): 4

Hydric Soil Present? Yes ____ No X

Remarks:

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Pickett Mountain City/County: T6 R6 WELS/Penobscot Sampling Date: 6/14/2022

Applicant/Owner: Wolfden State: ME Sampling Point: Wetland

Investigator(s): Tom Tetreau Section, Township, Range: _____

Landform (hillslope, terrace,etc.): Depression Local relief (concave, convex, none): Concave Slope (%) 0 - 0

Subregion (LRR or MLRA): LRR R Lat: 46.134717 Long: -68.466359 Datum: NAD83

Soil Map Unit Name: _____ NWI Classification: PFO

Are climatic / hyrologic conditions on the site typical for this time of year? Yes X No ____ (if no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (if needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | **Is the Sampled Area within a Wetland?** | Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | if yes, optional Wetland Site ID: | W02TTM |
| Wetland Hydrology Present? | Yes X No ____ | | |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required: check all that apply)

| | | | | | |
|---|---|---|---|---|---|
| X | Surface Water (A1) | X | Water-Stained Leaves (B9) | ____ | Surface Soil Cracks (B6) |
| X | High Water Table (A2) | ____ | Aquatic Fauna (B13) | ____ | Drainage Patterns (B10) |
| X | Saturation (A3) | ____ | Marl Deposits (B15) | ____ | Moss Trim Lines (B16) |
| ____ | Water Marks (B1) | ____ | Hydrogen Sulfide Odor (C1) | ____ | Dry-Season Water Table (C2) |
| ____ | Sediment Deposits (B2) | ____ | Oxidized Rhizospheres on Living Roots (C3) | ____ | Crayfish Burrows (C8) |
| ____ | Drift Deposits (B3) | ____ | Presence of Reduced Iron (C4) | ____ | Saturation Visible in Aerial Imagery (C9) |
| ____ | Algal Mat or Crust (B4) | ____ | Recent Iron Reduction in Tilled Soils (C6) | ____ | Stunted or Stressed Plants (D1) |
| ____ | Iron Deposits (B5) | ____ | Thin Muck Surface (C7) | X | Geomorphic Position (D2) |
| ____ | Inundation Visible on Aerial Imagery (B7) | ____ | Other (Explain in Remarks) | ____ | Shallow Aquitard (D3) |
| ____ | Sparsley Vegetated Concave Surface (B8) | | | ____ | Microtopographic Relief (D4) |
| | | | | ____ | FAC-Neutral Test (D5) |

Secondary Indicators (minimum of two required)

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes X No ____ | Depth (inches) 0.5 | |
| Water Table Present? | Yes X No ____ | Depth (inches) 0 | Wetland Hydrology Present? Yes X No ____ |
| Saturation Present? | Yes X No ____ | Depth (inches) 0 | |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION - Use scientific names of plants** Sampling Point: **Wetland-W02TTM**

| **Tree Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Acer saccharum | 15 | X | FACU |
| Abies balsamea | 15 | X | FAC |
| Acer rubrum | 15 | X | FAC |
| Betula alleghaniensis | 10 | | FAC |
| Betula papyrifera | 5 | | FACU |
| | 60 | = Total Cover | |

| **Shrub Stratum** (Plot Size: 15'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Betula alleghaniensis | 20 | X | FAC |
| Acer pensylvanicum | 10 | X | FACU |
| Acer rubrum | 5 | | FAC |
| Hamamelis virginiana | 5 | | FACU |
| | 40 | = Total Cover | |

| **Herb Stratum** (Plot Size: 5'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Carex trisperma | 50 | X | OBL |
| Equisetum sylvaticum | 20 | X | FACW |
| Maianthemum canadense | 10 | | FACU |
| Dryopteris intermedia | 10 | | FAC |
| Carex gynandra | 5 | | OBL |
| | 95 | = Total Cover | |

| **Woody Vine Stratum** (Plot Size: 30'radius) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| | | | |
| | | = Total Cover | |

**Dominance Test Worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

**Prevalence Index Worksheet:**

| | | | | |
|---|---|---|---|---|
| OBL species | 55 | x 1 | 55 | |
| FACW species | 20 | x 2 | 40 | |
| FAC species | 75 | x 3 | 225 | |
| FACU species | 45 | x 4 | 180 | |
| UPL species | 0 | x 5 | 0 | |
| Column Totals | 195 | (A) | 500 | (B) |

Prevalence Index = B/A = 2.56

**Hydrophytic Vegetation Indicators:**

- ____ 1- Rapid Test For Hydrophytic Vegetation
- X 2- Dominance Test is > 50%
- X 3- Prevalence Index is =< 3.0
- ____ 4- Morphological Adaptations
- ____ 5- Problematic Hydrophytic Vegetation

**Definitions of Vegetation Strata:**

Tree- Woody plants 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub- Woody plants less than 3 in. DBH and greater than or equal to 3.28ft (1m) tall.

Herb- All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28ft tall.

Woody Vines- All woody vines greater than 3.28ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: **Wetland-W02TTM**

| Depth (inches | Matrix Color | Matrix % | Redox Features Color | Redox % | Type | Loc | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/1 | 100 | | | | | Muck | |
| 12-20 | 10YR 5/1 | 98 | 10YR 4/4 | 2 | C | M | Sandy Loam | |
| 6-12 | 10YR 4/1 | 98 | 10YR 4/4 | 2 | C | M | Silt Loam | |

**Hydric Soil Indicators:**

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (B15)
- ____ Thin Dark Surface (S9)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matric (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)

**Indicators for Problematic Soils:**

- ____ 2 cm Muck (A10)
- ____ Coast Prarie Redox (A16)
- ____ 5 cm Mucky Peat or Peat (S3)
- ____ Dark Surface (S7)
- ____ Polyvalue Below Surface (S8)
- ____ Thin Dark Surface (S9)
- ____ Iron-Manganese Masses (F12)
- ____ Piedmont Floodplain Soils (F19)
- ____ Mesic Spodic (TA6)
- ____ Red Parent Material (F21)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

# EXHIBIT 7.0 SITE PLANS

## 7.1 EXISTING SITE PLAN

The existing conditions of the proposed Project Area are shown **Figure 7-1**. The Conceptual Site Plan is presented on **Figure 2-1** (**Exhibit 2)**. The site plans include a series of proposed site facilities (buildings, structures, pads, ponds, etc.) associated with a numerical identifier. The timing of construction of these Project elements is described in **Exhibit 2 – Project Description. Figure 7-2** presents development setbacks from natural resources, except for roads and utility lines.

**Table 7-1** presents the facility, identifier, area, and height of each of the proposed facilities. Each facility is also given a structure type of Building, Lined Pad or Impervious Area. For the purposes of this Exhibit, a building is any erected structure built out of steel, wood, concrete, or other building construction materials and includes facilities such as office buildings, maintenance shop, etc. A lined pad is any surface that is lined with an engineered material such as clay, rubber, or polyethylene and includes facilities such as water storage ponds and ore storage pad. Impervious areas include all buildings and lined pads, as well as other structures that do not have engineered covers such as the parking areas, roads, and laydown storage. The development area includes all listed structure types and the built environment. The development area does not include the cleared areas outside of proposed development. The total estimated development area is approximately 104 acres. The total cleared area is approximately 129 acres. Both of these areas would be reduced by 47 acres without the inclusion of the solar facility.

Specific to parking requirements, the conceptual site plan includes consideration for mine employees, mine contractors and visitors. Based on expected shift operations, mine visitors, and contractors an area for approximately 100 parking spaces is detailed.

### Table 7-1: Development Plan

| Name | ID | Square Footage | Height (ft) | Acreage | Structure Type |
|---|---|---|---|---|---|
| Water Treatment Facility | 5 | 14,860 | 30 | 0.341 | Building |
| Electric Substation | 6 | 2,000 | 30 | 0.046 | Building |
| Back-up Power Generation (Diesel or Propane) | 7 | 600 | 10 | 0.014 | Building |
| Fire Water Pumphouse | 10 | 384 | 10 | 0.009 | Building |
| Warehouse | 13 | 6,000 | 30 | 0.138 | Building |
| Office and Mine Rescue Facility | 14 | 8,440 | 20 | 0.194 | Building |
| Core Shack and Storage | 15 | 3,600 | 20 | 0.083 | Building |
| Maintenance Shop | 17 | 4,800 | 30 | 0.110 | Building |
| Equipment Fueling Station | 18 | 2,000 | 12 | 0.046 | Building |
| Backfill Plant | 21 | 2500 | 20 | 0.057 | Building |
| Blast Shack | 23 | 900 | 12 | 0.021 | Building |

| Name | ID | Square Footage | Height (ft) | Acreage | Structure Type |
|---|---|---|---|---|---|
| East Ventilation Raise | 25 | 100 | 10 | 0.002 | Building |
| Headframe and Hoist | 28 | 3,250 | 80 | 0.075 | Building |
| Temporary Explosives Storage | 31 | 1,800 | 8 | 0.041 | Building |
| West Ventilation Raise | 32 | 100 | 10 | 0.002 | Building |
| Security Guard House/Gate | 36 | 200 | 10 | 0.005 | Building |
| Water Recharge Area #1 | 9 | 272,278 | -2 to 4 | 6.251 | Water Recharge Area |
| Sanitary Subsurface Wastewater Disposal System | 11 | 2,800 | -2 to 4 | 0.064 | Buried Structure |
| Water Recharge Area #2 | 19 | 253,536 | -2 to 4 | 5.820 | Water Recharge Area |
| Water Recharge Area #3 | 27 | 75,424 | -2 to 4 | 1.731 | Water Recharge Area |
| Water Recharge Area #4 | 33 | 134,498 | -2 to 4 | 3.088 | Water Recharge Area |
| Water Recharge Area #5 | 38 | 87,418 | -2 to 4 | 2.007 | Water Recharge Area |
| Water Recharge Area #6 | 39 | 123,640 | -2 to 4 | 2.838 | Water Recharge Area |
| Organics Storage | 26 | 193,892 | 15 | 4.451 | Existing Ground |
| Security fencing | 37 | -- | 6 | -- | Fence (6,635') |
| Snow Storage | 3 | 112,337 | 30 | 2.579 | Impervious area |
| Parking Facility | 12 | 38,144 | 0 | 0.876 | Impervious area |
| Laydown (Equipment/Supplies Storage) | 16 | 24,395 | 0 | 0.560 | Impervious area |
| Mine Access (Portal) | 24 | 16,775 | -32 | 0.385 | Impervious area |
| Existing Site Road | 34 | 178,875 | 0 | 4.106 | Impervious area |
| Proposed Site Road | 35 | 167,650 | 0 | 3.849 | Impervious area |
| Low Grade Ore Storage Pad | 2 | 240,296 | 65 | 5.516 | Lined Pad |
| Pre-Treatment Water Storage Pond | 4 | 141,360 | 10 | 3.245 | Lined Pad |
| Post-Treatment Water Storage Pond | 8 | 105,870 | 10 | 2.430 | Lined Pad |
| Waste Rock Storage Pad #1 | 20 | 164,034 | 50 | 3.766 | Lined Pad |
| Ore (Mill Feed) Storage Pad #1 | 22 | 54,839 | 35 | 1.259 | Lined Pad |
| Ore (Mill Feed) Storage Pad #2 | 29 | 44245 | 40 | 1.016 | Lined Pad |
| Waste Rock Storage Pad #2 | 30 | 44245 | 40 | 1.016 | Lined Pad |
| Solar Facility | 1 | 2,025,064 | 5 to 8 | 46.489 | N/A |
| **Total Buildings Area** | | **51,534** | **SQ FT** | **1.18** | **Acres** |
| **Total Lined Pads Area** | | **794,890** | **SQ FT** | **18.25** | **Acres** |
| **Total Impervious Area** | | **1,338,422** | **SQ FT** | **30.73** | **Acres** |
| **Total Developed Area** | | **4,553,149** | **SQ FT** | **104.53** | **Acres** |
| **Total Cleared Area** | | **5,632,126** | **SQ FT** | **129.30** | **Acres** |

Key: ft = feet; ID = identification number; SQ FT = square feet

**Figure 7-3** presents the proposed site plan overlayed onto the estimated boundaries of the orebody on the most recent version of the USGS topographic map and a Maine LUPC Land Use Guidance Map. Note that, although some wetlands are identified on this map (outside of the proposed boundary), additional wetlands have been mapped within the boundary (**Exhibit 6, Figures 6-1a to 6-1e**).

# EXHIBIT 7 FIGURES

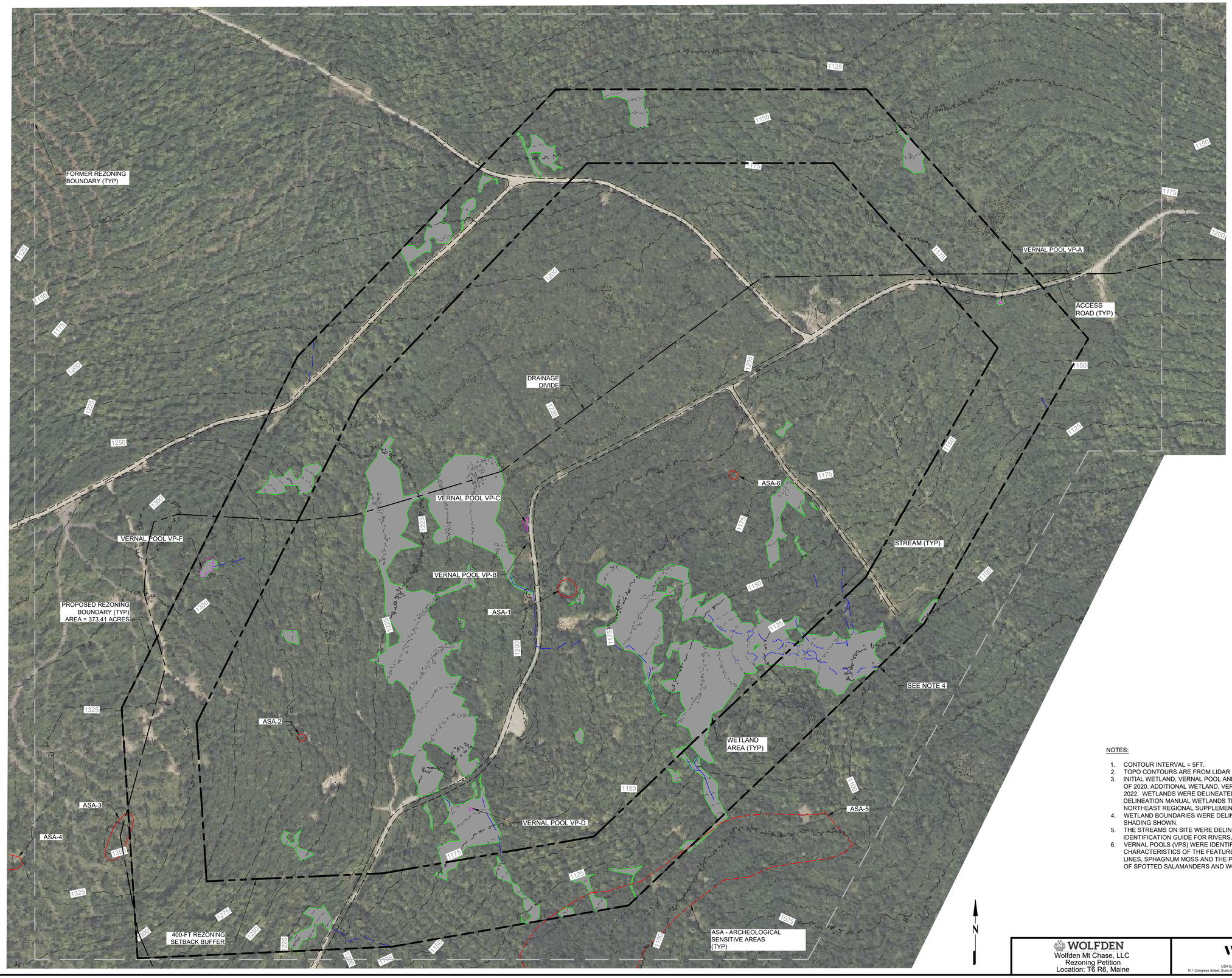
Figure 7-1: Existing Site Conditions

Figure 7-2: Site Plan Setback Distances

Figure 7-3: Estimated Boundaries of Ore Deposits

# EXHIBIT 7 ATTACHMENTS

Not Applicable




LEGEND:

- 1125 — MAJOR CONTOURS
- 1124 — MINOR CONTOURS
- STREAM
- EXISTING SITE ROAD
- VERNAL POOLS
- ASA - ARCHEOLOGICAL SENSITIVE AREAS
- 400-FEET REZONING SETBACK BUFFER
- PROPOSED REZONING
- OLD REZONING
- WETLAND

NOTES:

1. CONTOUR INTERVAL = 5FT.
2. TOPO CONTOURS ARE FROM LIDAR DATA (NOAA.GOV), MARCH 2021.
3. INITIAL WETLAND, VERNAL POOL AND STREAM DATA WERE COLLECTED BY WOOD AND OTHERS IN MAY-JUNE OF 2020. ADDITIONAL WETLAND, VERNAL POOL, AND STREAM DATA WERE COLLECTED BY STANTEC-JUNE OF 2022. WETLANDS WERE DELINEATED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL WETLANDS TECHNICAL REPORT (Y-87-1) AND THE NORTH CENTRAL AND THE NORTHEAST REGIONAL SUPPLEMENT (ERDC/EL TR-12-1).
4. WETLAND BOUNDARIES WERE DELINEATED WITHIN THE REZONE BOUNDARY AND MAY CONTINUE BEYOND THE SHADING SHOWN.
5. THE STREAMS ON SITE WERE DELINEATED FOLLOWING THE NATURAL RESOURCE PROTECTION ACT (NRPA) IDENTIFICATION GUIDE FOR RIVERS, STREAMS, AND BROOKS (DANIELSON, 2018).
6. VERNAL POOLS (VPS) WERE IDENTIFIED ON MAY 17, MAY 18, AND MAY 28, 2020, BASED ON PHYSICAL CHARACTERISTICS OF THE FEATURES INCLUDING ISOLATED WATER BODIES, WATER STAINED LEAVES, WATER LINES, SPHAGNUM MOSS AND THE PRESENCE OF HYDROPHYTIC VEGETATION AS WELL AS EGG MASS COUNTS OF SPOTTED SALAMANDERS AND WOOD FROGS WERE COLLECTED.

0 125 250 500
SCALE IN FEET

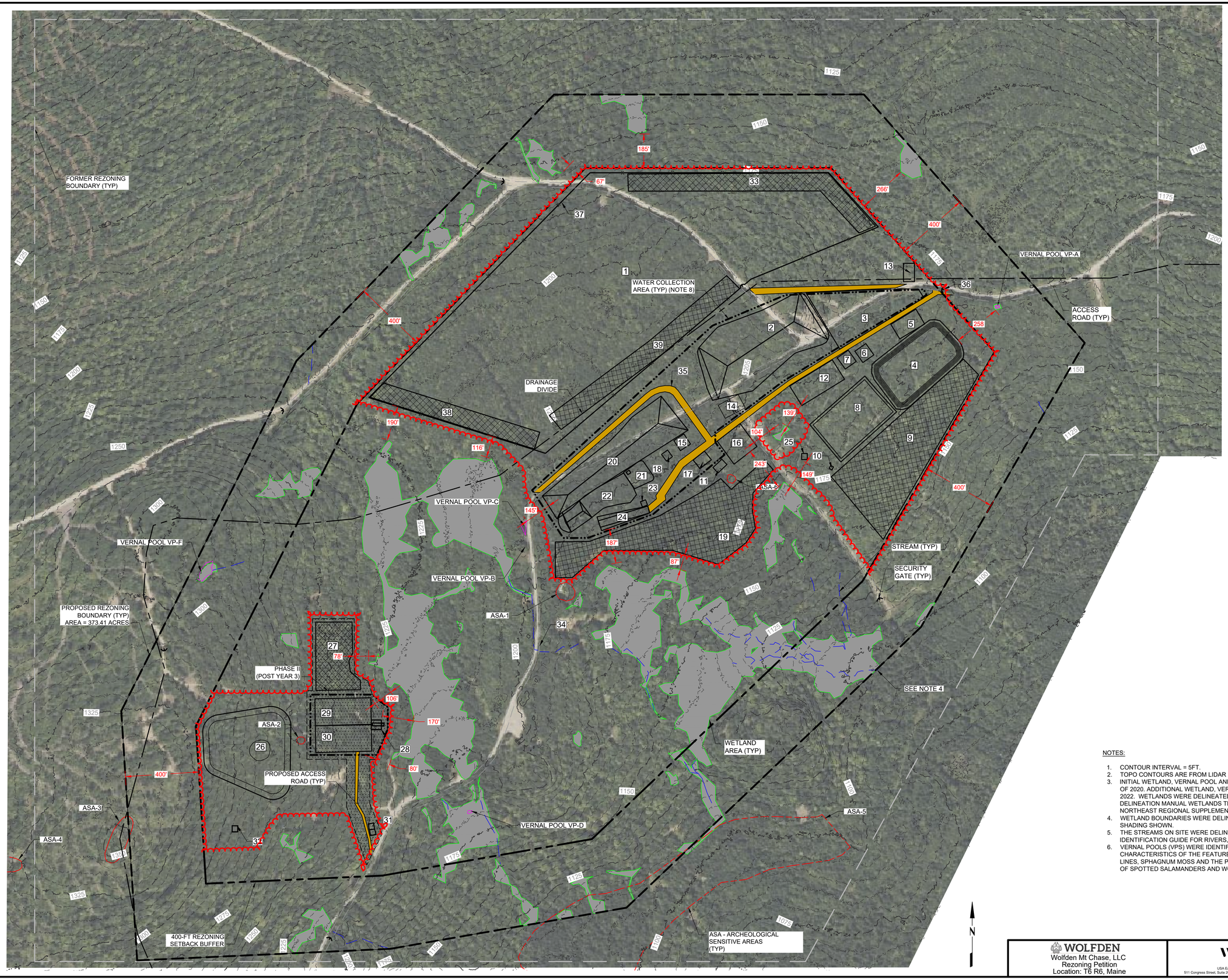
Prepared/Date: WJW 10/06/22
Checked/Date: MAP 10/06/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

EXISTING CONDITIONS PLAN
Project 3617-22-7547
Figure 7-1

C:\Users\wilson.white\OneDrive - Wood PLC\Projects\Wolfden Resources\9.0 Drawings\Design 2022\Sheets\Figure 7-1 Existing Conditions Plan.dwg Thu, 06 Oct 2022 - 8:38am wilson.white




| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACILITY |
| 6 | ELECTRICAL SUBSTATION |
| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
| 8 | POST-TREATMENT WATER STORAGE POND |
| 9 | WATER RECHARGE AREA #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | WATER RECHARGE AREA #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | WATER RECHARGE AREA #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK STORAGE PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | WATER RECHARGE AREA #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | WATER RECHARGE AREA #5 |
| 39 | WATER RECHARGE AREA #6 |

LEGEND:

- 1125 — MAJOR CONTOURS
- 1124 — MINOR CONTOURS
- STREAM
- EXISTING SITE ROAD
- VERNAL POOLS
- ASA - ARCHEOLOGICAL SENSITIVE AREAS
- 400-FEET REZONING
- SETBACK BUFFER
- PROPOSED REZONING
- OLD REZONING
- WETLAND
- 14 — FACILITIES DESIGN
- WATER COLLECTION AREA
- WATER RECHARGE AREA
- PHASE II (POST YEAR)
- PROPOSED SITE ROAD
- DRAINAGE DIVIDE
- SECURITY FENCE
- SECURITY GATE
- CLEARING LIMIT
- 400' — SETBACK DISTANCE (FT)

NOTES:

1. CONTOUR INTERVAL = 5FT.
2. TOPO CONTOURS ARE FROM LIDAR DATA (NOAA.GOV), MARCH 2021.
3. INITIAL WETLAND, VERNAL POOL AND STREAM DATA WERE COLLECTED BY WOOD AND OTHERS IN MAY-JUNE OF 2020. ADDITIONAL WETLAND, VERNAL POOL, AND STREAM DATA WERE COLLECTED BY STANTEC-JUNE OF 2022. WETLANDS WERE DELINEATED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL WETLANDS TECHNICAL REPORT (Y-87-1) AND THE NORTH CENTRAL AND THE NORTHEAST REGIONAL SUPPLEMENT (ERDC/EL TR-12-1).
4. WETLAND BOUNDARIES WERE DELINEATED WITHIN THE REZONE BOUNDARY AND MAY CONTINUE BEYOND THE SHADING SHOWN.
5. THE STREAMS ON SITE WERE DELINEATED FOLLOWING THE NATURAL RESOURCE PROTECTION ACT (NRPA) IDENTIFICATION GUIDE FOR RIVERS, STREAMS, AND BROOKS (DANIELSON, 2018).
6. VERNAL POOLS (VPS) WERE IDENTIFIED ON MAY 17, MAY 18, AND MAY 28, 2020, BASED ON PHYSICAL CHARACTERISTICS OF THE FEATURES INCLUDING ISOLATED WATER BODIES, WATER STAINED LEAVES, WATER LINES, SPHAGNUM MOSS AND THE PRESENCE OF HYDROPHYTIC VEGETATION AS WELL AS EGG MASS COUNTS OF SPOTTED SALAMANDERS AND WOOD FROGS WERE COLLECTED.

0 125 250 500
SCALE IN FEET

Prepared/Date: WJW 10/17/22
Checked/Date: MAP 10/17/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

SETBACKS
FOR PROPOSED FEATURES
Project 3617-22-7547
Figure 7-2

C:\Users\william.whitten\OneDrive - Wood PLC\Projects\Workan Resources\8.0 Drawings\Design 2022\Sheets\Figure 7-2_Setback Plan.dwg Mon, 17 Oct 2022 - 1:18pm william.whitten

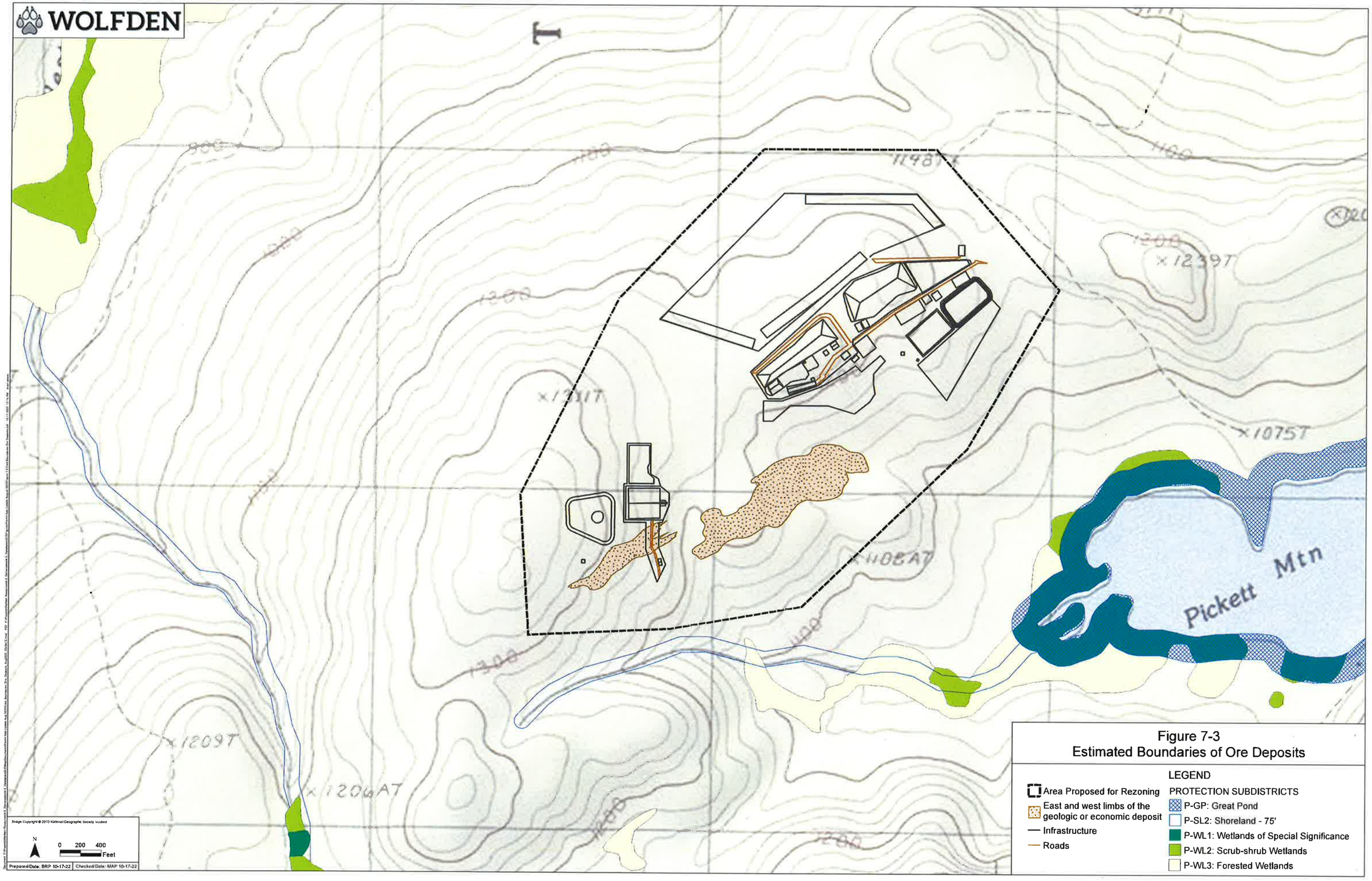



Figure 7-3
Estimated Boundaries of Ore Deposits

# EXHIBIT 8.0 SITE PHOTOGRAPHS

Representative site photographs of the Project Area are included as **Attachment 8-A**.

# EXHIBIT 8 FIGURES

Not Applicable

# EXHIBIT 8 ATTACHMENTS

Attachment 8-A: Representative Site Photographs

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 8-A: Representative Site Photographs

Stantec

# Photographic Log

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 1

**Photo Source:**
Stantec

**Date:**
June 15, 2022

**Photograph #:**
1

**Direction:**
Southeast

**Description:**
Intersection of Route 11 and W Hale Pond Rd

**Photograph ID:** 2

**Photo Source:**
Stantec

**Date:**
June 15, 2022

**Photograph #:**
2

**Direction:**
South

**Description:**
W. Hale Pond Rd

Stantec

# Photographic Log

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 3

**Photo Source:**
Stantec

**Date:**
June 15, 2022

**Photograph #:**
3

**Direction:**
Northwest

**Description:**
Intersection of W Hale Pond Rd and Bear Mtn. Pond Rd

**Photograph ID:** 4

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
4

**Direction:**
West

**Description:**
Bear Mtn Pond Rd

Stantec

# Photographic Log

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 5

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
5

**Direction:**
West

**Description:**
Intersection of Bear Mtn Pond Rd and Pleasant Lake Rd

**Photograph ID:** 6

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
6

**Direction:**
North

**Description:**
Pleasant Lake Rd

Stantec

# Photographic Log

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 7

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
7

**Direction:**
North

**Description:**
Bridge over outlet stream to Pickett Pond

**Photograph ID:** 8

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
8

**Direction:**
North

**Description:**
Intersection of Pleasant Lake and McDonald Rd

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 9

**Photo Source:**
Stantec

**Date:**
June 16, 2022

**Photograph #:**
9

**Direction:**
Southeast

**Description:**
Typical wooded upland in eastern quadrant of Project area

**Photograph ID:** 10

**Photo Source:**
Stantec

**Date:**
June 16, 2022

**Photograph #:**
10

**Direction:**
Northeast

**Description:**
Vegetation at southern end of conceptual water recharge area 1

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 11

**Photo Source:**
Stantec

**Date:**
June 15, 2022

**Photograph #:**
11

**Direction:**
North

**Description:**
Typical wooded upland in northern quadrant of Project area in vicinity of conceptual solar facility

**Photograph ID:** 12

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
12

**Direction:**
Southwest

**Description:**
Typical wooded upland in western quadrant of Project area

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 13

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
13

**Direction:**
North

**Description:**
Access road near conceptual headframe, ore and waste rock storage pads, and water recharge area #3.

**Photograph ID:** 14

**Photo Source:**
Stantec

**Date:**
June 14, 2022

**Photograph #:**
14

**Direction:**
North

**Description:**
Typical wooded upland in southern quadrant of Project area

Stantec

# Photographic Log

| | | | |
|---|---|---|---|
| **Client:** | **Wolfden Resources** | **Project:** | **195602317** |
| **Site Name:** | **Pickett Mountain** | **Site Location:** | **T6, R6, Maine** |

**Photograph ID:** 15

**Photo Source:**
Stantec

**Date:**
June 15, 2022

**Photograph #:**
15

**Direction:**
Northwest

**Description:**
Typical wooded upland in center portion of Project area in vicinity of the conceptual ore and waste rock storage pads

# EXHIBIT 9.0 CONSISTENCY WITH THE COMPREHENSIVE LAND USE PLAN

The LUPC Comprehensive Land Use Plan (CLUP) provides for sound planning practices in the public interest to encourage and manage multiple uses of land and resources within the LUPC's jurisdiction (LUPC 2010). In 2012, the Legislature made a number of changes that impact the Commission and the role of the CLUP. Subsequently, the Commission approved guidance for interpreting the CLUP that reflects these statutory changes. (Guidance for Interpreting the 2010 CLUP, Approved October 5, 2012.) Importantly, and as reflected in the Guidance, the statutory changes place an increased emphasis on serving the regions in which the unorganized and deorganized areas located; honoring the rights and participation of residents and property owners; and encouraging and facilitating regional economic viability. (Guidance at 3.) The following subsections describe how the proposed rezoning for the Project fits within the CLUP, and how the proposed Project meets the CLUP's principal values, goals, and policies as informed by the 2012 statutory changes and Guidance.

## 9.1 CLUP PRINCIPAL VALUES AND BROAD GOALS

The LUPC Commission has identified four **principal values** that, taken together, define the distinctive character of the jurisdiction (LUPC 2010):

1. The economic value of the jurisdiction derived from working forests and farmlands, including fiber and food production, largely on private lands. This value is based primarily on maintenance of the forest resource and the economic health of the forest products industry. The maintenance of farmlands and the viability of the region's agricultural economy is also an important component of this value.

2. Diverse and abundant recreational opportunities, including many types of motorized and non-motorized activities. Unique opportunities exist for recreational activities which require or are significantly enhanced by large stretches of undeveloped land, ranging from primitive recreation in certain locations to extensive motorized trail networks. Recreation is increasingly an economic driver in the jurisdiction and the State.

3. Diverse, abundant and unique high-value natural resources and features, including lakes, rivers and other water resources, fish and wildlife resources, plants and natural communities, scenic and cultural resources, coastal islands, mountain areas and other geologic resources.

4. Natural character, which includes the uniqueness of a vast forested area that is largely undeveloped and remote from population centers. Remoteness and the relative absence of development in large parts of the jurisdiction are perhaps the most distinctive of the jurisdiction's principal values, due mainly to their increasing rarity in the Northeastern United States. These values may be difficult to quantify but they are integral to the jurisdiction's identity and to its overall character.

The LUPC policies shall be directed toward the achievement of the vision for the jurisdiction and the following three broad goals:

1. Support and promote the management of all the resources, based on the principles of sound planning and multiple use, to enhance the living and working conditions of the people of Maine and property owners and residents of the unorganized and deorganized townships, to ensure the separation of incompatible uses, and to ensure the continued availability of outstanding quality water, air, forest, wildlife, and other natural resource values of the jurisdiction.

2. Conserve, protect and enhance the natural resources of the jurisdiction primarily for fiber and food production, outdoor recreation and plant and animal habitat.

3. Maintain the natural character of certain areas within the jurisdiction having significant natural values and primitive recreational opportunities.

## 9.2 THE PROJECT SATISFIES CLUP DEVELOPMENT GOALS AND POLICIES

LUPC has defined specific goals and policies that are intended to guide its actions. The Project's relationship to each of these goals is discussed separately and, where applicable, specific policies of the CLUP are also referenced. Only the goals and policies of particular applicability are discussed below.

## 9.3 LOCATION OF DEVELOPMENT

<u>CLUP Goal: Guide the location of new development in order to protect and conserve forest, recreational, plant or animal habitat and other natural resources, to ensure the compatibility of land uses with one another and to allow for a reasonable range of development opportunities important to the people of Maine, including property owners and residents of the unorganized and deorganized townships.</u>

The Project location is dictated by the unique geologic conditions that resulted in the formation of a mineral deposit of economic value. The Project must locate where the resource is found and the CLUP policy on adjacency is not applicable (see **Exhibit 7, Figure 7-3**). The location and physical relationship of the mineralized zones to surrounding topography and water bodies allows the deposit to be developed by underground mining methods, which, when combined with carefully managed mine water collection and treatment systems, will allow mine development, operation, and closure without impacting water quality of these adjacent resources. This approach allows for an optimal compatibility of uses, limiting the footprint to approximately 129 acres. The way the Project is designed avoids and minimizes, to the extent possible, protected natural resources including but not limited to wetlands, vernal pools, rare and endangered plant and wildlife species (see **Section 10.5 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**).

The Project is also unique in having a finite duration currently anticipated to be from 10 to 15 years for mining operations, up to 25 to 30 years for the solar facility. The reclamation of the proposed site will sequentially remove all buildings and structures including the water treatment systems when they are no longer required. Once the access to underground workings is permanently sealed and the mine site is

regraded and revegetated it will attain the natural character and values that existed prior to mining (See **Section 2.4 of Exhibit 2 – Project Description**). The solar facility will be decommissioned and removed at the end of its useful life or at the end of the Project life, in accordance with MDEP decommissioning requirements, allowing that portion of the site to also return to its natural character.

While consistent with the CLUP location of development goal, the Project is also consistent with CLUP polices including:

**Policy 1** Development that is directed to a suitable area and retains the principal values including a working forest, and integrity of natural resources.

*The Project location is dictated by the unique geologic conditions that resulted in the formation of a mineral deposit of economic value. The Project will support the long-term conservation of select areas of working forests in the Project Area as well as protecting high-value natural resources such as surface water bodies, streams, wetlands, vernal pools, and flora and fauna. The project has a limited lifespan and will return to principal uses. After completion of the project, the footprint will return to forested lands that can be harvested in future years post closure.*

**Policy 2** Guide development to areas near existing towns and communities and other areas appropriate for development.

*The Project location is near existing towns with proximity and connectivity by public roads to other organized town and economic centers, with adequate available public infrastructure and services. The nearest communities are relatively close to the Project, including Hersey (4.5 miles) and Patten (9.5 miles). The nearby communities and service providers have confirmed adequacy of services and infrastructure for each Project aspect. See* ***Exhibit 17 – Fire, Police, and Ambulance, Exhibit 18 – Educational Services, Exhibit 19 – Solid Waste Disposal, Exhibit 20 – Electricity and Telephone,*** *and* ***Exhibit 21 – Public Roads****.*

**Policy 3** Discourage growth which results in scattered and sprawling development patterns.

*As discussed in* ***Exhibit 2 – Project Description*** *and* ***Exhibit 10 – Surrounding Uses & Anticipated Impacts****, the Project footprint is necessarily located at the mineral deposit and will be of limited duration on approximately 129 acres to be cleared and 104 acres of actual development, minimizing the Project footprint to the extent practicable. The Wolfden property surrounding the Project will remain forested.*

**Policy 7** In areas that are not appropriate as new development centers, allow for (a) planned developments which depend on a particular natural feature, subject to site plan review, and (b) other development, subject to concept plan review.

*The Project depends on the unique geologic conditions that resulted in the formation of a particular natural feature, a mineral deposit of economic value.*

### 9.3.1 Economic Development

CLUP Goal: Encourage economic development that is connected to local economies, utilizes services and infrastructure efficiently, is compatible with natural resources and surrounding uses, particularly natural resource-based uses, and does not diminish the jurisdiction's principal values.

The Project is a natural resource-based use that will provide direct and substantial economic benefit to the local communities and the State (see **Section 10.10 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**). This benefit is in the form of job skills training, primary wages to local employees, wages that are spent in the local economy, an increase in income tax and property tax revenue, and indirect wages at secondary jobs that help support the mining operations (mechanical equipment repair, vehicle maintenance, road maintenance, solid waste management, and other specialized services).

The Project Area and the Wolfden property are in vegetative regrowth from past logging efforts that are estimated from approximately 10 years ago until recently. Wolfden actively leases its timber rights to a local logging company, preserving productive use of its working forests. The proposed development will be largely self-sufficient and not impose an undue burden on local community services or resources (see **Exhibit 17 – Fire, Police, and Ambulance, Exhibit 18 Educational Services, Exhibit 19 – Solid Waste Disposal, Exhibit 20 – Electricity and Telephone,** and **Exhibit 21 – Public Roads)**. The Project will require importation or generation in part of approximately 2.34 megawatts (MW) of daily electrical supply to the mine. This will require construction of approximately 11 miles of new transmission line along Route 11 and the existing private gravel access road. See **Exhibit 20 – Electricity and Communications** for additional information including a letter from Versant Power (**Exhibit 20, Attachment 20-A**) confirming electrical supply can be supplied based on current Project design.

The Project occupies a largely upland area removed from adjacent lakes and ponds and would not impact water quality of these water bodies or affect related fish and wildlife resources during the active period of the Project. Plants and natural communities that are located outside of the proposed area of land disturbance would not be impacted. If rare and exemplary botanical features are identified on-site in subsequent surveys impacts will be avoided to the extent possible, and such plant communities would be relocated or protected pending concurrence with the MNAP. There are no stream, vernal pool or wetland impacts associated with the activities in area proposed for rezoning. The presence of cultural resources, including historic logging camps and related structures are not known to be present on the site. A Phase 0 archeological survey was completed and is discussed in **Exhibit 25 Archaeological and Historic Resources** of this application.

The Project Area is not in a remote area of the jurisdiction, being located approximately 4.4 miles from state highway Route 11 and is accessed by well developed, existing gravel roads on private property.

In addition to meeting this CLUP goal, the Project also is consistent with many elements of the CLUP's policies including the following items:

**Policy 1** Encourage other resource-based industries and enterprises which further the jurisdiction's tradition of multiple use without diminishing its principal values.

*The Project proposes development of a unique geologic conditions that resulted in the formation of a mineral deposit of economic value and will support the long-term conservation of select areas of working forests in the Project Area*

**Policy 4** Allow new technologies which will provide the LUPC the opportunity to evaluate the technology and its effectiveness.

*The Project will include state of the art water treatment applied to mining.*

**Policy 5** Continuously review permitting procedures to identify means to expedite the permitting process while accomplishing the agency's purposes.

*The Project will include a multi-year permitting effort.*

### 9.3.2 Site Review

CLUP Goal: Assure that development fits harmoniously into the existing communities, neighborhoods and the natural environment.

The nature of the proposed Project, its location, use of buffers, and the proposed reclamation, as discussed in following sections, allows for a harmonious relationship to the natural environment and local communities. **Exhibit 16 – Harmonious Fit and Natural Character** further discusses these criteria.

Within the operations area, all above ground exterior lights greater than 60 watts or incandescent lights greater than 160 watts will be housed in downward facing full cut-off fixtures as specified in CLUP Standards under 10.25F. Other sources of light will include vehicle headlights and building interior lighting.

In addition to meeting this CLUP goal, the Project also is consistent with many elements of the CLUP's policies, including the following items:

**Policy 1** Require that provision be made for fitting development harmoniously into the existing natural environment, including:

a. Requiring the use of buffers, building setbacks, height restrictions, design and materials standards, lighting standards, and landscaping to minimize the impacts of land use activities upon one another and to maintain the scenic quality of shorelines, hillsides, ridgelines, and roadways;

*A 400-foot buffer will be established around the cleared and developed area, which is far removed from other land use activities. Once reclaimed and vegetated this will be a minimal change to the natural appearance of the landforms at the site.*

b. Requiring that developments provide for adequate parking and traffic circulation (*see* ***Exhibit 2 – Project Description***); and

*The Project will provide for parking at the mine operations site and the transportation routes, described in* ***Exhibit 2 – Project Description,*** *would not adversely affect traffic circulation.*

c. Limiting the number and size of signs in order to prevent undue visual impacts or hazardous conditions.

*The only signage visible to the public associated with the Project would be for transportation safety at the location where vehicles egress and exit from SR-11 to private roads.*

**Policy 2** Prevent the degradation of natural and cultural values resulting from cumulative impacts of incremental development.

*The Project final design will be permitted through the MDEP, and efforts will be made to minimize impacts to the principal values of the jurisdiction, including avoidance and minimization of impacts to protected natural resources. Due to the location-specific nature of this mineral deposit, development of this Project will not result in incremental development.*

### 9.3.3 Infrastructure

CLUP Goal: Ensure that infrastructure improvements are well planned and do not have an adverse impact on the jurisdiction's principal values.

The Project meets the CLUP's goal of ensuring that infrastructure improvements are well planned and do not have an adverse impact on the jurisdiction's principal values. These improvements will include upgrading existing gravel access roads located on private lands and the intersection of the private road with Route 11 for public safety purposes (see **Exhibit 21 – Public Roads).** The Project will also, separate from this application, establish a new power transmission service line to supply additional needed electrical power for the Project.

The power transmission route has been planned with Versant Power and would run from their substation located on Route 11, located approximately 0.6 miles south of downtown Patten, Maine. The transmission line would run north and northeast along Route 11 then follow the same gravel access road proposed for the mine for a total distance of approximately 11 miles. The access road upgrades to be considered in the design for the permit application submittal will be developed concurrently with the transmission line design. See **Exhibit 20 – Electricity and Communications.**

The Project is also consistent CLUP policies including the following items:

**Policy 1** Consider the capacity of existing infrastructure and services to accommodate proposed development, as well as the costs associated with the provision of these services to proposed development.

*It is Wolfden's objective that the primary workforce be employed locally from residents. This will require training for that work force since many unique skills are required of miners working underground. The mine will employ approximately 233 workers (employees and local contractors), composed of 91 shift*

*employees per day on average, to support all activities related to the Project at the mine site. With a local workforce, the imposition on existing infrastructure and services (housing, schools, roads, medical facilities, fire, police, solid waste, and municipal) is minimized since this population is already using these services. An analysis of the capacity of these services in the local communities is provided in* ***Exhibit 17 – Fire, Police, and Ambulance, Exhibit 18 – Educational Services, Exhibit 19 – Solid Waste Disposal, Exhibit 20 – Electricity and Telephone,*** *and* ***Exhibit 21 – Public Roads.***

**Policy 2** Discourage the construction or establishment of major new public roads that would degrade the natural character of remote areas.

*The Project will not require construction or establishment of any new public roads that would degrade the natural character of remote areas.*

**Policy 3** Require that new utility lines, pipelines and associated facilities be (a) located or co-located within or adjacent to existing utility or public road rights of way to the extent practicable; (b) constructed and landscaped so that they do not degrade natural values; and (c) located so as not to inappropriately encroach upon or change the character of remote areas, or produce an intensity of use that is inappropriate for a particular area.

*The new utility lines, principally electric power transmission, will be located or co-located within or adjacent to existing utility or public road rights of way to the extent practicable. Where new utilities cannot be established along existing utility corridors, they will be designed to minimize visual and physical impacts that would degrade natural values of the area. The areas contemplated would not be considered remote and would be near or adjacent to existing private roads.*

**Policy 5** Require that highly visible facilities such as communication towers be dismantled and removed from the site when they are unused for an extended period of time.

*Infrastructure at the Site (buildings, water collection and treatment ponds, soil stockpile areas) would be decommissioned, dismantled, and removed at the end of the Project as part of site reclamation. The land surface once occupied by these buildings would be regraded and returned as close to original grades as practical.*

### 9.3.4 Development Rate, Density and Type

<u>CLUP Goal: Ensure that development is of a rate, density and type conducive to maintaining the jurisdiction's principal values.</u>

The Project will be constructed in accordance with final plans approved by the MDEP. It will be the only Project of its kind in this location due to the single mineral resource, not increasing the density of development. The Project is also consistent with CLUP policies, including the following items:

**Policy 6** Limit development types and densities on the basis of soil suitability and other site limitations.

*The current design of the Pickett Mine development addresses potential soil limitations. The concept layout and design employs the engineering methods and practices recommended in the soil evaluation to*

*identify and address any potential limitations posed by the soil conditions. The site-specific soils information available at this phase of the rezoning process will be supplemented with additional detailed site-specific information that will further refine the design as the Project moves forward. See* ***Exhibit 23 – Soil Suitability*** *for additional information.*

### 9.3.5 Affordable Housing

CLUP Goal: Facilitate the provision of affordable housing in appropriate locations to households with a full range of incomes.

The Project does not involve construction of housing, but as described in **Section 10.10 of Exhibit 10 – Surrounding Uses and Anticipated Impacts**, the local employment anticipated by the Project will provide employee wages sufficient for those employees to afford housing in the local market.

### 9.3.6 Land Conservation

CLUP Goal: Encourage the long-term conservation of select areas of the jurisdiction that are particularly representative of its cultural and natural values, including working forests, high-value natural resources and recreational resources.

The Project has a temporary lifespan followed by decommissioning and removal. It will support the long-term conservation of select areas of working forests in the Project Area as well as protecting high-value natural resources such as surface water bodies, streams, wetlands, vernal pools, flora and fauna. The manner in which these natural resources shall be protected is discussed in **Section 10.5 of Exhibit 10 – Surrounding Uses and Anticipated Impacts** and **Exhibit 26 – Rare or Special Plant Communities and Wildlife Habitat**. Wolfden will continue to work with local logging companies to manage and allow harvesting of forest resources on its property.

The Project is consistent with the CLUP's land conservation policy:

**Policy 1** Encourage conservation efforts that protect one or more of the following: working forest or farmland; landscape features of statewide, regional or local significance; public access to lakes, rivers or ocean waters; high-value recreational resources; high-value natural resources; and undeveloped, multiple use lands in high-growth areas.

*Wolfden has developed cooperative working relationships with local landowners and local timber companies, to ensure continued use of its working forest resources and help maintain public access on private roads to access lakes within its property.*

## 9.4 CLUP NATURAL AND CULTURAL RESOURCES AND POLICIES

### 9.4.1 Air and Climate Resources

CLUP Goal: Protect and enhance the quality of air and climate resources throughout the jurisdiction.

The Project will not adversely affect air quality since dust will be controlled and processes that utilize chemicals that would be considered air pollutants are not used. Onsite emission sources will be limited to motorized heavy machinery and vehicles for above ground and underground mining related activities, similar to vehicles used in existing logging.

Rock crushing operations are a potential source of dust, but adequate provisions will be provided for dust management and control. Dust suppression is an important operational safety concern below ground in the mine. Blasted rock is mucked out wet to eliminate dust underground. Dust suppression on road and pads on the ground surface would be controlled by the application of sprayed water from a tanker truck, as required.

**Policy 1** Require compliance with all state and federal air quality standards. Require compliance with more stringent standards where necessary to preserve the air quality or unique values of identified sensitive areas, or to improve the air quality of identified nonattainment areas.

*The Project will comply with state and federal air quality standards.*

### 9.4.2 Cultural, Architectural and Historical Resources

CLUP Goal: Protect and enhance archaeological and historical resources of cultural significance.

The MHPC has been consulted and due to the presence of archaeological site 147.001 (MHPC Archeological Survey report 2719- E.C. Jordan 1984) at the headwaters of Pickett Mountain Pond, a Phase 0 Archeological survey was conducted in Spring 2020 and 2022 as discussed in **Exhibit 25 Archaeological and Historic Resources.** The scope for the Phase 0 survey was developed in consultation with the MHPC. The phase 0 study indicates that five areas of the proposed project (including buffer zone) are archaeologically sensitive for the presence of Native American archaeological sites. Four of these ASAs were classified as sensitive due to the presence of knappable lithic material of a type known to have been used by Native Americans to make stone tools; and one area was identified as sensitive as a Native American archaeological habitation site. These ASAs have been avoided as part of the site design (see **Exhibit 2, Figure 2-1**). By working cooperatively with MHPC and the Tribes to evaluate archaeological resources, the Project will meet the CLUP's goal of protecting archaeological and historical resources of cultural significance. If MHPC determines that further surveys will be required based on final design, those surveys will be designed and completed in consultation with MHPC.

The Project is consistent with the following CLUP policies based on the consultation with MHPC and Phase 0 Archeological survey:

**Policy 1** Identify and protect unique, rare and representative cultural resources to preserve their educational, scientific and social values.

**Policy 2** Collaborate with other agencies in efforts aimed at the protection of cultural resources.

**Policy 3** Complete an archaeological survey as part of this development proposal.

### 9.4.3 Energy

CLUP Goal: Provide for the environmentally sound and socially beneficial utilization of indigenous energy resources where there are not overriding public values that require protection.

The Project will further the CLUP's energy goals through designs that favor and incorporate energy efficiency and utilization of technologies such as heat pumps to assist heating and cooling at above ground facilities, when possible. An approximate 47-acre area is included in the rezone area to support a potential solar facility, if subsequent evaluations, planning, and agency consultations indicate this is viable. There are no environmentally sensitive resources in the area proposed for solar development. The primary purpose for the solar facility would be to provide the majority of energy required for mine operations. The Project will require a new transmission line to supply the additional electrical power required for mine operations beyond what is generated from solar operations to ensure operations continue to take place without interruption as well as to supply power for peak loading. See **Exhibit 20 – Electricity and Communications** for additional detail.

In addition to meeting this CLUP goal, the Project also is consistent with elements of the CLUP's policies due to inclusion of the solar facility, which has been sited to avoid impacts to natural and cultural resources.

**Policy 1** Support indigenous, renewable energy resources as part of state and national efforts to promote energy independence, diversity and long-term sustainability.

**Policy 5** Recognize that new renewable energy projects displace electrical energy provided by fossil fuels and thus carry the following benefits: reduction of Maine's dependence on imported fuels; improvement of environmental quality; enhancement of state and regional security; and progress toward meeting Maine's renewable energy and greenhouse gas reduction objectives.

**Policy 6** Accommodate energy generation installations that are consistent with state energy policies, are suitable in proposed location(s), and minimize intrusion on natural and cultural resources and values.

**Policy 7** Prohibit energy developments and related land uses in areas identified as environmentally sensitive when there are overriding environmental and other public values requiring protection.

### 9.4.4 Forest Resources

CLUP Goal: Conserve, protect and enhance the forest resource in a way that preserves its important values, including timber and fiber production, ecological diversity, recreational opportunities, as well as the relatively undeveloped remote landscape that it creates.

As discussed in **Exhibit 2 – Project Description** and **Exhibit 10 – Surrounding Uses and Anticipated Impacts,** the Project footprint will require approximately 129 acres to be cleared and 104 acres of actual development. The cleared and development areas would revert to forest uses after decommissioning and

removal of the mine and solar facilities. The balance of Wolfden's property (6,761 acres) will be accessible for timber harvest, thus meeting the CLUP's goal to conserve, protect and enhance the forest.

The specific CLUP policies items that are supported by the proposed Project include:

**Policy 1** Encourage active forest management.

**Policy 2** Support uses that are compatible with continued timber and wood fiber production, as well as biodiversity.

**Policy 3** Protect areas identified as environmentally sensitive.

**Policy 5** Support efforts by landowners to manage vehicular access to private roads when necessary to reduce land use conflicts.

**Policy 9** Encourage the use of Maine's best management practices for forestry on its land.

### 9.4.5 Geologic Resources

CLUP Goal Pertaining to Geologic Resources: Conserve soil and geological resources by controlling erosion and by protecting areas of significance.

CLUP Goal Pertaining to Mineral Resources: Allow environmentally responsible exploration and mining of metallic and non-metallic mineral resources where there are not overriding, conflicting public values which require protection.

The Project Area has had extensive exploration for mineral resources. There are no identified important natural geological formations, or geologic hazards such as seismically active faults, high elevations, or steep slopes subject to instability or erosion. Based on visual inspection, the area proposed for the Project features nearly level to moderate slopes with high percentage of vegetative cover and organic matter, and moderate to deeply rooted vegetation in glacially derived soils with a shallow water table. Fragile soils, most subject to erosion, are not known to be present. Based on current information, soil types are suitable for the proposed development.

As discussed in **Exhibit 21 – Public Roads**, site access is by existing gravel roads that are currently used for logging operations and that are in good condition. Any modification or improvement of these roads will be completed in accordance with a sedimentation and erosion control plan that will be developed during the mine design and permitting phase under MDEP rules. Based on current information, soil types are suitable for proposed development (i.e., construction of buildings, pads, and ponds), though more detailed studies, including soil mapping and geotechnical investigations will be required prior to preliminary and final design of buildings and structures. Soil and groundwater studies will be conducted under the baseline characterization for the MDEP Chapter 200 permit applications. These studies will quantify the infiltration capacity of soils and groundwater hydraulic conditions including gradients and saturated hydraulic conductivities and physical properties of site soils. Such studies will be needed to site, design, and size the WRAs as well as a site septic system. Such studies will also assist in determining engineering approaches that may be warranted to design improvements to the performance of such recharge/ infiltration systems.

Any modification of roads or the one existing stream crossing (outlet from Pickett Mountain Pond) would be completed in conformance with Land Use Standards enumerated in Chapter 10.27,D. The preliminary structural analysis and load rating of the bridge frame superstructure indicate the bridge superstructure should be capable of supporting a loaded semi-tractor trailer dump truck anticipated for this project (see **Exhibit 21 – Public Roads).**

The proposed mining activities would occur only within the area rezoned for planned development and would not adversely impact competing uses and public values. The proposed facility would minimize water, air, land, noise, and visual pollution through operations described in **Exhibit 2 – Project Description.** These operations will not affect public safety and health, and will avoid undue adverse impacts on fisheries, wildlife, botanical, natural, historic, archaeological, socioeconomic, and other values. The proposed mining operation provides distinct economic and social benefits and would not pose undue burden on existing services as described in **Exhibit 10 – Surrounding Uses and Anticipated Impacts.**

The Project will be subject to a long-term post closure monitoring and maintenance program subject to the requirements of MDEP Chapter 200 rules and including reclamation of the mine site to restore natural values and protect public health and safety and allow beneficial reuse of the Project Area.

Specifically, the Project is consistent with the following CLUP policy items pertaining mineral resources as discussed above and in the referenced Exhibits:

**Policy 6** Exploration for mineral resources with minimal disturbance to natural and cultural resources.

**Policy 9** Permit a metallic mining development in an area zoned for planned development, which broadly considers impacts and benefits, competing uses and public values.

**Policy 10** Regulate the mining operation to minimize water, air, land, noise and visual pollution, to ensure public safety and health, and to avoid undue adverse impacts on fisheries, wildlife, botanical, natural, historic, archaeological, socioeconomic and other values.

**Policy 11** Complete effective monitoring and reclamation of the mining site to protect public health and safety and to promote beneficial reuse where feasible.

### 9.4.6 Plant and Animal Habitat Resources

<u>CLUP Goal: Conserve and protect the aesthetic, ecological, recreational, scientific, cultural and economic values of wildlife, plant and fisheries resources.</u>

The proposed mining activity is not within areas known to contain unique, threatened, or endangered plant or wildlife resources and will be able to meet the CLUP goals and policies to preserve and protect aesthetic, ecological, cultural, and economic values of plant and wildlife resources. The area proposed for development is primarily upland forested habitat, co-dominated by deciduous trees (i.e., beech, birch, and red maple) and coniferous trees (i.e., spruce, fir, cedar, and hemlock). The area has been logged in the past decade and is currently in vegetative re-growth. Since the area is relatively small compared to the surrounding woodland habitat it should not have a negative effect on connectivity of habitats in the area. Wolfden has conducted delineation of wetlands and vernal pools in spring 2020 and a wetland

confirmation in summer 2022. Additional studies of terrestrial fauna will be conducted under the baseline characterization work under the MDEP Chapter 200 regulations and will at that time conduct a final assessment for potential rare, threatened, or endangered (RTE) species.

Wolfden has also met with staff of the MDIFW as well as MNAP. There is one area, a fen, between Pleasant and Mud Lakes that MNAP has identified as a priority site for a botanical survey. This area is approximately 1.5 miles north of the Project Area and would not be adversely affected by proposed activities. The MNAP environmental review for the Project is presented in **Exhibit 26 Rare or Special Plant Communities and Wildlife Habitat**. Based on current information, MNAP RTE plants are not documented in the Project Area. Based on a desktop review of available information including site photos and field data collected during the wetland delineations, a Stantec botanist determined there is a low potential for any rare botanical features in the Project area because the forest and wetland community types along with the overall topography are quite typical and not areas generally associated with rare plants; and absence of indicator species (e.g., basswood) that would suggest more enriched habitat conditions.

Agency feedback related to plant and animal habitat resources are included in **Exhibit 26 Rare or Special Plant Communities and Wildlife Habitat**.

Specifically, the CLUP policy items that would be consistent with the Project as described above include:

**Policy 1** Coordinating with and supporting agencies in the identification and protection of a variety of high-value wildlife habitats, including but not limited to: habitat for rare, threatened or endangered species; rare or exemplary natural community and ecosystem types; native salmonid fish species; riparian areas; deer wintering areas; seabird nesting islands; waterfowl and wading bird habitats; and significant vernal pools.

**Policy 2** Conduct land use activities that are protective of sensitive habitats, including but not limited to habitats for fish spawning, nursery, feeding and other life requirements for fish species.

**Policy 3** Develop the site in a manner that retains connectivity of habitats and minimize road mortality of wildlife by promoting road building practices that facilitate wildlife movement and by directing development to appropriate areas.

**Policy 5** Protect wildlife habitat in a fashion that is balanced and reasonably considers the management needs and economic constraints of landowners.

**Policy 7** Consider mechanisms to encourage sustainable land use patterns that contribute to maintenance of large tracts of undeveloped land, particularly those areas having statewide ecological significance that are important to healthy plant and animal populations.

### 9.4.7 Recreational Resources

CLUP Goal: Conserve the natural resources that are fundamental to maintaining the recreational environment that enhances diverse, abundant recreational opportunities.

The Project is not anticipated to have adverse direct or indirect recreational impacts to use of local lakes and ponds including Pleasant Lake and Pickett Mountain Pond. The project does not interrupt access to existing hiking, snowmobile, and ATV trails. Establishment of a forested buffer and maintenance of tree canopies along the perimeter of the Project Area are intended to reduce potential visual impacts. Based on visual analyses completed for this application (see **Section 16.1 of Exhibit 16 – Harmonious Fit and Natural Character)**, limited visual effects are anticipated to occur to the snowmobile/ATV trail located immediately south of the Project Area, Pickett Mountain Pond, eastern shore of Tote Road Pond, and the northern face and summit of Mount Chase. The project does not directly affect these resources. The limited visual effects will not adversely impact recreational opportunities offered by those resources. See **Exhibit 16 – Harmonious Fit and Natural Character and Exhibit 10.8 - Recreational Resources** of this application for additional discussion of recreational resources. The specific recreational resource policies of the CLUP that would be met or supported by the proposed Project include:

**Policy 6** Support cooperative efforts that ensure continued public access across, and recreational use of, private lands.

*Cooperative efforts that assure continued public access across any rights of way on Wolfden's property, excepting reasonable restrictions on certain roads that lead to the mine site, as needed for public safety. Minimal impact to recreational trail connections or traditional recreational activities near the Project site is anticipated; however, Wolfden commits to modifying or relocating trail connections if circumstances related to the safety of workforce or general public are identified and warranted.*

**Policy 7** Support efforts that ensure continued public access to public waters.

*Efforts on the part of Wolfden will allow for continued public access to public water on their property.*

**Policy 8** Promote respect for and responsible use of private lands.

*Wolfden will support responsible use of its property.*

### 9.4.8 Water Resources

<u>CLUP Goal: Preserve, protect and enhance the quality and quantity of surface waters and groundwater.</u>

**Section 10.5 of Exhibit 10 – Surrounding Uses and Anticipated Impacts** provides a detailed discussion of Potential Impacts to Existing Uses and Natural Resources and provides a description of mine water treatment and management. **Exhibit 2 – Project Description** describes the operations and reclamation phases of the Project. Collectively these environmentally responsible water management practices would prevent degradation or impacts to groundwater and surface water and protect water quality in adjacent aquatic habitats including wetlands, vernal pools, streams, lakes, and ponds. These actions would meet the CLUP's goal of protecting the quality and quantity of surface waters and groundwater.

The Project will have no direct impact on shorelands since the Project location is removed from such features.

The specific CLUP policies that will be advanced through the planned development and regulatory framework include the following:

**Policy 1** Regulate uses of land and water in order to prevent degradation of the jurisdiction's excellent water quality and undue harm to aquatic habitat.

**Policy 2** Protect the recreational and aesthetic values associated with water resources.

**Policy 4** Conserve and protect lakes, ponds, rivers, streams and their shorelands, which provide significant public recreational opportunities.

**Policy 8** Control land uses on identified aquifers and their recharge areas in order to prevent adverse effects on water quality or quantity.

**Policy 10** Protect ground water quality throughout the jurisdiction through proper controls on potentially polluting activities.

**Policy 12** Conserve the quality and quantity of public and certain private water supplies by managing land use in source protection areas.

### 9.4.9 Wetland Resources

CLUP Goal: Conserve and protect the ecological functions and social and economic values of wetland resources.

See **Exhibit 6 – Structures, Features, and Uses** of this application for a discussion of wetland resources.

The specific wetlands resource policies of the CLUP that would be met or supported by the proposed Project include:

**Policy 1** Support the nationwide goal of no net loss of wetland functions and values by avoidance or minimization of impacts.

*The proposed Project has been designed with no impacts to vernal pools, wetlands, and streams and includes a buffer on all such natural resources.*

**Policy 3** Ensure that development avoids alteration of wetland areas. If avoidance is not feasible, ensure that development minimizes alteration. If loss of wetland functions is unavoidable, require actions to restore, reduce or gradually eliminate lost or degraded wetland functions. If necessary, require compensation for lost or degraded wetland functions through protection of wetlands of equal or greater value.

*The proposed Project has been designed with no impacts to vernal pools, wetlands, and streams and includes a buffer on all such natural resources. The water treatment and discharge system has been designed to meet water quality standards and maintain existing wetland functions and values. Monitoring of wetland resources will be a requirement of the MDEP Chapter 200 permit.*

# EXHIBIT 9 FIGURES

Not Applicable

# EXHIBIT 9 ATTACHMENTS

Not Applicable

# EXHIBIT 10.0 SURROUNDING USES AND ANTICIPATED IMPACTS

## 10.1 INTRODUCTION

To characterize surrounding uses and anticipated impacts, LUPC guidelines for a zone change application specific to metallic mineral mining (Chapter 12) and the general guidelines for a LUPC zone change application (Chapter 10) require:

- A detailed list of existing uses and features in the area including the number and type of residences, the type and scale of commercial enterprises, and other relevant details. Examples of uses and features include, but are not limited to: homes, businesses, commercial forest land, farmland, recreational resources, natural features, cultural features, etc. (Chapter 10);
- A description of both potential positive and negative impacts the proposed development may have on the community or area. If describing economic benefits, distinguish between short-term and long-term benefits (Chapter 10);
- A description of what measures will be taken to assure no undue adverse impact of the proposed new or expanded land use to wildlife habitat. Special consideration should be given to areas near waterbodies (Chapter 10);
- If the proposed development is on or near a mapped and zoned high yield sand and gravel or bedrock aquifer, explain how the new or expanded land use will result in no undue adverse impact to the aquifer (Chapter 10);
- For recreational resources, explain why the proposed development will result in no undue adverse impact to these features AND how the values of recreational resources will be maintained (Chapter 10);
- A description of general measures that may be undertaken to assure that mining in the specified location will not have undue adverse impacts on existing uses and resources and measures that a permittee may take to avoid, minimize or mitigate any adverse impacts of existing uses and features (Chapter 12); and
- A description of socioeconomic impacts, both positive and negative, of the proposed metallic mineral mining or level C mineral exploration activities upon the immediate area and communities within and adjacent to the Commission's jurisdiction likely to be affected by the proposed activities, as well as to the county and state. Distinguish between short-term and long-term benefits (Chapter 12).

The LUPC guidelines also require the preparation of supporting figures to understand the existing surrounding uses and anticipated impacts associated with the proposed development. These figures include:

- A map and or description of the location of public, private and industrial water supplies as well as mapped aquifers located within a three-mile radius of the mining area or exploration site (Chapter 12);
- A map identifying significant natural resources and sensitive natural areas located within a three-mile radius of the mining area or exploration site including protected water bodies, significant wildlife and plant areas, fragile mountain areas, historic sites, scenic resources, public lands, registered critical areas, and Commission subdistricts (Chapter 12); and
- A map and description of existing uses, such as recreational uses, within a three-mile radius of the mining area or exploration site (Chapter 12).

Consistent with these requirements, this exhibit provides a summary of surrounding uses and potential anticipated impacts from the Project. Where appropriate, direction is provided to other Exhibits for more specific details on the analysis and methods used to inform these summaries.

## 10.2 RESIDENCES

There are no residences within the Project Area. There are six seasonal residences (camps) around Pleasant Lake approximately 1 mile to the north of the Project Area. Two of these residences are located approximately 675 feet from the southern lake shore, and four are located along the northern shoreline. These residences are depicted in **Exhibit 16, Figure 16-1**. Beyond these 6 seasonal residences, there are approximately 20 residences located along the eastern shore of Upper Shin Pond, located approximately three miles from the Project Area.

A 3-mile viewshed analysis was completed for areas within 3-miles of the Project Area and is presented in **Exhibit 16 – Harmonious Fit and Natural Character**. This exhibit also presents a supporting line-of-sight analysis from the Pleasant Lake seasonal camps as **Attachment 16-A Pleasant Lake Sight-Line Analysis**. Methodology for these analyses is discussed in more detail in **Exhibit 16.** The tallest point in the Project Area (top of the headframe) may be visible from the camps on the north shore of Pleasant Lake. However, when viewed from Pleasant Lake, Mount Chase (elevation 2,440 feet) will be located behind the headframe and partially mask this structure from the horizon. These analyses also indicate that existing vegetation and the Project's maintenance of a tree line surrounding proposed site infrastructure is expected to minimize visual impacts to Pleasant Lake. The proposed solar array is expected to be completely shielded by the tree line and vegetation. Residences along the shore of Upper Shin Pond are not expected to experience any visual impacts from the Project based on these analyses.

WSP (formerly John Wood Group, PLC) has completed a sound assessment (**Exhibit 16, Attachment 16-B Noise Assessment Report**) to model the potential for sound impacts from Project operations. Three points of reception (POR) locations were selected to represent the seasonal camps located along both shores of Pleasant Lake, with the closest one located approximately 4,000 feet away from the Project Area. Predicted daytime and nighttime operations sound levels at these PORs were modeled to

be well below MDEP noise guidelines. Residences along the shore of Upper Shin Pond are also not expected to experience any acoustic impacts from the Project given their distance from operations. WSP's sound assessment included a POR at the western edge of Wolfden's property, approximately 9,000 feet (1.75 miles) east of Upper Shin Pond. Similar to what was modeled for Pleasant Lake, predicted daytime and nighttime operations sound levels at this location were modeled to be well below MDEP noise guidelines.

## 10.3 COMMERCIAL ENTERPRISES/BUSINESSES

Herbert C. Haynes Inc (H.C. Haynes), a local forest management company based out of Winn, Maine, currently owns and manages several parcels located within 3 miles of the Project Area. These parcels are actively managed for timber production and other land-based resources (e.g., wildlife habitat, recreation, and hunting). H.C Haynes has granted a permanent easement to Wolfden allowing full and commercial access their property and the Project Area. Except for these commercial forestry activities, there are no businesses within 3 miles of the Project Area. The impact of the Project on businesses in the larger region are discussed in **Attachment 10-A**.

## 10.4 PUBLIC LANDS

There are no existing public lands within 3 miles.

## 10.5 NATURAL RESOURCES

### 10.5.1 Physical Setting and Soils

The Pickett Mountain Mineral Deposit contained within the Project Area is situated beneath and on an approximate 2.7-mile-long ridge with moderate elevations ranging from 1,360 to 1,140 feet (west to east). This ridge is bordered to the south by Pickett Mountain Pond, to the east by Tote Road Pond and Grass Pond, and to the north by Pleasant Lake and Mud Lake. In general, the area beyond the Project Area within 3 miles of the proposed rezone boundary is surrounded by commercial forests. The Project Area is generally forested and was logged over the last 10 years. The Wolfden parcel outside of the proposed rezone boundary will continue to be managed for timber harvesting and forest management. **Section 6.1.9 in Exhibit 6 – Structures, Features, and Uses** provides more details and figures detailing the local geological conditions. Soils in the Project Area are generally Plaisted, Dixmont, Thorndike, and Rockland soil series. **Exhibit 23 – Soil Suitability** further describes soil conditions and an assessment of soil suitability for the Project Area.

#### 10.5.1.1 Soils

General soil conditions and their suitability for development within the Project Area were evaluated in the field by a Maine Certified Soil Scientist in September and October 2020. Over 30 test pits and observations were completed. In addition to field data collection, other information used to evaluate soils included a desktop review of the US Department of Agriculture's Natural Resources Conservation Service soil surveys, LiDAR topography, and geotechnical drilling data from past explorations. Results found that generally suitable soils or soils with limited suitability for development dominate the Project Area. Generally suitable soils are typically located on better drained, deeper soils. Soil limitations observed in

the field include shallow bedrock conditions and areas with a seasonal high-water table. These soil limitations can be addressed through careful siting of Project infrastructure and use of site-appropriate engineering design and construction approaches. Further evaluation of soil conditions and the design of the Project's infrastructure will be part of the MDEP Chapter 200 permitting efforts. **Exhibit 23, Attachment 23-A Soil Suitability Evaluation for the Wolfden-Pickett Mountain Mine Rezoning Petition** further describes the analysis and results of desktop and field investigations. As noted in **Section 10.5.4**, during construction and operations phases of the Project, an Erosion Prevention and Sediment Control Plan will be utilized to control soil erosion and sedimentation. Through adherence to this Plan and consideration of the existing soil limitations, the Project does not anticipate any adverse impacts to soils.

#### 10.5.1.2 Acid Rock Drainage

When mineralized rock is mined and processed, the surface area of exposed sulfide mineral increases along with the potential for acid generation. Undisturbed sulfide mineral deposits have limited exposed surfaces and, therefore, pose little threat to groundwater under natural, oxygen-limited conditions. Acid rock drainage occurs as a result of the oxidation and dissolution of sulfide bearing minerals and may generate low pH contact water. The Research Productivity Council Report (**Attachment 10-B)** details the results of analyzed rock samples from the Project Area and an assessment of the potential for existing rock to influence acid rock drainage from Project operations. Generally, non-mineralized rock outside of the Pickett Mountain mineral deposit (i.e., rock excavated during development) is non-acid generating and carries some neutralizing potential. Each sample collected greater than approximately 100 feet away from the mineral deposit had "Non-Acid Generating" results. Most of the infrastructure and mine development is planned in this area further than 100 feet from the mineral deposit for geotechnical considerations and this will significantly reduce the potential for acid rock drainage in contact waters. Three of the samples closest to the mineral deposit (bearing some sulfide minerals) were found to be potentially acid rock drainage producing, as expected.

Since the process leading to acid rock drainage requires the presence of both oxygen and water, as well as time, Wolfden will implement effective strategies to prevent acid generation into the design and operation of the mine. Within the Project Area, the potential sources of acid rock drainage are limited to mineralize rock from underground being temporarily stored on the surface. Although the mineral surface area remains small for broken rock material and the exposure of the rock material to water is short in duration before being removed from the mining site, the rock storage pads are designed within a water collection area. Rock pads will be lined to collect contact water from the material and then pumped to a storage pond and treated before being discharged (detailed further in **Section 10.5.2)**. This approach will remove potentially acid generating material and thereby remove the risk related to acid rock drainage.

### 10.5.2 Hydrology and Water Quality

The Project Area is characterized by relatively thin glacial deposits and overlying bedrock based on subsurface drilling conducted during Wolfden's mineral exploration activities. Except for the occasional rock outcrop or rock ridge, the entire Project Area is forested. Groundwater and surface water divides are expected to be controlled by topography and groundwater flow direction should mimic topography. **Figure**

**10-1** depicts anticipated groundwater and surface water divides and indicates anticipated groundwater flow directions. **Figure 10-2** details the proposed watershed conditions of the Project.

Based on studies of similar geologic and geographic settings[5] and historically averaged precipitation data,[6] the site is anticipated to receive approximately 45 inches of total annual precipitation (see **Figure 10-3**). Recharge to groundwater (i.e., net precipitation minus evapotranspiration) will result in overburden groundwater and shallow bedrock groundwater recharge and groundwater flow and discharge toward surface water bodies including lakes, ponds, and streams.

The majority of shallow groundwater recharge will occur in spring and fall when temperatures are above freezing, evapotranspiration rates are lowest, and precipitation is highest**.** On average it is expected that approximately 42% of precipitation is lost to evapotranspiration and surface run-off.[6] The majority of recharge is expected to infiltrate to shallow (possibly perched) and deeper saturated overburden groundwater where present. Additionally, a smaller amount of recharge is expected to reach bedrock groundwater (typically in the range of 5-10%[6]). This deeper groundwater, including overburden and bedrock, will form the base flow of groundwater discharge to nearby surface water bodies such as Pickett Mountain Pond and Pleasant Lake.

The perched shallow groundwater that occurs in the shallow developed soil horizon is important for the infiltration of precipitation and movement of shallow groundwater that supports wetlands and baseflow of intermittent and perennial streams. This component of subsurface flow is distinct from the deeper saturated groundwater conditions, where present, in the denser, silty glacial tills. Investigation of the soil suitability at the Project Area conducted by Atlantic Resource Co. LLC and Wood (see **Exhibit 23, Attachment 23-A**) provided soil classifications of this shallow soil located above restrictive layers that included bedrock, the water table or till. The seasonal high-water table is generally greater than 15” and bedrock, where present is dominated by smooth shield type ledge that is located below a mantle of glacial till, rather than rock outcrops. Bedrock was observed generally greater than 20” below the ground surface (see **Exhibit 23, Attachment 23-A**). Based on published soil vertical soil hydraulic conductivity values for these soil types, the mean expected horizontal saturated hydraulic conductivity is estimated to be in the range of 1.98 feet/day for these shallow soils.[7] The ratio of horizontal to vertical hydraulic conductivity is typically assumed to be 10:1.[7]

A divide in surface water and groundwater occurs along the ridge separating surface water and groundwater flow to Pickett Mountain Pond and Pleasant Lake. The watershed surrounding and contributing to Pickett Mountain Pond is approximately 2,095 acres. In comparison, the watershed surrounding Pleasant Lake and Mud Lake is approximately 8,389 acres. Pickett Mountain Pond outlet flows eventually to Mud Lake and the combined watershed has a drainage area of approximately 10,485 acres. The precipitation runoff collection area of the project is 28.4 acres where water will be collected, treated and returned within the watershed. This area is approximately 1.4% of the Pickett Mountain Pond watershed and approximately 0.3% of the combined watershed area. The water balance equation, or how precipitation is eventually distributed, takes many forms but is often generally defined as $P = INT + EVT + INF + \Delta S$, where P is precipitation, INT is interception (direct run-off into streams, water bodies),

[5] Gerber and Hebson, Groundwater Recharge Rates for Maine Soils and Bedrock, Geological Society of Maine Bulletin 4. 1996
[6] http://www.nrcc.cornell.edu/wxstation/pet/pet.html
[7] United States Geological Survey, 2010. Simulation of Groundwater Mounding Beneath Hypotehical Stormwater Inflitration Basins. USGS Scientific Investigation Report 2010-5102.

EVT is evapotranspiration and INF is interflow or groundwater flow and ∆S is change in storage. Net recharge is defined as P-INT, or the water available for infiltration that will eventually become groundwater minus losses due to evapotranspiration during the growing season. An estimated water balance for the sub-basins is provided in **Table 10-1**. Most of the overburden groundwater would be expected to discharge locally within the local drainage basin (>95%), with the exclusion of recharge to bedrock. Some shallow bedrock groundwater would also be expected to discharge locally to streams in upland mountain areas and deeper sections of ponds, where present. The net change in storage is typically represented by bedrock groundwater lost to the regional groundwater system, and changes in water table storage. In general, the Project area occupies a very small area compared to the size of the watersheds.

#### 10.5.2.1 Water Treatment and Management Approach

The Project's water treatment approach is designed to capture, treat, and return mine water and contact water while maintaining existing hydrology and water quality to the Project area's wetlands, streams, and surrounding natural environment. Generally, water will be collected and treated and discharged in accordance with precipitation patterns. For example, more precipitation generally occurs in the spring and fall and, therefore, more water will be collected, treated, and discharged in the spring and fall than summer. While each of the Project's treatment elements are briefly summarized here, further discussion and details on each of these elements is provided in:

- **Attachment 10-C – Stormwater Collection Technical Memorandum** (completed by WSP [formerly John Wood Group, PLC])
- **Attachment 10-D – Water Treatment Scoping Study** (completed by Mine Water Service, Inc)
- **Attachment 10-E –** Water Management at the Pickett Mountain Mine Site Technical Memorandum (completed by Sevee and Maher Engineers Inc.)

**Table 10-1:** Estimated Hydrologic Budget

| Area | Size (acres) | Interception Direct Runoff (acre/ft/yr) | Net Precipitation (acre/ft/yr) | Evapo-transpiration (acre/ft/yr) | Groundwater Recharge (acre/ft/yr) | Overburden Recharge (acre/ft/yr) | Bedrock Recharge (acre/ft/yr) | Net Precipitation (gallons/yr) | Interception Direct Runoff (gallons/yr) | Evapo-transpiration (gallons/yr) | Groundwater Recharge (gallons/yr) | Overburden Recharge (gallons/yr) | Bedrock Recharge (gallons/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pleasant Pond/ Mud Lake Sub Watershed | 8389 | 1259 | 30221 | 12693 | 16320 | 14,808 | 1,511 | 9,846,987,465 | 410,291,144 | 4,135,734,735 | 5,317,373,231 | 4,825,023,858 | 492,349,373 |
| Pickett Mountain Pond Sub Watershed | 2095 | 315 | 7549 | 3170 | 4076 | 3,699 | 377 | 2,459,571,966 | 102,482,165 | 1,033,020,226 | 1,328,168,862 | 1,205,190,264 | 122,978,598 |
| Green Mountain Pickett Mountain Watershed | 10485 | 1574 | 37770 | 15863 | 20396 | 18,507 | 1,889 | 12,306,559,431 | 512,773,310 | 5,168,754,961 | 6,645,542,093 | 6,030,214,121 | 615,327,972 |
| Developed Mine Area | 28.4 | | 106.5 | | | | | 34,711,674 | | | | | |
| Developed Mine Area % of Pickett Mountain Sub Watershed | 1.4% | | | | | | | | | | | | |
| Pre-Development Mine Area % of Green-Pickett Mountain Sub Watershed | 0.3% | | | | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| Total Annual Precipitation | 45.03 | inches | | |
| Annual Interception | 4% | | | |
| Annual Interception | 1.80 | inches | | |
| Annual Net Precipitation | 43.23 | inches | | |
| Total Available for Recharge | 3.60 | feet | | |
| Bedrock Net Recharge | 5% | | 2.16 | inches |
| Overburden Net Recharge | 49% | | 21.18 | inches |
| EVT Rate & Run-off | 42% | | 18.16 | inches |
| Total RCH and EVT | 96% | | | |
| Developed Mine Area | 28.39 | acres | | |
| Mine Dewatering | 30 | gpm | 15,768,000 | gallons/yr |
| | 0.24% | of Total Watershed Groundwater Recharge | | |
| | 0.30% | of Pleasant Pond Mud Lake Sub Watershed Groundwater Recharge | | |
| | 1.19% | of Pickett Mountain Pond Sub Watershed Groundwater Recharge | | |
| | 2.56% | of Total Watershed Bedrock Groundwater Recharge | | |

Key: EVT = Evapotranspiration; ft = feet; gpm = gallons per minute; RCH = Recharge; yr = year

The stormwater analysis completed by Wood (**Attachment 10-C**) has modeled anticipated seasonal volumes of precipitation in the Project Area that will need to be collected and stored in a Pre-Treatment Water Storage Pond (Pond). Water in contact with mineralized rock (ore, low grade ore, and waste rock) stored on lined pads will be collected in the Pond prior to treatment. The stormwater analysis also incorporates the need for additional collection and storage of 30 gallons per minute (gpm) of mine water (from mine dewatering) into the Pond. Pond sizing includes a contingency for increased runoff volume during a 500-year, 24-hour storm event in accordance with 06-096 Chapter 200: Metallic Mineral Exploration, Advanced Exploration and Mining. Based on current precipitation estimates and consideration for a 500-year storm event, the Pond volume was modeled to have a required capacity of approximately 6.87 million gallons with a minimum 2-foot freeboard. The conceptual location of the Pond and its approximate footprint of 3.25 acres is depicted on site plan drawings in **Exhibit 2 – Project Description.** Collected stormwater and mine water will be subsequently treated and tested at the Project's water treatment facility. Collected water will not be allowed to return to the natural environment prior to treatment.

Collected stormwater and mine water will be fed to the onsite water treatment plant at a calculated maximum rate of 200gpm and treated using a multistage approach. First, pre-treatment via ultrafiltration (UF) will occur to remove suspended solids and other particles down to 0.1 micron in size. Second, reverse osmosis (RO) membranes will be employed to remove remaining chemical constituents down to their atomic radii in size. RO can effectively remove contaminants from water and can produce pure water containing only water molecules. The use of UF and RO is well-established and used across multiple industries. Treatment plant reject water (i.e., water not meeting quality standards) will either be returned to the treatment plant for another round of UF and RO of or used by mine operations as a concrete mix for backfilling areas of completed excavation as a physically and chemically stable mixture. Untreated or contaminated water will not be allowed to return to the natural environment. Through this approach, the Project will satisfy Maine Chapter 200 and Title 38, Chapter 3 wastewater discharge requirements. The Water Treatment Scoping Study (**Attachment 10-D)** provides more background and literature on how UF and RO technology works along with details on the conceptual design of the treatment system presenting the various steps and anticipated treatment volumes.

After water has been treated by UF and RO and tested, WRAs will allow for treated and tested water infiltration back into the natural environment. The WRAs will be positioned upgradient of both wetlands and streams so that existing hydrology (replenishment of shallow or perched groundwater) is maintained (see **Attachment 10-E**). Based on the current available information, a combination of spray irrigation and snowmaking (WRSs) placed over the WRAs will provide suitable conditions to return treated water at the Project Area while maintaining wetland and stream hydrology at the site. Using these technologies, and application rates typical of similar projects at similar sites, it is currently estimated that the Project will require between 15 and 29 acres of land required for recharge. There are at least 60 acres of available area for WRAs that could be utilized for treated water disposition within the 374 acres proposed for rezoning. For the purposes of visualization, the Conceptual Site Plan displays an example footprint of 22 acres (the mean anticipated required area). The final size and locations of WRAs will be determined once detailed soil studies have been completed.

Human sewage generated from the underground mine operations will be contained to Portable Toilets (Porta Potties). These will be on contract basis and managed through replacement of filled facilities with clean facilities by the supplier. Grey and black waters generated from the surface facilities will drain to a typical state approved septic system located on the site down gradient of the building infrastructure and potable water supply. Sewage management is further discussed in **Exhibit 24 – Sewage Water/Wastewater Disposal**. No adverse impacts to hydrology and water quality are anticipated from the management of the Project's wastewater.

### 10.5.3 Aquifers

The Project Area is not located near a high yield sand and gravel aquifer nor a high yield bedrock aquifer. A medium yield sand and gravel aquifer has been mapped along the north shore of Pleasant Lake (approximately 1.5 miles from the Project Area) with indicated yields >/= 10 gpm. The yield of the residential well on the south side of Pleasant Lake is reported as >/= 8 gpm. It is assumed that all seasonal residencies have private water supplies (wells), though this has not been confirmed. There are no other known private or public water supplies within a 3-mile radius of the site. **Figure 10-4** depicts these features in addition to inferred surface water divides and groundwater flow direction in the vicinity of the Project Area.

The Project's water treatment approach (see **Section 10.5.2.1**) is designed to treat mine process and stormwater and remove chemicals to meet background levels prior to its return to the natural environment. Treatment of water will occur through a combination of ultrafiltration and reverse osmosis. Additionally, the control of volume and location of these water releases will be designed to maintain existing rates of flow and percolation through the Project area's existing soils. As a result, the Project does not anticipate any adverse impacts to the quantity or quality of water received by local aquifers.

### 10.5.4 Wetlands/Streams/Waterbodies

Within 3 miles of the Project Area, the U.S. Fish and Wildlife Service (USFWS) has mapped wetlands in T6R6 WELS as a part of the National Wetlands Inventory dataset. LUPC Land Use Guidance Maps have incorporated National Wetlands Inventory mapped wetlands and are displayed in **Exhibit 6, Figure 6-1**. Within the Project Area, a formal delineation of wetlands, streams, and potential vernal pools (PVPs) in the Project Area was completed in June 2022 to supplement previous delineation efforts. Twenty-nine wetlands, 27 watercourses, and PVPs were identified during these surveys. Further information on the delineated wetlands, PVPs, vernal pools previously delineated, and representative photographs are in **Exhibit 6, Attachment 6-A Wetland and Watercourse Delineation and Potential Vernal Pool Survey Report**. The eastern shoreline of Upper Shin Pond, Pleasant Lake, Mud Lake, Huntley Duck Pond, Pickett Mountain Pond, Grass Pond, Tote Road Pond, Bear Mountain Pond, Hale Pond, and Green Pond are located within 3 miles of the Project Area (**Figure 10-1).**

Mine infrastructure in the Project Area will be sited at least 75 feet away from delineated wetlands, streams, PVPs, and vernal pools to avoid direct impacts to these resources during construction and mine operations. An Erosion Prevention and Sediment Control Plan will be developed for the Project to provide a strategy for controlling soil erosion and sedimentation during and after construction. This plan will incorporate the standards and specifications for erosion prevention for development projects contained in

the Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices. This strategy will not allow the introduction of sediment-laden runoff to enter any nearby waterways. To accomplish this strategy, temporary erosion and sediment control measures will be used during construction and will stay in effect until the Project Area has been stabilized permanently.

As previously noted, the Project's water treatment approach will return clean, treated water back to the environment using WRAs. The siting and release of water from these WRAs is designed to maintain current hydrology to wetlands, streams, PVPs, and vernal pools. At the completion of the mining project, the site will be reclaimed removing all buildings and structures. As a result of these actions, the Project does not anticipate any adverse impacts to these resources.

## 10.6 NATURAL COMMUNITIES/FISH AND WILDLIFE HABITAT

As noted in **Exhibit 6: Attachment 6-A Wetland and Watercourse Delineation and Potential Vernal Pool Survey Report**, the Project Area is generally dominated by forested uplands with several large, forested wetland complexes and smaller isolated wetlands throughout. A large hill is in the southwestern portion of the Project Area with topography sloping up to the north and to the east. The crest and side slopes of the hill are characterized by moderately shallow soils. Tree species in the upland forested areas include American beech, eastern hemlock, red maple, gray birch, paper birch, eastern white pine, sugar maple, and balsam fir. The upland sapling and shrub layer is dominated by regenerating species present in the forest canopy, as well as striped maple and hobblebush. The upland herbaceous layer is dominated by evergreen wood fern, Canada mayflower, and Canadian bunchberry. The upland forested communities are best characterized as a low-elevation beech-birch-maple forest, a matrix-level and widespread hardwood forest of the northern Maine landscape. The Project is planned to operate for 10-15 years after which the impacted area would revert to forest. It is anticipated that a similar forest structure to what is currently seen would return after mine operations cease and site reclamation and restoration activities are completed.

Correspondence with MDIFW and MNAP indicated their information notes no presence of significant natural communities in the Project Area. MDIFW-mapped Inland Waterfowl and Wading Bird Habitat (IWWH) is located on the inlet at the western end of Pickett Mountain Pond, approximately 0.25 miles from the Project Area. The Project does not have any anticipated impacts on this IWWH.

Critical habitat for the federally threatened Canada lynx (*Lynx canadensis*) and federally endangered Atlantic salmon (*Salmo salar*) overlaps with the Project Area and both the USFWS and MDIFW identified the potential for occurrence by listed bat species.

- Portions of the Project Area also likely support lynx movements through the region but the amount of potential habitat impacted through development is minimal versus what is available in the surrounding landscape. Pockets of coniferous or mixed coniferous communities, where snowshoe hare (primary prey source for lynx) may be present, are generally limited to the margins of wetlands and streams. Through adherence to 75-foot buffers around these areas, direct habitat impacts will be minimized. The Project will also propose a speed limit for all-Project related traffic between dusk and dawn when operating within the Project Area and along the access road to Route 11 to minimize vehicle collisions with wildlife.

- Delineated streams in the Project Area are generally intermittent in nature and unlikely to provide suitable habitat for Atlantic salmon. Regardless, the Project proposes no instream work and adherence to 75-foot buffers around wetlands and surface waters to minimize potential impacts to aquatic habitats. The Project's water management approach will maintain water quality standards to further avoid Project impacts to aquatic habitats in the immediate area that may support Atlantic salmon.

- Surveys for bat hibernacula will be required as part of the MDEP Chapter 200 permitting process and this will include inspections of all areas of talus and rock features per MDIFW recommendations noted below. In addition, the Project will limit required tree clearing to between November 1 and April 14 to avoid periods when trees may be used for reproduction and habitat for young who are unable to fly.

Other, more focused botanical and wildlife field investigations will be completed as part of the MDEP Chapter 200 permitting process. Results from these studies, and ongoing consultations with resource agencies, will inform specific design considerations to address any concerns. Through these measures, the Project anticipates no adverse impacts to natural communities, wildlife habitat, or rare and endangered species. Details on correspondence with USFWS, MDIFW, MDEP, and the MNAP, and a further discussion of potential fish and wildlife habitat in the Project Area, is provided in **Exhibit 26 – Rare or Special Plant Communities and Wildlife Habitat**.

## 10.7 FOREST RESOURCES

As previously described in this application, Wolfden currently owns a single parcel totaling ±7,135 acres located in the southeastern corner of T6 R6 WELS (**Exhibit 5 – Land Division History)** with the Project Area entirely contained within this parcel. Wolfden's full parcel is undeveloped and forested, except for the six privately owned seasonal residences on parcels along Pleasant Lake and the presence of logging roads. The Project and surrounding areas are predominantly commercial forests that were logged within the last 10 years and are generally in vegetative regrowth. Outside of Wolfden's parcel, but within the 3-mile radius of the Project Area, local forest management companies own and actively maintain several tracts of commercial forest. The area proposed for rezoning is approximately 374 acres, which includes approximately 129 acres of land that would be cleared for construction (**Exhibit 7 – Site Plans)**. The Project is planned to operate for 10 to 15 years after which the impacted area would be restored to forest and returned to active timber management. During mine operations, there would be no restrictions on current and future timber operations on the remaining 6,761 acres (94.8%) of the Wolfden parcel. Access to other tracts of commercially viable forest resources along the proposed access route to the Project would not be restricted. Road access conditions for logging trucks will be improved as a result of upgrades to meet the needs of loaded ore haul tracks leaving the Project. As a result, the Project does not anticipate any adverse impacts to forest resources and the local timber industry.

# 10.8 RECREATIONAL RESOURCES

## 10.8.1 Lakes and Ponds

Pleasant Lake, Mud Lake, and Grass Pond are all designated as Heritage Fish Waters by the MDIFW. Maine Heritage Fish Waters are native and wild brook trout lakes and ponds that represent unique ecological and valuable angling resources. Through discussion with local residents and users, there are various levels of use of the identified lakes and ponds within the 3-mile radius of the Project Area. Pleasant Lake has a higher level of use due the presence of six seasonal residences near or along its southern and northern shoreline as well as an unimproved boat launch along the southern shoreline. It has an average depth between 6 to 10 feet. Pickett Mountain Pond is accessible by foot, has no improved boat launch, and is very shallow (averaging 2 to 3 feet deep). The use of these ponds for recreation will not be restricted as part of the proposed Project. Some additional use of the boat launch on Pleasant Lake is anticipated due to increased traffic to the area by employees of the Project during operations. Correspondence from local residents on existing levels of use on Pleasant Lake and Pickett Mountain Pond are provided as **Attachment 10-F**.

Direct visual impacts of the top of the headframe may be experienced at Pickett Mountain Pond, the north side of Pleasant Lake, Mud Lake, Tote Road Pond, and Huntley Pond. Seasonal residences located along the north side of Pleasant Lake make may have visual line of sight to the top of the headframe. The headframe is 120 feet tall and could rise above the tree line approximately 80 feet. However, when viewed from Pleasant Lake, Mount Chase (elevation 2,440 feet) will be located behind the headframe and partially mask this structure from the horizon. In addition, most of the Project infrastructure will be well below 40 feet in total height and Wolfden intends to maintain a tree line surrounding the Project. When forest cover is incorporated into the visual analysis, the headframe is only visible from the north shore of Pleasant Lake and Pickett Mountain Pond. Sight-line analysis of the proposed solar array indicates that vegetation will completely screen views of the proposed solar panels from the Pleasant Lake and shoreline camps. The eastern shore of Upper Shin Pond is within the 3-mile radius as depicted in **Figure 10-1**; however, the Project Area is not visible from this location. See **Exhibit 16 – Harmonious Fit and Natural Character** for additional details on visual analyses.

Previous MDIFW surveys (1953, 1958) indicate both Pleasant Lake and adjoining Mud Lake are shallow mud bottom ponds with warm temperatures at all depths in summer months. However, inlet and outlet streams (i.e., West Branch of the Mattawamkeag River, Pickett Mountain Stream and Spring Brook) provided spawning and nursing areas for brook trout and landlocked salmon. The ponds did not have conditions supportive of cold-water fish species at the time of these older surveys. In 2019, MDIFW surveys suggested Pleasant Lake could support a landlocked salmon and brook trout fishery as they identified the presence of cold-water springs in the lake, ideal dissolved oxygen levels from across of the water column for this fishery, and excellent brook trout growth. A similar MDIFW survey of Pickett Mountain Pond from 1958 noted a maximum depth of seven feet and limited trout production. MDIFW noted that competition with other fish species, marginal water quality, and limited areas for reproduction reduced Pickett Mountain Pond's value as a brook trout fishery. Given the capture, collection, and treatment of impacted water to background level quality, the Project will not adversely impact surrounding water resources.

### 10.8.2 Public Boat Launches

As noted above, there is a single unmaintained public boat launch located within 3 miles of the Project Area on the southern shore of Pleasant Lake. The level of use of this boat launch is estimated at up to 10 uses per month with a maximum of 2-3 uses per day as a peak, based on anecdotal evidence and communications with the nearest camp residence. Some additional the use of the boat launch on Pleasant Lake is anticipated due to increased traffic to the area by employees of the Project during operation.

### 10.8.3 Campsites

There are no known public campsites within 3 miles of the Project Area. The closest known identified public campsites are in Shin Pond Village and Mount Chase Lodge, approximately 5 miles from the Project Area. No impacts from the Project are anticipated at these public campsites. See **Exhibit 16 – Harmonious Fit and Natural Character** for additional details on visual analyses.

### 10.8.4 Recreational Trails

The general area within 3 miles of the Project Area contains a network of logging roads used primarily for logging and for access to the previously described seasonal residences along Pleasant Lake. In addition, recreational vehicles like all-terrain vehicles (ATVs) and snowmobiles use the logging roads. Combined ATV/snowmobile trails have been developed around the Project Area including portions of Maine's Interconnected Trail System (ITS) and several groomed trails maintained by local clubs (see **Exhibit 16, Figure 16-1**). The closest ATV/snowmobile trail follows a gravel road approximately 0.5 miles south of the Project Area (sometimes referred to as Fire Road C) and traverses in an east or west direction between both Mount Chase and Pickett Mountain. The estimated level of use for the ATV trails is 500 trail riders per month from spring to fall and 700 trail riders per month for snowmobiles in the winter. Consultation with the nearby Katahdin Lodge, Shin Pond Village, and Patten ATV club was completed to provide guidance on usage information above and confirm the locations of trails. No snowmobile or ATV trails are within the Project Area.

The Project Area (headframe) would be visible from the following ATV and snowmobile trails (see **Exhibit 16, Figure 16-1)**:

- The trails northwest of Pleasant Lake.
- The trail northeast of Mud Lake.
- The trails east and south of Pickett Mountain Pond.

When forest cover is incorporated into the visual analysis, the headframe is only visible from the closest ATV/snowmobile south of Pickett Mountain Pond.

Within 3 miles of the Project Area, the only published hiking trail obtained from a query of publicly available datasets is a summit trail to Mount Chase, located approximately 2 miles south of the Project Area (see **Exhibit 16, Figure 16-1**). The Project Area will potentially be visible from this summit only.

# 10.9 CULTURAL/HISTORICAL RESOURCES

A field inspection in support of an archeological Phase 0 assessment of the Project Area was completed in June 2020 and May 2022. Results of this investigation and Phase 0 assessment are provided in **Exhibit 25 – Archeological and Historic Resources.** In summary, four areas within the Project Area are considered archeologically sensitive for the presence of Native American archeological sites based on the presence of outcrops of knappable material known to have been used by Native Americans to make stone tools. A fifth area within the Project Area is considered archeologically sensitive as a potential habitation site given its position as a fairly level till bench terrace located above Pickett Mountain Pond and in proximity to a previously documented site. The Project Area is not considered sensitive for the presence of Euroamerican archeological resources. Further investigation of these ASAs will occur during Chapter 200 permitting, but all of these ASAs have been avoided as part of Project design and no impacts are anticipated.

# 10.10 SOCIOECONOMICS

## 10.10.1 Existing Conditions

Stepwise Data Research Completed an Economic Assessment (EA) of the Project in July 2022 (**Attachment 10-A – Economic Assessment of Proposed Pickett Mountain Project**), which is summarized here. The EA used the Houlton and Millinocket labor market areas (LMA) as defined by the U.S. Department of Labor as the principal geography for analysis of current socioeconomic conditions and used statistics from greater Penobscot and Aroostook County and the State of Maine for consideration of supply chain impacts.

The statistics on the current socioeconomic conditions of the region reveal a sparsely populated region with limited economic activity and an aging population. Local wages trail the state average by 20-30% and poverty rates exceed the state average, particularly among children. In a place that once led Maine's manufacturing sector, the percentage of jobs in this field now trails the state average. The decline of the former Great Northern Paper mills in Millinocket and East Millinocket, which once employed thousands, has clearly hurt the local economy and no other large businesses have located here to take their place.

The Project lies in a relatively remote, rural area on the border of northern Penobscot County and southwestern Aroostook County, Maine, in an unorganized township. The closest community is Mount Chase, a settlement with about 190 year-round residents, located a few miles south. A few miles south of the Project Area along Route 11 is the town of Patten, with about 880 year-round residents. Patten has been designated a "rural hub" by the LUPC, their designation for a community that provides services to nearby communities. The nearest larger communities are Houlton (6,050 residents), a 40-mile drive to the east, and Millinocket (4,100 residents), 50 miles south. These larger communities are the region's principal employment centers and economic hubs and are classified as service centers by the State of Maine. The Project is roughly equidistant to both communities and will have an economic impact on both, through workforce and business connections

Approximately 27,000 people live in the Region of the Houlton and Millinocket LMAs. They represent just 2% of Maine's population and their numbers are declining. Since 1990, the region's population has

decreased by 19%, while the rest of Maine has grown 11.8%. Many young people have left in search of employment and the remaining population is notably older than the state average, especially in the Millinocket LMA. Incomes are relatively low and poverty rates exceed the state average, especially among children.

The population of the Region has declined steadily since the 1970s and 1980s, mirroring changes in the forest products industry that once dominated the region. A series of mill layoffs and closures reduced employment opportunities, causing many residents to relocate. While some sites are being redeveloped, technological advances mean new operations do not require the thousands of workers mills once employed. Since 1990, Mount Chase's population has decreased by 26%, Patten's by 30%, Millinocket LMA's by 31%, and Houlton LMA's by 10%. As the region's population has declined, the age of its residents has risen, suggesting many emigrants were young people seeking opportunities outside the region.

Incomes in the Region are significantly lower than elsewhere in Maine, most likely reflecting the region's lack of well-paying jobs and the age of its population. In Houlton LMA, poverty across all age groups significantly exceeds the state average. In Millinocket LMA, poverty among those under age 65 exceeds the state average, but those age 65 and older are slightly less poor than their peers statewide. Childhood poverty is particularly prevalent in the region. In both LMAs, approximately 1 in 3 children under age 5, or 28.8% in Houlton LMA and 34.8% in Millinocket LMA, is living in poverty. Maine's overall child poverty rate measures significantly lower from 2016-2020, at fewer than 1 in 6 Maine children (15.4%).

Recent employment statistics suggest a labor market with limited employment opportunities. In 2021, average employment was 6,876 in Houlton LMA and 3,033 in Millinocket LMA. Unemployment exceeded the state average (6.2% and 7.6%, respectively, compared to 4.6% statewide). Employment opportunities in the Region appear to model the seasonal fluctuations that typify Maine's economy. In 2021, employment was highest during the summer travels months, slightly lower in fall and winter, and lowest during spring "mud season". Within the Region, the fact that employment remains relatively high through the winter months compared to elsewhere in Maine likely reflects its popularity as a destination for snowmobiling and other winter recreation.

In 2021, average wages in the Region were 25%-35% lower than elsewhere in Maine. The average weekly pay of a Maine job was $1,051, compared to $798 in Houlton LMA and $720 in Millinocket LMA. "Living wages" for Aroostook and Penobscot counties calculated by researchers at the Massachusetts Institute of Technology suggest local jobs may not pay enough to support a minimum standard of living. In 2020, the average weekly wage in these counties was $836 and $951, respectively. This would cover the needs of a single adult living alone but falls far short for an adult with one child. In 2016-2020, the percentage of residents in Houlton LMA (88.2%) with health insurance coverage trailed the state average, while Millinocket LMA was equivalent to the statewide coverage rate of 92.4%. The lack of health insurance coverage for the overall population may reflect a lack of jobs providing this benefit to younger residents.

Compared to the rest of Maine, in 2021 the Region had a higher concentration of businesses in the agriculture, forestry, fishing, and hunting industry classification; transportation and warehousing; and public administration. There was a lower concentration of businesses in wholesale trade and professional and technical services. The overall number of business establishments in the region across all industries

has declined in the past two decades. Mirroring the mix of business establishments, a disproportionate share of employment in the Region is in retail trade, educational services, and health care and social assistance.

The Maine Office of Tourism (MOT) publishes visitor information for the "Maine Highlands" region, which encompasses Penobscot and Piscataquis counties, and includes the Region (**Figure 10-5**). Tourism is a significant contributor to the Region economy. In 2021, taxable sales from the Region (including the Maine Revenue Service Economic Summary Areas [ESA] of Houlton, Patten, and Millinocket) were $36 million, which represented 0.8% of statewide restaurant and lodging sales. Across Maine, sales at these tourism-related businesses accounted for 14,7% of all retail sales. In the Houlton ESA and Patten ESA, that percentage was lower (10.0% and 11.5% respectively) while in Millinocket ESA it was significantly higher (22.6%). Maine's tourism economy has grown robustly in recent years with statewide restaurant and lodging sales rising 78.3% from 2010 to 2021. Growth was much lower in the Region over this time period, ranging from 29.4% in Patten to 36.7% in Houlton and 40.1% in Millinocket. Snowmobiling and ATV use provide significant tourism revenue to the region and state. Spending on trips (as opposed to spending on the snowmobile itself) during the 2018-2019 season was more than $200 million. Forty-six percent of resident snowmobilers and 45% of non-resident snowmobilers visited the "Maine Highlands" region as defined by the Maine Department of Transportation (MDOT) (**Figure 10-5**), making it the most visited tourism region in Maine with resident snowmobilers and the second most popular with non-residents. In all, an estimated 523,000 "snowmobiling days" took place in the Maine Highlands region during the 2018-2019 season. A 2005 study found that ATV user activity contributed $200 million to the state economy in the 2003-04 season. This value is likely significantly larger now, both due to cost inflation and the increased popularity of ATV use. In 2003-2004, the Maine Highlands region was the most popular region for ATV riders, with an estimated 24% of all rides happening in the region and 35% of all riders riding in the area.

### 10.10.2 Potential Positive Impacts

In total, the Project expects to spend $622 million dollars during fourteen years of planning and operations of the Project (excluding contingency spending), of which $340 million is expected to be spent with businesses located within the economic region of Aroostook and Penobscot Counties. As that spending ripples through the regional economy, creating indirect and induced economic benefits, a total impact of $715 million in business sales and $248 million in earnings will be created within the regional economy. The Project is expected to create 4,540 job-years (roughly 324 jobs per year inclusive of 272 Project-associated jobs for 14 years). Roughly 11% (510 job-years) are expected to be created in the start-up phase and 89% (4,030 job years) in the operations phase. The estimated 324 annual jobs represent 0.4% of the total jobs in the economic region and 4.1% of jobs in the Houlton and Millinocket labor market areas. While the economic data does not allow for a hyper-local estimate of the economic impacts, it is fair to assume that the economic impacts are expected to be felt most acutely by the towns closest to the project and will dissipate with distance. The jobs created by the Project are further detailed in **Table 17 and 18 of Attachment 10-A**. There are a total of 16 administrative supervisory and management staff for the Project. Additionally, there are 103 daily project operators, who work 10.5 hours dayshifts and nightshifts over a 7 days-on and 7 days-off rotational schedule. In addition, there are 14 hired staff that work-day shift only but follow the similar 7 days-on and 7 days-off working rotation. Note that the Preliminary Economic Assessment (PEA) does not specify each of the of the mill operators and

staff as shown in **Table 18** (**Attachment 10-A**); however, the costs associated with those positions are reflected within the economics of the document.

The EA estimated that 55% of total spending will be procured locally (50% of startup costs and 56% of operational costs). Wolfden will seek to use local companies and contractors whenever feasible to maximize benefits to the local economy. Much of the non-regional spending is expected to occur within Maine, but the non-regional economic impacts were outside the scope of the EA. Therefore, the overall estimated economic benefits of the Project are conservative because they do not include benefits that accrue to Maine outside of the Region. If $25 million in estimated contingency spending is included, which is budgeted to be spent but not yet tied to specific budget items, it increases the estimated overall impact to $743 million in business sales, $258 million in earnings, and 4,720 job-years.

Mining is a new economic opportunity in Maine that will require work-force development and training. Wolfden will support job training programs focused on mining operations as well as focused investment and support in technical institutions. Specifically, Wolfden has, and will continue to, work in partnership with local community colleges, vocational schools, and other educational institutions. These opportunities include existing coordination with Northern Maine Community College (NMCC) and Eastern Maine Community College (EMCC) to develop a 12-week, skills-based training program. The program would accept up to 12 students at a time to allow for individualized training. Courses will repeat on a continual basis if there remains a demand and regional interest. The target audience for this program includes energetic and driven individuals above 18 years old with an interest in working in an industrial setting.

Marketing for the training program will occur through the partnering colleges as well as Wolfden social media and various community engagement strategies. A large part of community engagement and employee engagement will be accomplished through outreach to school science and job fairs in various communities, including harder to reach locations. Organizations such as the Northern Maine Development Commission and Eastern Maine Development Commission as well as Aroostook Partnership and One Katahdin will be important partners for reaching populations that may not typically have access to or interest in post-secondary educational programs.

A similar training program, “Common Core Training,” which is implemented by the Northern Centre for Advanced Technology (NORCAT), has been successful in Canada. Since 1995, this program has trained individuals to support mine operators, contractors, and suppliers like Mansour Mining Technologies, Inc., MacLean Engineering, Atlas Copco, Maestro Mine Ventilation, and Boart Longyear. Likewise, a program developed with support from current Wolfden staff in partnership with New Brunswick Community College (NBCC)has been successful in meeting workforce needs for two different mining operations in northern New Brunswick. Since operations at those mines have ceased, experienced miners have been able to retain jobs outside of northern New Brunswick and continue their careers. Wolfden would expect that miners with experience gained through work-force development in Maine also would have opportunities to export their skills beyond Maine following closure of the Project. Finally, Wolfden is committed to working with employees regarding financial planning and education in preparation for the Project’s eventual completion and reclamation.

The highest amount of direct Project spending, almost $165 million, will flow to the regional construction industry for a variety of excavation, infrastructure, and building services. Just under $10 million will be spent in the wholesale trade industry for equipment and materials ranging from drill bits to heavy

machinery. About $12 million will go to the mine support industry, which in Maine currently consists mostly of support for the non-metallic mining industry, and $119 million of spending will flow directly to Project employees within the region through their earnings. **Table 10-2** provides a breakdown of expected regional spending by each industry.

### Table 10-2: Regional Spending by Industry

| Industry (NAICS) | Start-up (Years 1-2) | Operations (Years 3-12) | Total Regional Spending |
|---|---|---|---|
| Construction | $34,583,300 | $130,147,300 | $164,730,700 |
| Wholesale trade | $1,866,900 | $7,677,700 | $9,544,600 |
| **Total Construction and Investment** | **$36,450,200** | **$137,825,000** | **$174,275,300** |
| | | | |
| Project Employee Earnings (Households) | $2,065,200 | $116,826,200 | $118,891,400 |
| Utilities | $8,629,700 | $16,956,400 | $25,586,100 |
| Support activities for mining | $3,703,700 | $7,895,700 | $11,599,400 |
| Professional, scientific, and technical services | * | $4,450,000 | $4,450,000 |
| Waste management and remediation services | $3,426,100 | * | $3,426,100 |
| Truck transportation | * | $550,000 | $550,000 |
| Administrative and support services | * | $500,000 | $500,000 |
| General merchandise stores | * | $350,000 | $350,000 |
| Financial investments and related activities | * | $100,000 | $100,000 |
| **Total Mine Operations** | $17,824,700 | $147,628,300 | $165,453,000 |
| | | | |
| **Total** | **$54,274,900** | **$285,453,200** | **$339,728,200** |

* Indicates that no regional spending in this NAICS industry for this phase of the project was used in the economic impact analysis. It does not, however, necessarily mean that no spending in this industry will occur during the phase (spending may occur outside of the region) or that no spending for this type of work will occur (for example, spending related to trucking materials may be classified within the support activities for mining industry as opposed to the truck transportation industry).
Source: Attachment 10-A

## 10.10.3 Potential Negative Impacts

Maine has one of the most stringent regulatory frameworks for mining in the nation, which includes precautionary operational safeguards and environmental monitoring. Wolfden will operate within the requirements of Maine law to preserve the ecological, social, and economic integrity of the region. The EA includes a qualitative assessment of the impact of the proposed Project on tourism and housing. It concludes that if the Project is successful in its plan to hire local workers within an hour travel distance of the Project, the impact on the local housing market will likely be negligible. Likewise, based on the Project footprint and expected operations, the impact on the Maine Highlands tourism market will also likely be negligible.

The Maine Office of Tourism researched the most popular attractions for overnight visitors in the Maine Highlands Region, which includes the Region. Except for the Patten Lumberman's Museum, all are located at a considerable distance from the Project (more than an hour's drive away) and none are expected to be negatively affected by the Project's operations, noise, or infrastructure. It is reasonable to assume that the Project will have no impact on visits to the region's primary tourism attractions.

Snowmobiling and ATV riding are also important parts of tourism and local recreation in the Maine Highlands region, which includes a larger area than the Region considered by the EA. For snowmobilers, the Highlands region, is the most visited tourism region with residents and the second most visited with non-residents; for ATV riders, it is the most visited. Both snowmobilers and ATV riders generally ride long distances: for example, resident snowmobilers drove an average of 780 miles in 2018-2019, while non-residents drove an average of 973 miles. No snowmobile or ATV trails are within the rezone area.

Publicly available data on other forms of recreation like hiking, hunting, and fishing taking place within the Region are sparse and it is unclear how large an economic market these forms of recreation make up, and how many people from outside the region come to the Region to recreate. While there are trails nearby, none are within the Project boundaries. Pickett Mountain is not a world-class tourism attraction like Mount Katahdin, nor does it have “gateway-community” amenities close by. The Project’s footprint will be less than a square mile in a region of thousands of square miles of recreational opportunities. Wolfden has also publicly stated it does not intend to revoke public access to its more than 6,700 acres of adjacent land for hunting or trail use. All of these factors lead to the reasonable conclusion that the proposed Project will have little to no negative effect on the regional tourism industry.

Home prices and rents in the Region are affected by myriad factors that drive the overall supply and demand for housing in the region. Today, all these factors interact in the form of house prices and rents that are lower than the statewide average and a housing vacancy rate that is above the state average, particularly in Houlton LMA (32%) and Millinocket LMA (41%). There are over 6,900 vacant housing units in these LMAs. There are several reasons to conclude the proposed Project will have little-to-no effect on housing prices and rents including long-standing market trends that are not easily disrupted and likelihood that most workers will come from the local region. To the extent that some workers will prefer to rent or buy a home closer to the Project instead of commuting, the high vacancy rate in the region will likely be able to absorb a modest impact on demand with little effect on overall pricing fundamentals. It is Wolfden’s objective that the primary workforce will be hired from the local economic region whenever feasible.

### 10.10.4 Conclusion

The EA evaluates the socioeconomic impacts, both positive and negative, of the Project on the immediate area and communities likely to be affected by the Project. The EA details expenditures during the start-up as well as operational phases of the Project, employment and wages associated with the Project, and the indirect and induced economic impacts. As detailed in the EA, the Project impact will result in a total output of $714,523,300, total earnings of $247,845,700, and total job-years of 4,540 (roughly 324 jobs per year for 14 years). This is a significant economic boost to a region of otherwise limited economic activity and where wages trail and poverty rates exceed the state average. The EA also undertakes a qualitative assessment of the Project’s impact on tourism, housing and job training. The job training, if successful, will provide an added economic benefit to the region that may extend beyond the life of the Project. Negative impacts to tourism and housing are expected to be negligible. Thus, the Project will have a significant positive socioeconomic impact in a region where economic development opportunities are limited.

# EXHIBIT 10 FIGURES

Figure 10-1: Watershed – Existing Conditions

Figure 10-2: Watershed – Proposed Conditions

Figure 10-3: Historic Regional Precipitation Patterns

Figure 10-4: Sand and Gravel Aquifers

Figure 10-5: Maine Tourism Regions

# EXHIBIT 10 ATTACHMENTS

Attachment 10-A: Economic Assessment of the Proposed Pickett Mine Project.

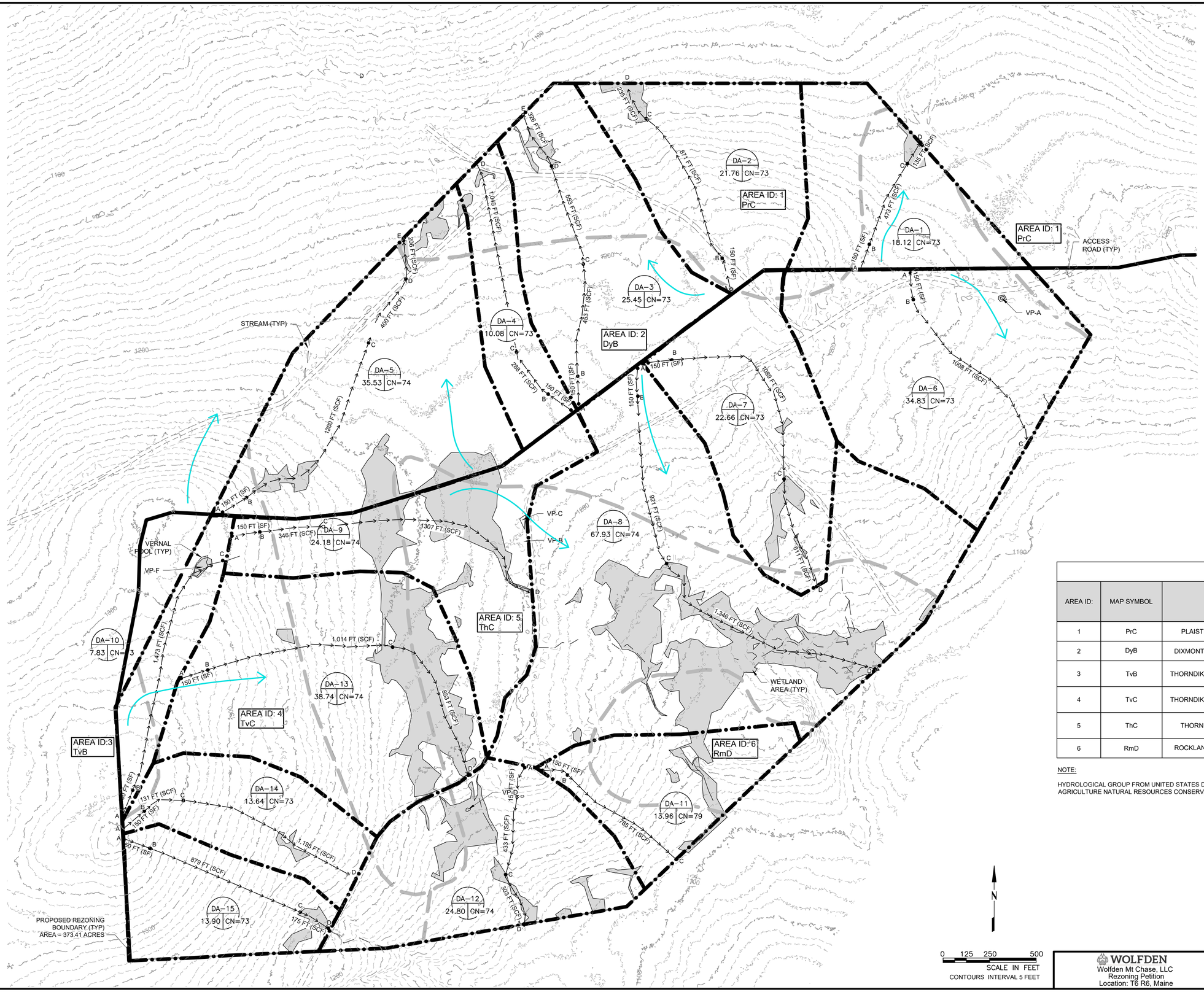
Attachment 10-B: Research Productivity Council Report

Attachment 10-C: Stormwater Collection Technical Memorandum

Attachment 10-D: Water Treatment Scoping Study

Attachment 10-E: Water Management at the Pickett Mountain Mine Site Technical Memorandum

Attachment 10-F: Recreational Use of Pleasant Lake Letters from Residents




LEGEND:

- BOUNDARY DRAINAGE
- TC FLOW PATH
- APPROXIMATE GROUNDWATER FLOW
- EXISTING CONTOURS
- SOIL SERIES BOUNDARY
- STREAM
- PICKETT MOUNTAIN POND / PLEASANT LAKE WATERSHED DIVIDE
- WETLAND
- 400-FEET REZONING SETBACK BUFFER
- PROPOSED REZONING
- VERNAL POOLS

ABBREVIATION:

DA - DRAINAGE AREA
TC - TIME OF CONCENTRATION
CN - CURVE NUMBER
POA - POINT OF ANALYSIS
SF - SHEET FLOW
SCF - SHALLOW CONCENTRATION FLOW

DA=7 — DRAINAGE AREA
25.50 CN=98 — CURVE NUMBER
AREA IN ACRES

SOIL KEY

| AREA ID: | MAP SYMBOL | SOIL SERIES | DRAINAGE CONDITION | SLOPE (%) | HYDROGRAPHICAL GROUP |
|---|---|---|---|---|---|
| 1 | PrC | PLAISTED VERY STONY LOAM | WELL DRAINED | 8-15 | C |
| 2 | DyB | DIXMONT VERY STONY SILT LOAM | SOMEWHAT POORLY DRAINED | 2-8 | C/D |
| 3 | TvB | THORNDIKE VERY STONY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 2-8 | D |
| 4 | TvC | THORNDIKE VERY STONY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 8-15 | D |
| 5 | ThC | THORNDIKE SHALY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 8-15 | D |
| 6 | RmD | ROCKLAND, THORNDIKE MATERIA | EXCESSIVE DRAINAGE | 15-25 | - |

NOTE:

HYDROLOGICAL GROUP FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

Prepared/Date: WJW 10/25/22
Checked/Date: MAP 10/25/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

EXISTING GROUNDWATER AND SURFACE WATER DIVIDE
Project 3617-19-7478
Figure 10-1

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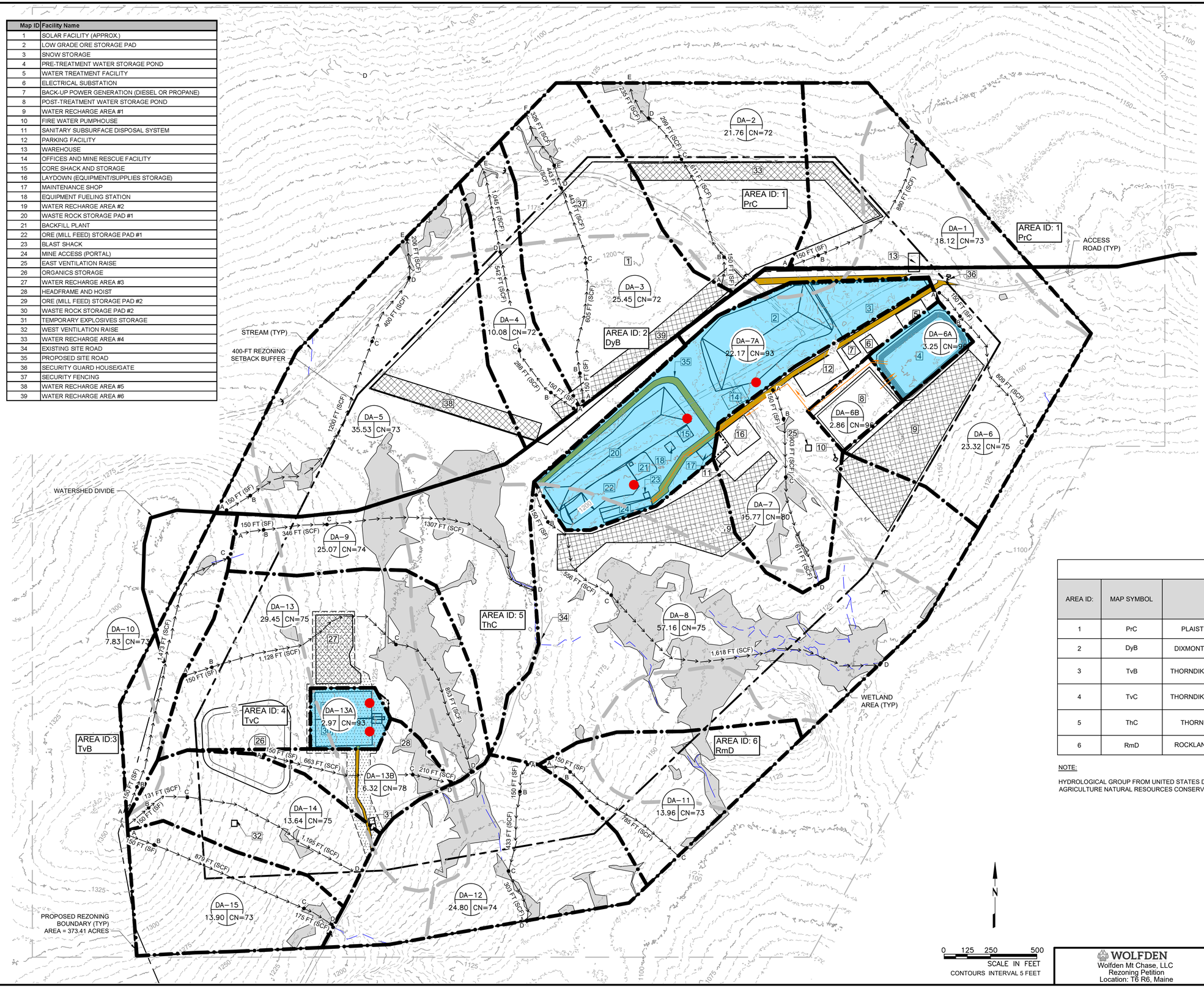
| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACILITY |
| 6 | ELECTRICAL SUBSTATION |
| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
| 8 | POST-TREATMENT WATER STORAGE POND |
| 9 | WATER RECHARGE AREA #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | WATER RECHARGE AREA #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | WATER RECHARGE AREA #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK STORAGE PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | WATER RECHARGE AREA #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | WATER RECHARGE AREA #5 |
| 39 | WATER RECHARGE AREA #6 |




LEGEND:

- BOUNDARY DRAINAGE
- TC FLOW PATH
- MINE FACILITY DRAINAGE AREAS WHERE PRECIPITATION RUNOFF IS COLLECTED AND TREATED
- EXISTING CONTOURS
- SOIL SERIES BOUNDARY
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- WETLAND
- 400-FEET REZONING SETBACK BUFFER
- PROPOSED REZONING
- VERNAL POOLS
- EFFLUENT
- INFLUENT
- EMERGENCY EFFLUENT LINE
- PAD SUMP

ABBREVIATION:

DA - DRAINAGE AREA
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POA - POINT OF ANALYSIS
SF - SHEET FLOW
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| 5 | ThC | THORNDIKE SHALY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 8-15 | D |
| 6 | RmD | ROCKLAND, THORNDIKE MATERIA | EXCESSIVE DRAINAGE | 15-25 | - |

NOTE:

HYDROLOGICAL GROUP FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

Prepared/Date: WJW 10/25/22
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WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME, 04112 (207) 775 - 5401

PROPOSED WATERSHED CONDITIONS
Project 3617-19-7478
Figure 10-2

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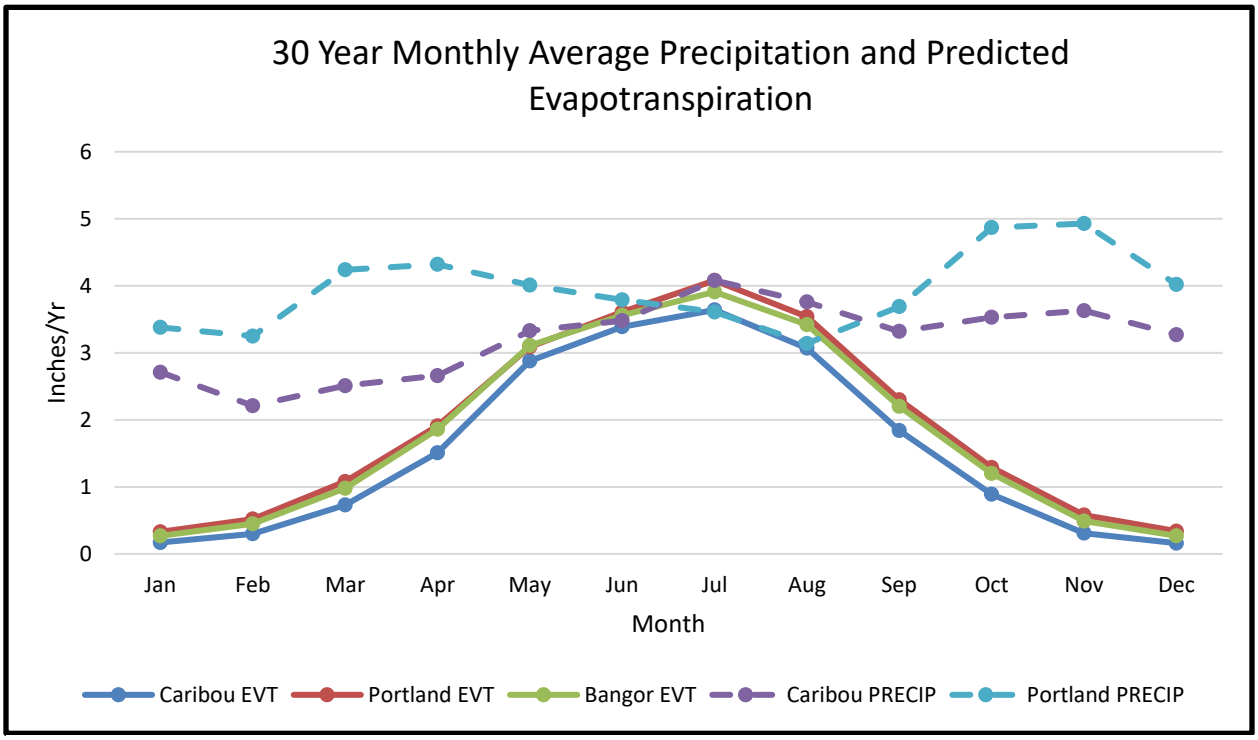
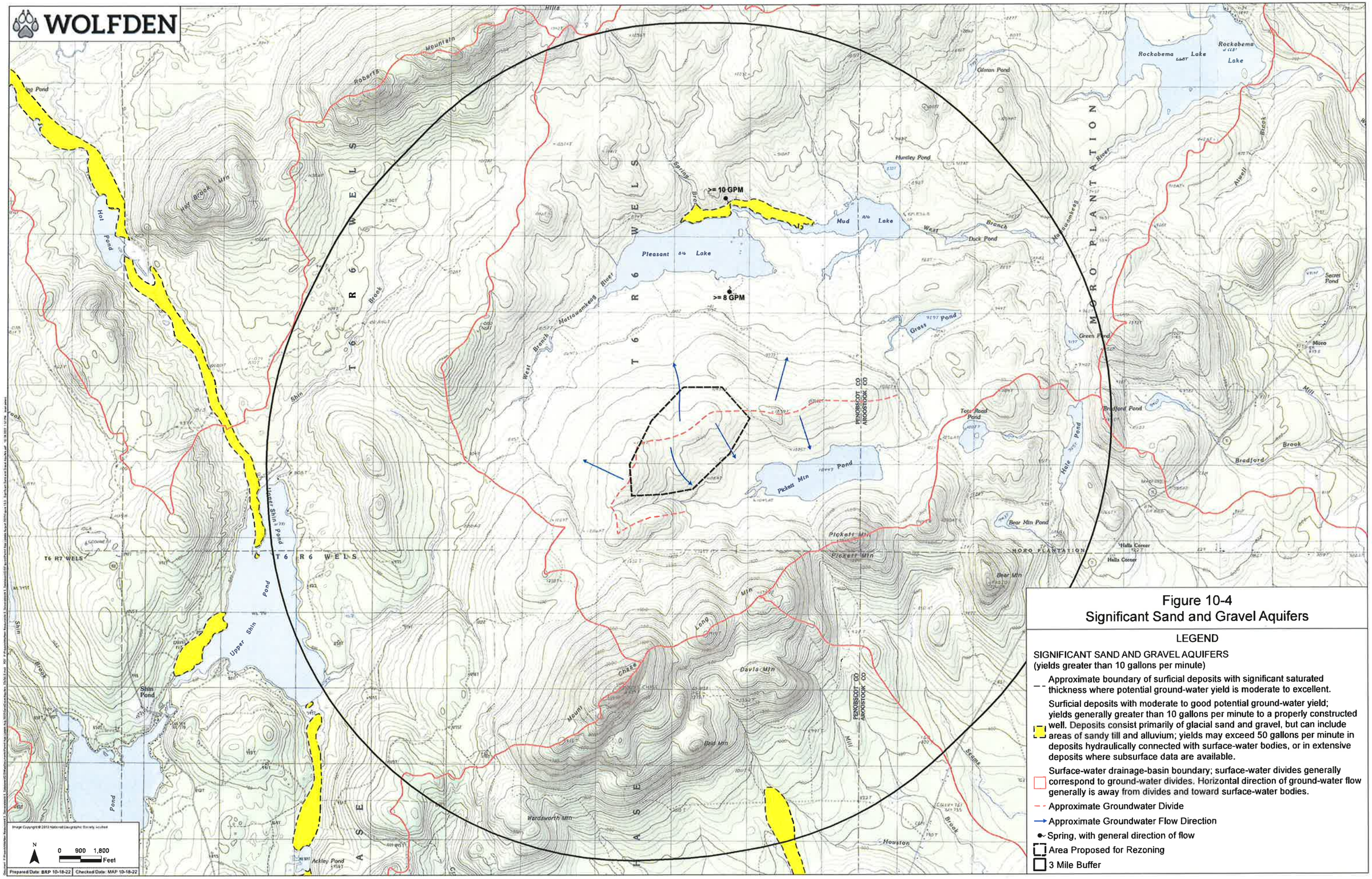



*Source: http://www.nrcc.cornell.edu/wxstation/pet/pet.html*

**Figure 10-3: Historic Regional Precipitation Patterns**

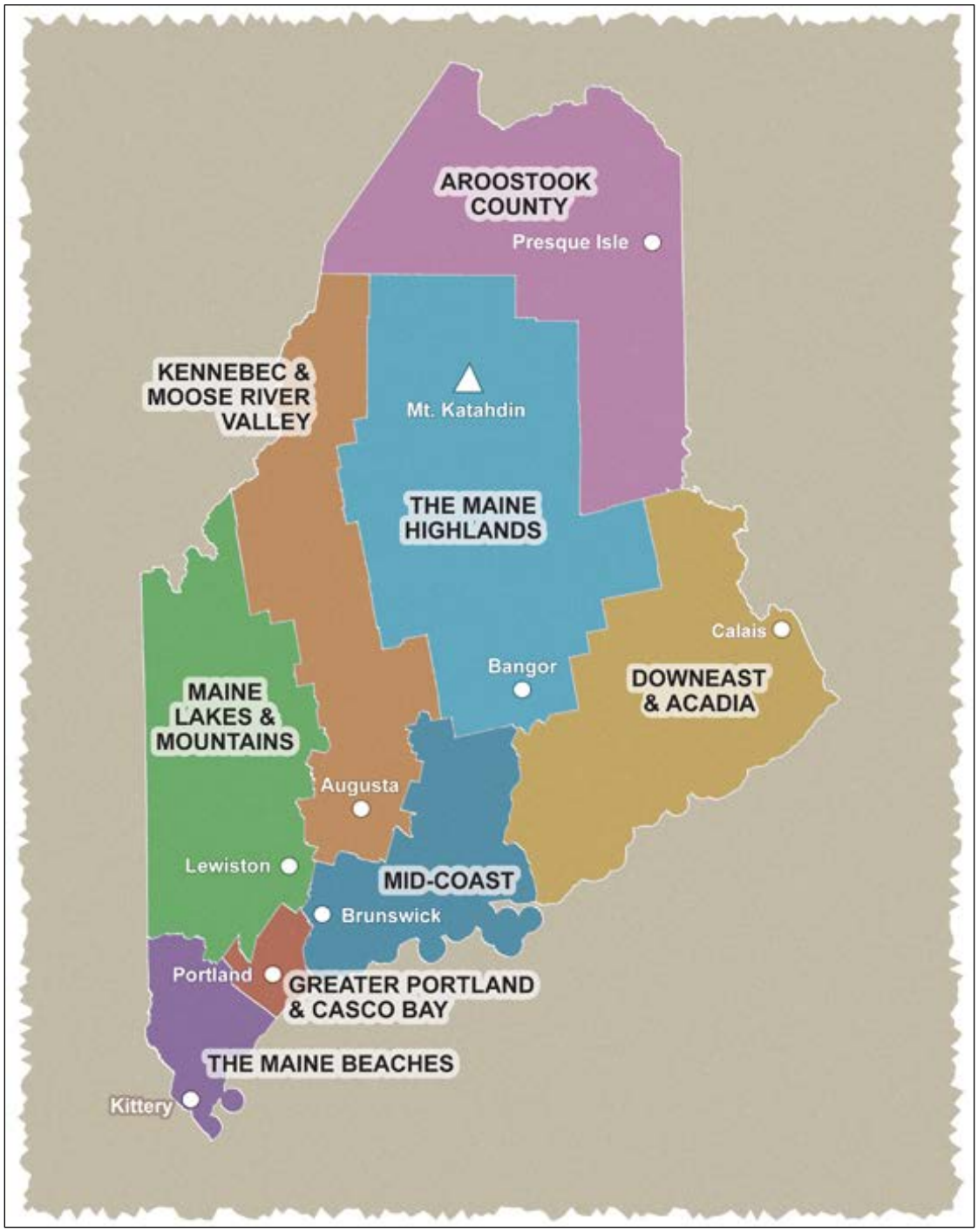



## Figure 10-4
## Significant Sand and Gravel Aquifers

### LEGEND

SIGNIFICANT SAND AND GRAVEL AQUIFERS
(yields greater than 10 gallons per minute)

- Approximate boundary of surficial deposits with significant saturated thickness where potential ground-water yield is moderate to excellent.
- Surficial deposits with moderate to good potential ground-water yield; yields generally greater than 10 gallons per minute to a properly constructed well. Deposits consist primarily of glacial sand and gravel, but can include areas of sandy till and alluvium; yields may exceed 50 gallons per minute in deposits hydraulically connected with surface-water bodies, or in extensive deposits where subsurface data are available.
- Surface-water drainage-basin boundary; surface-water divides generally correspond to ground-water divides. Horizontal direction of ground-water flow generally is away from divides and toward surface-water bodies.
- Approximate Groundwater Divide
- Approximate Groundwater Flow Direction
- Spring, with general direction of flow
- Area Proposed for Rezoning
- 3 Mile Buffer




*Source: https://www.exploremaine.org/*

**Figure 10-5: Maine Tourism Regions**

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 10-A: Economic Assessment of the Proposed Pickett Mountain Project

# ECONOMIC ASSESSMENT OF THE PROPOSED PICKETT MINE PROJECT

Submitted to Wolfden Mt. Chase LLC

Stepwise Data Research
November 2022

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# ECONOMIC ASSESSMENT OF THE PROPOSED PICKETT MINE PROJECT

In February 2021, Wolfden Mt. Chase LLC (Wolfden) retained Stepwise Data Research, an economic consulting firm based in Yarmouth, Maine, to provide a comprehensive socioeconomic analysis of Wolfden's proposed Pickett Mine Project (Project) proposed for T6 R6 in northern Penobscot County. This analysis is intended to meet the requirements of the Land Use Planning Commission (LUPC) specific to rezoning for Mining and Level C Mineral Exploration Activities in Chapter 12 of the LUPC Rules and as further informed by previous consultation with LUPC staff and LUPC's third-party economic expert. Section 1 of this report provides baseline statistics on the current socioeconomic conditions of the region surrounding the proposed Project. Section 2 quantifies the economic impact of the proposed Project in terms of jobs, earnings, and output. Because the Project's economic impact will be felt regionally, this section reports the economic impact for the entire Project, including both the mine located in T6 R6 and the concentrator and tailings facility which will be located in at a remote location. Section 3 provides a qualitative assessment of several other potential economic impacts related to the Project's operations. Section 4 is a detailed appendix including baseline economic statistics and a description of the methodology used for the economic impact analysis.

## 1. Socioeconomic Conditions of the Pickett Mine Project Region

### Key Findings

This section of the report presents information on the current socioeconomic conditions of the region surrounding the Project. The statistics reveal a sparsely populated region with limited economic activity and an aging population. Local wages trail the state average by 20-30% and poverty rates exceed the state average, particularly among children. In a place that once led Maine's manufacturing sector, the percentage of jobs in this field now trails the state average. The decline of the former Great Northern Paper mills in Millinocket and East Millinocket, which once employed thousands, has clearly hurt the local economy and no other large businesses have located here to take their place.

### Data Sources

Most of the statistics in this section of the report come from the U.S. Census Bureau's American Community Survey and are five-year estimates for 2016-2020. Results from the 2020 Census are utilized for demographic data. Except for the decennial census, five-year estimates are the most reliable source of detailed information on communities with populations under 65,000. Combining five years of survey results reduces the margins of error for statistics on small populations, while creating a more current snapshot of socioeconomic conditions than provided by the decennial censuses. Estimates for labor market areas (explained below) are aggregations of estimates for the municipalities and unorganized territories located within them. Where appropriate, these aggregations are weighted averages that account for the varying size and composition of the communities within each labor market area (LMA). See appendices for additional notes and data sources.

## Defining the Region

Wolfden's proposed Project lies in a relatively remote, rural area on the border of northern Penobscot County and southwestern Aroostook County, Maine, in an unorganized township called T6 R6. The closest community is Mount Chase, a settlement with about 190 residents, located a few miles south. A few miles farther south along Rt. 11 is the town of Patten, with about 880 residents. Patten has been designated a "rural hub" by the LUPC, their designation for a community that provides services to nearby communities. The nearest larger communities are Houlton (6,050 residents), a 40-mile drive to the east, and Millinocket (4,100 residents), 50 miles south. These larger communities are the region's principal employment centers and economic hubs and are classified as service centers by the State of Maine. The Project is roughly equidistant to both communities and will have an economic impact on both, through workforce and business connections. Therefore, the Houlton and Millinocket LMAs, as defined by the U.S. Department of Labor, are the principal geography for analysis in this section of the report (herein referred to as the "Pickett region"). Because the proposed Project's supply chain of businesses will extend beyond the labor market into each of the two counties, this memo also presents statistics for Penobscot County, where the Project and most of Millinocket LMA are located; Aroostook County, which contains most of Houlton LMA; and the state of Maine.[i] Table 1 presents the towns and unorganized territories in Houlton LMA and Millinocket LMA.[1]

*Table 1: Towns in Houlton and Millinocket LMA*

| **Houlton LMA** | | | **Millinocket LMA** |
|---|---|---|---|
| Amity | Macwahoc Plantation | | East Millinocket |
| Bancroft | Merrill | | Glenwood Plantation |
| Crystal | Monticello | | Mattawamkeag |
| Danforth | Moro Plantation | | Maxfield |
| Dyer Brook | Mount Chase | | Medway |
| Hammond | New Limerick | | Millinocket |
| Haynesville | Oakfield | | Northeast Piscataquis UT* |
| Hersey | Orient | | North Penobscot UT* |
| Hodgdon | Patten | | Seboeis Plantation |
| Houlton | Reed Plantation | | South Aroostook UT* |
| Island Falls | Sherman | | Woodville |
| Kingman UT* | Smyrna | | |
| Linneus | Stacyville | | |
| Littleton | Weston | | |
| Ludlow | | | **UT = Unorganized Territory* |
| | | | |

[i] Houlton LMA includes towns primarily in Aroostook and Penobscot counties, with one town in Washington County. Millinocket LMA also includes towns primarily in Aroostook and Penobscot counties, with one unorganized township in Piscataquis County. See Appendix for a map of labor market areas.

## Population[ii]

Approximately 27,000 people live in the Pickett region (consisting of the Houlton and Millinocket LMAs). They represent just 2% of Maine's population and their numbers are declining. Since 1990, the region's population has dwindled 19%, while the rest of Maine has grown 11.8%. Many young people have left in search of employment and the remaining population is notably older than the state average, especially in Millinocket LMA. Incomes are relatively low and poverty rates exceed the state average, especially among children.

### Density

The forestlands surrounding the Project are vast and sparsely populated (Table 2). The population density of Penobscot County (44.8 people per square mile) is similar to Maine overall (44.2), but the majority of residents are concentrated in Bangor, 100 miles south of the Project. The density of Houlton LMA, in which the Project is located, is two-thirds lower (16.6), and neighboring Millinocket LMA, which includes large swaths of unorganized territories, has just 2.7 people per square mile. Aroostook County's density is 10.1.

*Table 2: Population Density*

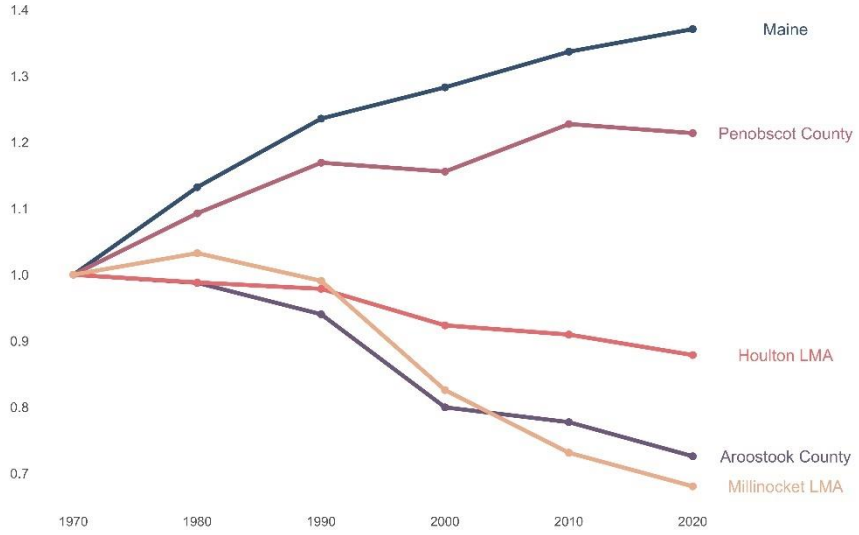
| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **Land area (square miles)[2]** | 30,845 | 6,671 | 3,397 | 1,086 | 3,378 |
| **People per square mile (2020)** | 44.2 | 10.1 | 44.8 | 16.6 | 2.7 |

### Population Growth

The population of the Pickett region has declined steadily since the 1970s and 1980s, mirroring changes in the forest products industry that once dominated the region (Chart 1). A series of mill layoffs and closures reduced employment opportunities, causing many residents to relocate. While some sites are being redeveloped, technological advances mean new operations do not require the thousands of workers mills once employed. Since 1990, Mount Chase's population has dwindled by 26%, Patten's by 30%, Millinocket LMA's by 31%, and Houlton LMA's by 10%. Today, 18,000 people live in Houlton LMA – 27% of Aroostook County's population and 1.3% of Maine's – and 9,100 people live in Millinocket LMA – 6% of Penobscot County's population and less than 1% of the state.

[ii] See Appendix A for data sources and additional detail.

*Chart 1: Population Growth, 1970-2020*

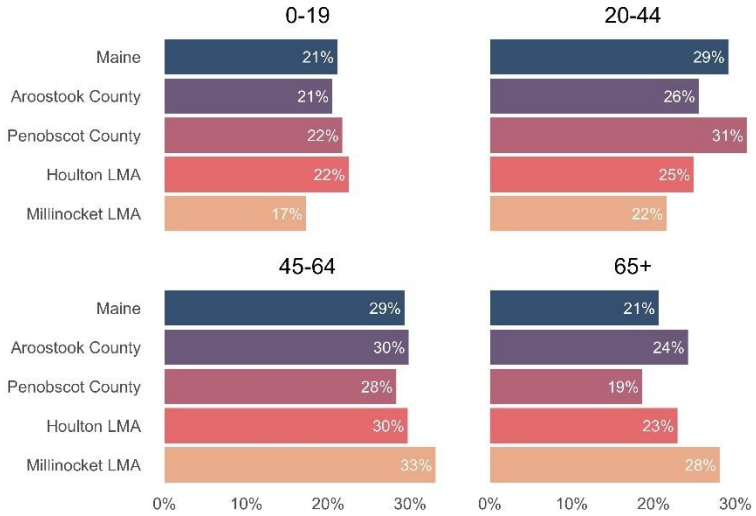



## Age Structure

As the region's population has declined, the age of its residents has risen, suggesting many emigrants were young people seeking opportunities outside the region. With a median age of 44.8 years, Maine is one of the oldest states in the nation, but Houlton LMA is older, with a median age of 46.3, and Millinocket LMA's median is 54.3 years – nearly a decade above Maine's.[3] Similarly, about 1 in 4 residents in these LMAs (22.9% and 28.0%, respectively) is age 65 or older, compared to 1 in 5 Maine residents (20.6%). Aroostook County's median age (48.0 years) is slightly higher than the state's, while Penobscot's is notably lower (42.2 years), likely because of the numerous colleges in and around Bangor.

Chart 2 below presents the population distribution by generation. Compared to Maine, both LMAs have a higher percentage of older residents, and fewer children and young people, but Houlton LMA's population is only slightly skewed while Millinocket LMA's is significantly older.

*Chart 2: Age Distribution, 2016-2020*



### Race and Ethnicity

The racial and ethnic mix of residents in the Pickett region largely mirrors Maine's overall population. More than 90% of Houlton LMA and Millinocket LMA residents identify as white (and not Hispanic or Latino), 1% are Hispanic or Latino, less than 2% are Black, Asian, or another race, and 2.9%-3.7% identify as two or more races. In Houlton LMA, over 3% of residents identify as Native American, which significantly exceeds the state rate of 0.5%. This is likely due to the Houlton Band of Maliseet Indians, which reportedly has about 1,700 members (although not necessarily living in Houlton LMA).[4]

### Household and Family Structure

The structure of households and families within the region reflects the age of its population, although there are subtle differences between Houlton LMA and Millinocket LMA. Despite Houlton LMA's population being slightly older than Maine's, its average household size (2.34 people) and average family size (2.93 people) are comparable to the state average (2.29 and 2.82, respectively).[5] By contrast, Millinocket's families and households are smaller (2.08 and 2.55, respectively). This paints a picture of Houlton LMA as a somewhat more vibrant population with more multi-generational households. For instance, in Houlton LMA, 1 in 3 married family households (33.6%) have at least one child living with them, compared to fewer than 1 in 4 married families in Millinocket LMA (24.6%), most likely because Millinocket's married couples are older.

### Household Income

Incomes in the Pickett region are significantly lower than elsewhere in Maine, most likely reflecting the region's lack of well-paying jobs and the age of its population. In 2016-2020, the median income of Houlton LMA households ($43,740) was roughly comparable to Aroostook County's ($43,791), while 26.5% below Maine's ($59,489). Millinocket LMA's median household income was $41,847 or 4.4% below Penobscot County's ($52,128) and 29.7% below Maine's. More information about residents' wages is in the Industries section below.

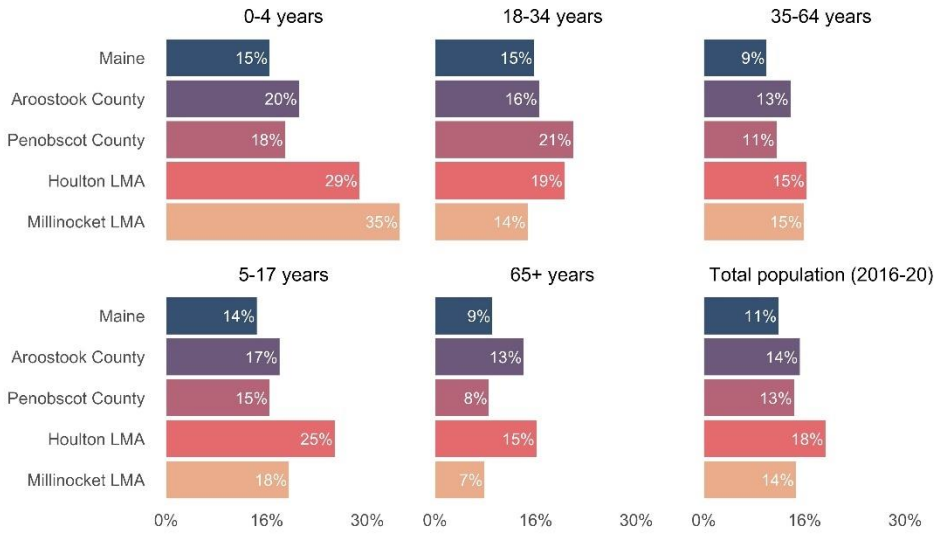
### Poverty

In Houlton LMA, poverty across all age groups significantly exceeds the state average. In Millinocket LMA, poverty among those under age 65 exceeds the state average, but those age 65 and older are slightly less poor than their peers statewide. This may reflect the legacy of a previously robust forest products industry that provided well-paying jobs in decades past. The high percentage of older, non-poor residents in Millinocket LMA reduces its overall poverty rate. In 2016-2020, 18.1% of Houlton LMA residents were living in poverty, compared to 14.3% across all of Aroostook County. This could reflect Houlton's role as a regional service center. During the same period, 13.7% of Millinocket LMA residents were living in poverty, comparable to 13.4% throughout Penobscot County. However, poverty in all of these regions exceeds the state rate of 11.1%. Childhood poverty is particularly prevalent in the region. In both LMAs, approximately 1 in 3 children under age 5, or 28.8% in Houlton LMA and 34.8% in Millinocket LMA, is living in poverty. Maine's overall child poverty rate measures significantly lower from 2016-2020, at fewer than 1 in 6 Maine children (15.4%).

Comparing current poverty rates with a decade prior, from 2006-2010, shows subtle differences in the two LMAs (Chart 3). In both LMAs, poverty increased by between 1 and 2 percentage points. This contrasts to decreases statewide (-1.5%) and across both Penobscot (-2.3%) and Aroostook (-1.1%) Counties. In Millinocket, the increase appeared to be concentrated in children under 5, while in Houlton

LMA it was more evenly spread. (See Appendix A for more details; given the large margins of error for small towns in these LMAs, caution should be taken when interpreting these changes.)

*Chart 3: Poverty Rate, 2016-2020*




## Labor Force[iii]

In 2021, there were approximately 10,609 people in the labor force of the Pickett region (Houlton LMA and Millinocket LMA), equal to 1.6% of Maine's entire labor force. Of these, on average, 9,909 were employed and 700 (6.6%) were unemployed. The region's workers are notably older than the state average and have fewer college degrees. Nine in ten residents over age 25 have a high school diploma.

### Education

Roughly ninety percent of residents over age 25 in both Houlton and Millinocket LMA have a high school diploma, slightly below the statewide rate of 93.2% (Table 3). Compared to rest of Maine, formal measures of postsecondary educational attainment among workers in the Pickett region are relatively low. In 2016-2020, the percentage of Houlton LMA and Millinocket LMA residents with a bachelor's degree or higher was half the state rate (17.2% and 12.7%, respectively, compared to 32.5% statewide). This likely reflects both the lack of demand for workers with postsecondary degrees and the historic dominance of industries that did not require them. Twenty percent of Aroostook residents have a bachelor's degree or higher, as do 28.6% of Penobscot County residents. Penobscot trails the state in educational attainment despite the abundance of postsecondary institutions in and around Bangor, suggesting that many students leave the area after graduation.

[iii] See Appendix B for data sources and additional detail.

*Table 3: Percentage of Population Over Age 25*

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **H.S. Diploma or Higher** | 93.2% | 89.8% | 92.9% | 89.1% | 92.1% |
| **Associate's Degree or Higher** | 42.7% | 31.7% | 39.5% | 27.3% | 25.5% |
| **Bachelor's Degree or Higher** | 32.5% | 19.8% | 28.6% | 17.2% | 12.7% |

## Occupations

The occupational mix of residents in the Pickett region reflects the area's natural assets, sparse population, and lack of business activity (Table 4). Compared to Maine's overall population, individuals are more likely to work in natural-resource-based industries of farming and forestry, and in the type of public service jobs required in all communities, such as healthcare support and protective services (firefighters, police, etc.). They are less likely to work in positions involving management, business, and financial services, and computers, engineering, and science. In terms of the occupations most relevant to mining – construction, installation, production, transportation, and material moving – in Aroostook and Penobscot Counties there are roughly 22,000 workers in these occupations today, and 2,800 workers within Houlton LMA and Millinocket LMA (see Appendix B for details).

*Table 4: Ratio Local/State Occupation Percentage*

| | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|
| 1.00 means the local share of people in the occupation matches the state share. Values greater than 1.00 mean the local share exceeds the state share. | | | | |
| | | | | |
| **Management, business, and financial** | 0.82 | 0.78 | 0.82 | 0.61 |
| **Computer, engineering, and science** | 0.42 | 0.82 | 0.32 | 0.30 |
| **Education, legal, comm. svc., arts, and media** | 0.83 | 1.05 | 0.87 | 0.79 |
| **Healthcare practitioners and technical** | 0.96 | 1.19 | 0.79 | 0.99 |
| **Healthcare support** | 1.28 | 1.22 | 1.31 | 1.43 |
| **Protective service** | 1.45 | 1.07 | 1.85 | 1.51 |
| **Food preparation and serving related** | 0.93 | 1.13 | 0.94 | 0.95 |
| **Building and grounds cleaning and maintenance** | 0.95 | 1.04 | 0.86 | 1.65 |
| **Personal care and service** | 0.93 | 1.16 | 0.85 | 1.09 |
| **Sales and related** | 0.94 | 1.14 | 1.20 | 0.97 |
| **Office and administrative support** | 1.10 | 1.01 | 0.88 | 1.13 |
| **Farming, fishing, and forestry** | 2.27 | 0.51 | 1.90 | 1.29 |
| **Construction and extraction** | 1.05 | 0.99 | 0.99 | 1.50 |
| **Installation, maintenance, and repair** | 1.24 | 1.19 | 1.33 | 1.63 |
| **Production** | 1.13 | 0.68 | 1.00 | 0.71 |
| **Transportation** | 1.49 | 1.08 | 1.78 | 0.91 |
| **Material moving** | 1.24 | 0.99 | 1.56 | 1.69 |

## Employment

Recent employment statistics suggest a labor market with limited employment opportunities (Table 5). In 2021, average employment was 6,876 in Houlton LMA and 3,033 in Millinocket LMA. Unemployment exceeded the state average (6.2% and 7.6%, respectively, compared to 4.6% statewide) and labor force participation rates suggest that unemployment could have been even higher if more residents had been actively seeking employment.

In 2016-2020, labor force participation was 63.0% statewide, but just 52.6% in Houlton LMA and 49.4% in Millinocket LMA. To be counted as participating in the labor force, an individual must be available to work and actively seeking employment. This means retirees, students, and those who are voluntarily caring for children or other family members at home are not considered to be in the labor force. The low labor force participation rates in the Pickett region partly reflects the advanced age of the population and a lack of job opportunities.

*Table 5. 2021 Employment*

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **Labor force** | 681,884 | 29,056 | 74,855 | 7,328 | 3,281 |
| **Employment** | 650,334 | 27,408 | 71,312 | 6,876 | 3,033 |
| **Unemployment** | 31,550 | 1,648 | 3,543 | 452 | 248 |
| **Unemployment rate** | 4.6% | 5.7% | 4.7% | 6.2% | 7.6% |

## Seasonality

Employment opportunities in the Pickett region appear to model the seasonal fluctuations that typify Maine's economy. In 2021, employment was highest during the summer travels months, slightly lower in fall and winter, and lowest during spring "mud season". In 2021, the fluctuation between the highest-employment month, July, and the lowest, April, was 6.7% (451 jobs) in Houlton LMA and 9.3% (273 jobs) in Millinocket LMA. Statewide, employment fluctuated 2% between February and December 2021. Due to disruptions in the labor market in 2020 related to the coronavirus pandemic, throughout 2021 unemployment declined consistently in the state, county, and LMAs. This suggests that on top of seasonal fluctuation, the labor market was stabilizing throughout 2021 from significant changes during the prior year. Within the Pickett region, the fact that employment remains relatively high through the winter months compared to elsewhere in Maine likely reflects its popularity as a destination for snowmobiling and other winter recreation. As employment rises and falls, unemployment goes in the opposite direction.

## Commuting Patterns

Despite the region's vastness, most workers have shorter commutes than other Mainers. For instance, in Houlton LMA and Millinocket LMA, 33% of workers commute less than 10 minutes, compared to just 17% of all Maine workers. This may reflect both the availability of homes near workplaces and the ease of traveling on country roads. The exception to this trend is a small group of about 475 workers in Millinocket LMA (14% of its total workforce) who commute over one hour, compared to just 7% of Maine workers. These individuals may be traveling to jobs in Bangor or Houlton, both of which are just over one hour's drive.

## Industries[iv]

In 2021, the Pickett region had 868 business establishments with employees (about 1.5% of the state total). Collectively, they employed just over 7,800 workers (about 1.3% of the state total). This means that, on average, regional businesses are smaller than elsewhere in Maine. In 2021, the average number of jobs supported by Houlton LMA and Millinocket LMA employers was 9.5 and 8.0, respectively, compared to 10.2 statewide, 9.7 in Aroostook, and 12.5 in Penobscot. The mix of business establishments in the Pickett region reflects the area's unique connection to natural resources, for both recreation and extraction.

### Establishments

Compared to the rest of Maine, in 2021 the Pickett region had a higher concentration of businesses in the agriculture, forestry, fishing, and hunting industry classification; transportation and warehousing; and public administration. There was a lower concentration of businesses in wholesale trade and professional and technical services. Houlton LMA had a significantly higher percentage of health care and social assistance establishments (12.5% compared to 8.6% statewide), reflecting its role as a regional service center. Millinocket LMA had significant concentrations in retail trade; arts, entertainment, and recreation; and accommodation and food services, reflecting its proximity (about 25 miles) to Mount Katahdin and its role as a destination for outdoor recreation.

The overall number of business establishments in the region across all industries has declined in the past two decades, even while the number of Maine establishments has grown. From 2001 to 2021, the number of goods-producing establishments declined in Houlton LMA and Millinocket LMA by 17.3% and 20.4%, respectively (compared to a 12.2% increase statewide), while the number of service-providing establishments fell 11.7% and 18.5% (compared to a 32.1% increase statewide).

One hundred twenty-four businesses in Houlton LMA (20% of all local businesses) and 43 businesses (17%) in Millinocket LMA were in goods producing industries, which includes natural resource extraction, construction, and manufacturing.

### Employment

Mirroring the mix of business establishments, a disproportionate share of employment in the Pickett region is in retail trade, educational services, and health care and social assistance. In 2021, manufacturing held 8.5% and 5.3% of respective jobs in Houlton LMA and Millinocket LMA. The region trailed the state average of 9.9%, a striking fact in light of the past dominance of the region's forest products manufacturing sector. There was also a lower than average share of employment in wholesale trade, and professional and technical services. Houlton LMA had a significantly higher percentage of jobs in the agriculture, forestry, fishing, and hunting sector (4.7% compared to 1.4% statewide), which probably reflects the area's farming industry. Millinocket LMA has a higher percentage of employment in arts, entertainment, and recreation (6.0% compared to 1.6% statewide), which may reflect the presence of several outdoor recreation businesses, such as whitewater rafting companies.

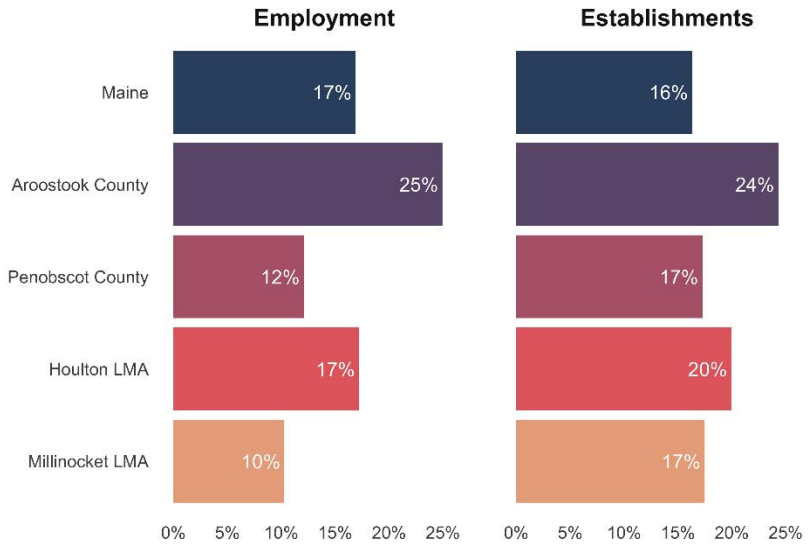
Due to privacy laws, the exact numbers of workers employed by regional establishments is not available. The Maine Department of Labor only reports employment by wide ranges (e.g., 1-500). The largest employers in Aroostook County include health care providers such as Northern Light AR Gould Hospital

[iv] See Appendix C for data sources and additional detail.

and Northern Maine Medical Center, assisted living facilities and social service providers, major retailers such as Walmart and Hannaford, forest products manufacturers such as Louisiana Pacific, which is located within the Houlton LMA, and the Smith & Wesson gun manufacturer in Houlton. Most of Penobscot County's largest employers are located in the Bangor metro area, with the exception of the Millinocket Regional Hospital.

Between 2001 and 2021, the percentage of jobs at goods-producing businesses fell from 19.7% to 16.9% across Maine (Chart 4). In Houlton LMA, it fell at an approximately similar rate, from 21.1% to 17.2% (a loss of 349 jobs). In Millinocket LMA, however, it plummeted from 34.1% to 10.3% (1,175 lost jobs). This reflects the historic dominance of the paper mills, which suffered closures and mass layoffs in the 2000s. For the industries most important to the Project's supply chain (see economic impact analysis section), in Aroostook and Penobscot counties there are roughly 4,250 workers in the construction industry, 2,700 in wholesale trade, and 310 in utilities; for the two LMAs, there are 303 workers in construction, 113 in wholesale trade, and 77 in utilities. In all, in 2021 roughly 4,900 workers in Aroostook County, 6,800 in Penobscot County, 1,000 in Houlton LMA, and 200 in Millinocket LMA worked in goods-producing industries (see Appendix C for details).

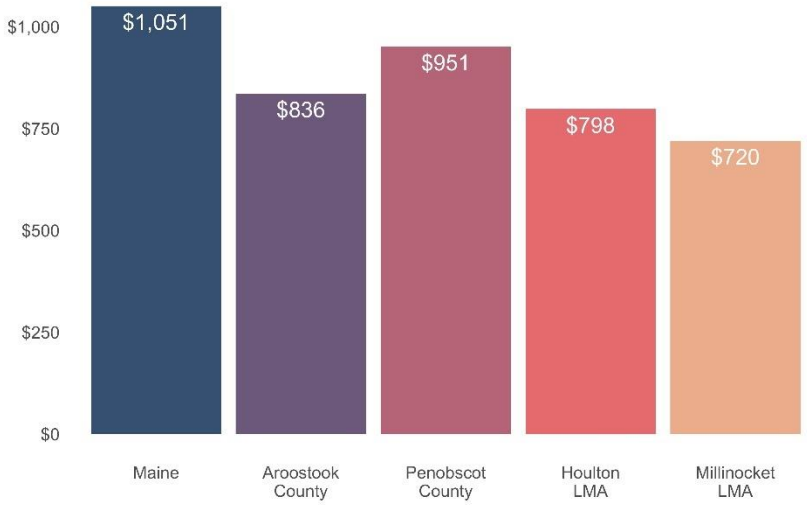
*Chart 4: Goods Producing Industries*



## Wages

In 2021, average wages in the Pickett region were 25%-35% lower than elsewhere in Maine. The average weekly pay of a Maine job was $1,051, compared to $798 in Houlton LMA and $720 in Millinocket LMA (Chart 5). Lower wages can reflect many things, including the local mix of industries and occupations, workforce skills, and the vibrancy of the local economy. In Houlton LMA, wages were nearer to the state average in public administration, utilities, construction, administration and waste services, and retail trade; they were 40% or more below the state average in finance and insurance; wholesale trade; real estate and rental and leasing; professional and technical services; and arts, entertainment, and recreation. In 2021, Houlton LMA's average weekly wage was fairly close to Aroostook County's ($798 and $836, respectively). In Millinocket LMA, wages were nearer to or above the state average in agriculture, fishing, forestry, and hunting; utilities; and arts, entertainment, and recreation; they were 50% or more below the state average in finance and insurance; and administrative and waste services. In 2021, Millinocket LMA's average weekly wage was well below Penobscot County's ($720 compared to $951).

*Chart 5: Weekly Wages*




"Living wages" for Aroostook and Penobscot counties calculated by researchers at the Massachusetts Institute of Technology suggest local jobs may not pay enough to support a minimum standard of living. In 2020, the average weekly wage in these counties was $836 and $951, respectively. This would cover the needs of a single adult living alone (estimated at $624-$664 per week) but fall far short for an adult with one child ($1,216-$1,329 per week).[6] Table 6 below shows wages for other household compositions.

*Table 6: Weekly Living Wage (2020)*

| | Maine | Aroostook County | Penobscot County |
|---|---|---|---|
| **1 adult, 0 children** | $715 | $624 | $664 |
| **1 adult, 1 child** | $1,392 | $1,216 | $1,329 |
| **1 adult, 2 children** | $1,735 | $1,492 | $1,662 |
| **2 adults (both working), 0 children** | $478 | $458 | $464 |
| **2 adults (both working), 1 child** | $766 | $678 | $734 |
| **2 adults (both working), 2 children** | $991 | $869 | $955 |

## Retail Sales

In 2021, sales of taxable products in the Houlton, Millinocket, and Patten Economic Summary Areas (ESAs), were $280 million, just 0.9% of the state total (Table 7).[7] This is a decline from 1.2% of statewide sales in 2010. On average, sales by businesses in these areas grew 38% from 2010 to 2021, well exceeding the rate of inflation during that time (24%). However, by contrast, sales by businesses across Maine rose 97%.

*Table 7: Retail Sales ($ thousands)* [8]

| | Maine | Houlton ESA[9] | Millinocket ESA[10] | Patten ESA[11] |
|---|---|---|---|---|
| **Total taxable retail sales, 2021** | $32,474,400 | $180,696 | $60,864 | $38,219 |
| **Total taxable retail sales, 2010** | $16,446,734 | $131,119 | $45,961 | $25,577 |
| **Change 2010 to 2021, not adjusted for inflation** | +$16,027,666 | +$49,577 | +$14,903 | +$12,642 |
| **Percentage change** | +97% | +38% | +32% | +49% |
| **Inflation, 2010-2021 (CPI-U, nationwide)** | 24% | | | |

## Tourism

The Maine Office of Tourism (MOT) publishes visitor information for the "Maine Highlands" region, which encompasses Penobscot and Piscataquis counties, and includes the Pickett region.[v] It also includes the city of Bangor which, according to MOT surveys, is the region's primary destination. Table 8 below shows the most population attractions for overnight visitors to the region.

[v] The LUPC specified the Maine Highlands region as the appropriate tourism region to include in this socioeconomic report. See Appendix N for a map of all tourism regions.

*Table 8: Maine Highlands Top Attractions for Overnight Visitors, 2019*[12]

| | | | |
|---|---|---|---|
| 35% | Bangor Mall | 9% | Moosehead Marine Museum (Greenville) |
| 29% | Baxter State Park | 9% | Mt. Katahdin |
| 21% | Hollywood Casino (Bangor) | 7% | Peaks Kenny State Park (Dover-Foxcroft) |
| 17% | Moosehead Lake | 7% | Mt. Kineo |
| 14% | Maine Beer Trail | 6% | Page Farm & Home Museum (Orono) |
| 13% | Lily Bay State Park (Greenville) | 6% | Patten Lumberman's Museum |
| 13% | UMaine Museum of Art (Orono) | 5% | Gulf Hagas |
| 13% | Sebec Lake | 5% | Maine Forest and Logging Museum (Bradley) |
| 12% | Bangor Waterfront Concert Series | 5% | Penobscot Theatre (Bangor) |
| 12% | Dysart's Restaurant and Truck Stop (Bangor) | 5% | Curran Homestead (Orrington) |
| 10% | Maine Discovery Museum (Bangor) | 4% | Katahdin Iron Works (Brownville) |
| 10% | Collins Center for the Performing Arts (Orono) | 4% | Wabanaki Art Center |
| 10% | Cole Land Transportation Museum (Bangor) | 4% | Thomas Hill Standpipe (Bangor) |

According to MOT publications, this vast region attracted over 907,000 visitors in 2021, about 6% of the state total, and visitor spending supported the equivalent of about $879 million in regional economic activity. This reflects both the direct economic impact on tourism related businesses and the indirect impact on other businesses in the community. In total, MOT estimates that visitor spending in the Maine Highlands supported the equivalent of about 9,400 jobs, $296 million in earnings, and $75 million in tax revenue.[13]

Taxable sales at restaurants and lodging establishments help approximate what percentage of this spending may have occurred in the Pickett region (Table 9). In 2021, these sales were $36 million, which represented 0.8% of statewide restaurant and lodging sales. Across Maine, sales at these tourism-related businesses accounted for 14,7% of all retail sales. In Houlton ESA and Patten ESA, that percentage was lower (10.0% and 11.5% respectively) while in Millinocket ESA it was significantly higher (22.6%). Maine's tourism economy has grown robustly in recent years. Statewide restaurant and lodging sales rose 78.3% from 2010 to 2021. Growth was much lower in the Pickett region, ranging from 29.4% in Patten to 36.7% in Houlton and 40.1% in Millinocket.

*Table 9: Restaurant and Lodging Sales*[14]

| | **Maine** | **Houlton ESA**[15] | **Millinocket ESA**[16] | **Patten ESA**[17] |
|---|---|---|---|---|
| **2010 ($ thousand)** | $2,672,972 | $13,248 | $9,823 | $3,403 |
| **(percentage of total sales)** | 16.3% | 10.1% | 21.4% | 13.3% |
| **2021 ($ thousand)** | $4,766,321 | $18,104 | $13,762 | $4,402 |
| **(percentage of total sales)** | 14.7% | 10.0% | 22.6% | 11.5% |
| **Change, 2010-21** | +78.3% | +36.7% | +40.1% | +29.4% |

Two forms of tourism and local recreation that provide significant revenue to the region and state are snowmobiling and ATV use. A 2020 report on snowmobiling estimated its impact on the Maine economy (statewide) to be more than $600 million during the 2018-19 season. In that year, 60,000 snowmobiles were registered by Maine residents and 25,000 were registered by non-residents. Spending on trips (as opposed to spending on the snowmobile itself) was more than $200 million. Forty-six percent of resident snowmobilers and 45% of non-resident snowmobilers visited the Maine Highlands region, making it the most visited tourism region in Maine with resident snowmobilers and the second most popular with non-

residents. In all, an estimated 523,000 "snowmobiling days"[vi] took place in the Maine Highlands region during the 2018-19 season.[18]

A 2005 study found that ATV user activity contributed $200 million to the state economy in the 2003-04 season. This value is likely significantly larger now, both due to cost inflation and the increased popularity of ATV use. For example, there are now 70,000 registered ATVs compared to 59,000 in the 2003-04 season.[19] In 2003-04, the Maine Highlands region was the most popular region for ATV riders, with an estimated 24% of all rides happening in the region and 35% of all riders riding in the area.[20]

## Housing[vii]

There are just under 20,000 housing units in the Pickett region, 2.6% of Maine's total. The 11,140 units in Houlton LMA represent 27.8% of all homes in Aroostook County. Millinocket LMA's 7,991 units equal 10.5% of Penobscot County's total. The age of these units reflects the history of the region, especially in Millinocket where construction activity appears to have paralleled the rise and fall of the forest products industry as a dominant employer. Due to outmigration and slow population growth, housing vacancy rates are high. Homeownership in the region is generally affordable, despite low incomes, but finding affordable rental housing may be a challenge.

### Age of Housing Stock

The age distribution of homes in Houlton LMA is similar to the state average, with 28% of residences built before 1950, 43% built between 1950 and 1990, and 29% construction after 1990 (Table 10). By contrast, Millinocket LMA's housing stock reflects the surge of home construction that occurred when the area's population peaked in the 1960s and 1970s.[21] Nearly 2 out of 3 homes (64%) were built between 1950 and 1990. Just 17% were after 1990. Since 2010, Census estimates suggest that just 134 homes have been built in Millinocket LMA, compared to over 560 in Houlton LMA.

*Table 10: Year Built*

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **Before 1950** | 28% | 29% | 25% | 28% | 19% |
| **1950-1990** | 42% | 48% | 45% | 43% | 64% |
| **Since 1990** | 29% | 23% | 30% | 29% | 17% |

### Occupancy

The decline of the forest products industry as a dominant employer, and the resulting outmigration of residents, has left many vacant homes in the Pickett region (Table 11). More than 40% of housing units in Millinocket LMA are estimated to be vacant as of 2020, as are nearly one-third (32.7%) in Houlton LMA. Elsewhere in Aroostook County and Maine, that ratio is about one-fourth (26.0% and 23.7% respectively), and in Penobscot County, just 17.1% of housing units were vacant in 2016-20.

[vi] A snowmobile day represents a single snowmobile in a region for some part of a day.
[vii] See Appendix D for data sources and additional detail.

*Table 11: Occupancy*

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **Total housing units** | 746,793 | 40,007 | 76,088 | 11,140 | 7,991 |
| **Occupied housing units** | 569,551 | 29,594 | 63,073 | 7,502 | 4,698 |
| **Occupancy rate** | 76.3% | 74.0% | 82.9% | 67.3% | 58.8% |
| **Vacancy rate** | 23.7% | 26.0% | 17.1% | 32.7% | 41.2% |

### Housing Affordability

MaineHousing statistics suggest that homeownership in the Pickett region is affordable for most residents, especially compared to elsewhere in Maine. In 2021, median home prices in Houlton LMA and Millinocket LMA ($115,000 and $109,000, respectively) were just 37% of the statewide median ($295,000). Despite lower incomes, fully 59.6% and 62.0% of households in Houlton LMA and Millinocket LMA, respectively, could afford to purchase a median-priced home in their area, compared to 38.4% statewide. This means they could pay for a median-priced home using no more than 28% of their income. In Houlton LMA, this percentage has fallen slightly from 62.6% in 2010, while in Millinocket LMA, it has fallen more significantly from 78.2%. These percentages reflect both the cost of local homes and the income level of the location population.

Households that rent tend to have lower incomes and face different expenses. MaineHousing considers rent affordable if a household can cover the cost a median-priced two-bedroom unit using no more than 30% of its income. By this measure, 48.9% of renter households in Millinocket LMA could afford the median rent in 2020, compared to 45.0% statewide. In Houlton LMA, 49.2% of renters could afford the average rent in 2017 (the most recent year for which data are available), compared to 45.0% statewide.

## Public Health[viii]

In Maine, data on most health conditions and risk factors is available at the county level. This limits the level of detail available on residents of the Pickett region. Statistics suggests a slightly lower percentage of residents have health insurance than the state average, but the impact on health outcomes is unclear.

### Health Insurance

In 2016-2020, the percentage of residents in Houlton LMA (88.2%) with health insurance coverage trailed the state average, while Millinocket LMA was equivalent to the statewide coverage rate of 92.4%. This is somewhat surprising since these areas are older than the state average, and nearly all older Americans are eligible for Medicare. Whereas 20.6% of Maine residents are age 65 and older, in Houlton LMA and Millinocket LMA that percentage is 22.9% and 28.0%, respectively. The lack of health insurance coverage for the overall population may reflect a lack of jobs providing this benefit to younger residents.

### Health Conditions and Risk Factors

In 2019, the percentage of Aroostook County and Penobscot County adults who smoked was above the state average (22% and 20%, respectively, compared to 19% statewide), as was the percentage of adults who were obese in 2019, 38% and 35%, respectively, compared to 31% statewide.

[viii] See Appendix E for data sources and additional detail.

In 2016-2018, the time period of the Maine Center for Disease Control's most recent snapshot report, the overall cancer rate in Penobscot County was significantly higher than the state average (525.2 cases per 100,000 population versus 473.2 cases statewide). This difference is perhaps due in part to the county's significantly higher rate of prostate cancer (109.7 compared to 98.2 statewide). Aroostook County's cancer rate (460.2) was slightly lower than Maine's, despite a significantly higher rate of colon and rectum cancer (48.6 compared to 34.8 statewide). Compared to 2008-2010, overall cancer rates have declined in Maine as well as in Aroostook and Penobscot Counties. These cancer rates control for the age of the populations in each region.

In both Aroostook and Penobscot counties, the prevalence of three other health conditions have all trended in the same direction as the state: death rates for diabetes have risen, and deaths rates for coronary heart disease and stokes have declined.

# 2. Economic Impact of the Proposed Pickett Mine Project on Regional Output, Earnings, and Jobs

## Key Findings

This section provides an estimate of the economic impact of the Project in terms of spending, output, earnings, and employment. In total, the Project expects to spend $622 million dollars[ix] during fourteen years of planning and operations of the Project (excluding contingency spending), of which $340 million is expected to be spent with businesses located within the economic region of Aroostook and Penobscot Counties. As that spending ripples through the regional economy, a total impact of $715 million in output (business sales), $248 million in earnings, and 4,540 job-years (roughly 324 jobs per year for 14 years, inclusive of both Wolfden's direct employment and the multiplicative employment impact related to the Project) will be created within the regional economy. Including contingency spending, which is budgeted to be spent but not yet tied to specific budget items, the overall impact increases to an estimated $743 million in output (business sales), $258 million in earnings, and 4,720 job-years (Table 12).

*Table 12: Economic Impact*

| *Impact Excluding Contingency Spending* | | | |
|---|---|---|---|
| **Total Spending** | Total Output | Total Earnings | Total Job-Years |
| **$622,123,219** | $714,523,300 | $247,845,700 | 4,540 |
| Implied Multipliers* | 1.1 | 0.4 | 7.3 |
| *Impact Including Contingency Spending* | | | |
| **Total Spending** | **Total Output** | **Total Earnings** | **Total Job-Years** |
| **$646,864,600** | $742,939,300 | $257,702,300 | 4,720 |
| Implied Multipliers* | 1.1 | 0.4 | 7.3 |

*The implied multipliers follow the methodology used in the RIMS II model: the multiplier for output = the total output divided by total spending; the earnings multiplier = total earnings divided by total spending; the multiplier for job-years equals total job-years per million dollars of total spending.

## Data Sources

The input data used in the economic modeling comes from a 2022 third-party financial model generated by A-Z Mining Professionals Inc., a comprehensive accounting of the Project's expected revenue and expenses for both the mine and off-site concentrator/tailings facility. Their model consisted of more than a dozen linked spreadsheets that, collectively, aggregate to the cash flow summary in the petition (Exhibit 10). For this analysis, the expenses in the A-Z financial model were adjusted by additional information supplied from Wolfden to reflect the portion of spending that is expected to incur at local businesses within the economic region (see Appendix for details).

The economic impact estimates related to employment, earnings, and output use the Regional Input-Output Modeling System (RIMS II) created and maintained by the U.S. Bureau of Economic Analysis.[x]

[ix] See Appendix M for differences between the operational spending used in the economic modeling and spending reported in the Preliminary Economic Assessment (PEA) petition (Exhibit 10).

[x] For more information on RIMS II, see http://www.bea.gov/regional/pdf/rims/rimsii_user_guide.pdf.

RIMS II multipliers help quantify the impact of the proposed mining Project in a region in two ways: first, through purchases the Project makes as part of its production process, for example by purchasing materials like concrete and services like accounting; and second, through increased regional spending from additional earnings by the project's own employees and employees in the industries that supply the Project's inputs. See Appendices G and H for more detailed descriptions of RIMS II and the methodology used in this report.

## Defining the Region

The LUPC recommended a number of factors for consideration when defining the appropriate geographic region where the economic impact of the proposed Project will be felt, including the following:

1. The labor markets from which the Project will draw employees; in this case, the Project's workforce is expected to be drawn mostly from the two closest labor market areas: Houlton and Millinocket. These labor market areas are defined by the Maine Department of Labor based on commuting patterns.
2. The supply chain of businesses that will supply goods and services to the Project; this will extend beyond the labor market areas farther into Aroostook and Penobscot counties.
3. The location of the Project's nearest "regional service centers," as defined by the Maine Department of Agriculture, Conservation, and Forestry, which are Houlton in Aroostook County (40 miles away) and Millinocket in Penobscot County (50 miles away).[22]
4. The location of the nearest "rural hubs," as defined by the Maine LUPC; these include towns to the north, south, and east that cover both Aroostook and Penobscot counties and include Medway, Millinocket, Lincoln, Patten, Island Falls, Oakfield, Houlton, and Ashland.[23]
5. The proximity of federal "Opportunity Zones" which offer tax incentives for investments in low-income communities; two Opportunity Zones are located roughly 50 miles to the south in Penobscot County, Millinocket and East Millinocket; and several are located about 100 miles to the north, in Aroostook County, encompassing the stretch from Washburn to Madawaska.
6. The planned state, county, and local transportation routes used during each phase of the Project; the Project expects ore haul trucks from the Project Area to utilize private roads, State Route (SR) 11, SR-159, or SR-158 to reach an ore processing and concentrator facility located in a satellite location (exact location is yet to be identified). After ore processing, haul trucks would use Interstate 95 to take ore concentrate to the commercial market. Figures 21-1 and 21-2 in the Petition provide additional details. Additionally, the Project expects small vehicle traffic from workers and site visitors living in various locations within Aroostook and Penobscot Counties to funnel into Route 11 from the north or the south and enter the project site via the existing access road off Route 11. There will also be additional daily trips of deliveries from contractors to the Project, which are also expected to follow the above-described route along Route 11 to the existing access road.

Adding to the considerations listed above are the limitations of the underlying data on inter-industry sales and consumer purchasing behavior. The RIMS II economic model, a well-regarded and accessible input-output model that the U.S. Bureau of Economic Analysis maintains and that this report utilizes for estimating the economic impact of the Project's spending, relies on publicly available data collected at the county level; it does not provide multipliers at geographies smaller than a county.[24] Given this constraint and the considerations above, the combined region of Aroostook County and Penobscot

County is chosen as the region for which to estimate the economic impacts related to employment, earnings, and output. This is herein referred to as the "economic region." While this region is considerably larger than the Project's footprint, it accurately reflects where most workers and supplies will be drawn from. In addition, while the economic data does not allow for a hyper-local estimate of the economic impact on, say, the town of Patten, it is fair to assume that the economic impact described below will be felt most acutely by the towns closest to the Project and will dissipate with distance.

## Wolfden Direct Expenditures

The 2022 financial model developed by A-Z Mining Professionals Inc. and used by Wolfden in their cash flow analysis estimates spending by type (capital expenditures and operating expenses),[xi] project category (Underground Development, Infrastructure, etc.), and year. Spending by year is further summarized into two time periods that together span the fourteen years of the project: a "start-up" time period which includes the two years prior to the mine's operations; and an "operations" time period which includes ten years of operations and two years of closure (twelve years in all).[xii] In total, the Project expects to spend more than $622 million over fourteen years, of which an estimated $340 million (55%) is expected to be spent within the economic region (See Table 15). Note that this does not include roughly $25 million in contingency spending and $9 million in planned reclamation costs, which are expected to be spent but have not yet been earmarked for specific budget items. Contingency spending is addressed in a separate section. See Appendix I for more details on the assumptions used to estimate the intraregional spending.

### Capital Expenditures

The Project expects to spend approximately $203 million in capital expenses (Table 13). Roughly half will be spent in the start-up phase of the Project and half will be spent during the operations phase. Ninety-two million dollars, or 45%, is expected to be paid to employees or businesses within the economic region, split roughly equally between the start-up and operations phase.

*Table 13: Capital Expenditures*

| | Start-up | Operations | Total Spending |
|---|---|---|---|
| **All** | $102,610,000 | $99,957,400 | $202,567,400 |
| **Within Economic Region** | $50,028,900 | $41,906,300 | $91,935,200 |
| **% in Region** | 49% | 42% | 45% |

### Operating Expenses

The Project expects to spend approximately $420 million in operating expenses,[xiii] virtually all within the operations phase of the Project (Table 14). Two hundred forty-eight million dollars, or 59%, is expected to be paid to employees or businesses within the economic region.

*Table 14: Operating Expenses (not including contingency spending)*

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[xi] Capital and operating expenses in the Wolfden financial model are defined in a specific way for mining projects: capital expenses include spending that occurs before the project reaches 60% of the "nameplate" production capacity output; operating expenses are those that occur after this threshold has been reached.

[xii] These two time periods were chosen to present separately because they represent distinct phases of the Project with large amounts of spending. The final two years of the Project are included within the operations time-period because of the relatively small amount of spending that occurs in that phase (approx. 0.2%).

[xiii] Not including $25 million in contingency spending and $9m in reclamation costs.

| | Start-up | Operations | Total Spending[xiv] |
|---|---|---|---|
| **All** | $6,811,000 | $412,744,800 | $419,555,800 |
| **Within Economic Region** | $4,245,900 | $243,547,100 | $247,793,100 |
| **% in Region** | 62% | 59% | 59% |

### Total Expenses

In all, Wolfden projects spending of $622 million on the proposed Project,[xv] of which $340 million (55%) is expected to be paid to employees or businesses within the economic region (Table 15). This estimate of $340 million of spending within the economic region is based on Wolfden's estimates of the amount of labor and materials that will be procured locally. Appendix I lists the local procurement estimates for each of 125 budget items that make up the total Project's costs. For example, Wolfden estimates that 50% of the materials and 80% of the labor associated with water treatment expenses in the operations phase of the Project will be procured locally. The total expenses for each of these 125 budget items are multiplied by the local procurement estimates to derive the estimate of total spending within the region, which totals $340 million or 55% of total expenses (Table 15). Because the amount of materials and labor that will be procured locally cannot be definitely known at this time, alternative scenarios of economic impact assuming lower and higher local procurement estimates are also shown in the section below labeled "Caveats and Limitations." Note also that Wolfden has indicated that it plans to maximize the amount of business it does with local businesses; strategies to do so are outside the scope of this report and are described by Wolfden in Exhibit 10 of the petition. Note also that much of the balance will be spent within Maine, just not within the economic region. In this way, the economic impacts described below are conservative in that they do not include benefits that accrue to Maine outside of the Pickett region.

*Table 15: Total Spending (not including contingency spending)*

| | Start-up | Operations | Total Spending[xiii] |
|---|---|---|---|
| **All** | $109,421,000 | $512,702,200 | $622,123,200 |
| **Within Region** | $54,274,800 | $285,453,400 | $339,728,200 |
| **% in Region** | 50% | 56% | 55% |

### Expenses Within LUPC Region

While the appropriate geographic region for the economic impact is the combined region of Aroostook and Penobscot counties (see Defining the Region, above), direct spending related to Project infrastructure and operations within the LUPC jurisdiction will be somewhat less. Based on estimates supplied by Wolfden, roughly $401 million or 64% of total Project spending will be related to the mine and its operations located in the LUPC jurisdiction, while the remaining 36% of Project spending will be related to the concentrator and tailings management facility, which will be located in a nearby town. Looking just at the portion of spending that accrues to firms and people within the economic region, roughly 68% or $232 million will be related to the mine itself, with the remaining balance related to the concentrator and tailings facility. See Appendix J for more details.

[xiv] See Appendix M for differences between the operational spending used in the economic modeling and spending reported in the Preliminary Economic Assessment (PEA) petition (Exhibit 10).

[xv] Not including $25 million in contingency spending and $9 million in reclamation costs

*Table 16: Total Spending (not including contingency spending)*

| | Start-up | Operations | Total Spending[xvi] |
|---|---|---|---|
| **All Spending** | **$109,421,000** | **$512,702,200** | **$622,123,200** |
| ***Related to Project Within LUPC*** | *$63,208,515* | *$337,614,195* | *$400,822,710* |
| ***% Related to Project in LUPC*** | *58%* | *66%* | *64%* |
| | | | |
| **Spending Within Economic Region** | **$54,274,800** | **$285,453,400** | **$339,728,200** |
| ***Related to Project Within LUPC*** | *$28,235,185* | *$204,149,332* | *$232,384,517* |
| ***% Related to Project in LUPC*** | *52%* | *72%* | *68%* |

## Employment and Wages

Embedded in the projections above are the hiring of 230 full-time employees who are expected to live within the economic region (Tables 17 and 18). In terms of administrative staff, 16 hires are projected, 10 of whom are expected to be hired within the economic region. Projected annual salaries range from $48,000 and $198,000 with an estimated average salary (weighted by hires) of $73,000, one and a half times the average wage in the economic region (Table 17).

*Table 17: General Administrative Staff*

| Position | # Hires | # Hires Expected to Live in Economic Region | Salary Range | % of Avg Wage vs LMAs | % of Avg Wage vs Economic Region |
|---|---|---|---|---|---|
| **Mine Manager** | 1 | - | - | - | - |
| **Mine Superintendent** | 1 | - | - | - | - |
| **Mill Superintendent** | 1 | - | | | |
| **Technical Services Superintendent** | 1 | - | - | - | - |
| **Senior Engineer** | 1 | - | - | - | - |
| **Accountant** | 1 | 1 | $60-90,000 | 185% | 157% |
| **Eng/Geo technicians** | 2 | 1 | $72-198,000 | 334% | 282% |
| **Warehouse Manager** | 1 | 1 | $112-168,000 | 346% | 292% |
| **Environment Coord.** | 1 | 1 | $64-96,000 | 198% | 167% |
| **Medical Contract** | 1 | 1 | $48-72,000 | 148% | 125% |
| **Security Guard** | 4 | 4 | $36-54,000 | 111% | 94% |
| **Site Services** | 1 | 1 | $48-72,000 | 148% | 125% |
| **Total / Average** | 16 | 10 | $73,000 | 180% | 152% |

*Note that the average salary and the comparisons to wages in LMA and economic region are calculated assuming each position is paid at the middle of the salary range. Average salary is weighted by hires.*

In addition to the administrative staff identified above, the Project expects to hire approximately 220 additional on-site staff, all of whom are expected to live within the economic region. These employees

[xvi] See Appendix M for differences between the operational spending used in the economic modeling and spending reported in the Preliminary Economic Assessment (PEA) petition (Exhibit 10).

will fill 110 distinct positions over two daily shifts (Table 18). The lowest paid staff will earn between roughly $15 and $35 dollars an hour.[xvii] On average, the on-site full-time staff will earn wages of roughly $64,000 per year, 33% higher than the average wage in the economic region.

(Note that these numbers reflect only the employees the Project expects to directly hire as Wolfden employees. In the first several years of the Project, it plans to contract with regional companies for much of the site work; the companies will supply their own employees. Once the mine is operational, the Project will transition to more direct hiring and continuous training.)

*Table 18: On-site Staff*

| Position | Daily Positions | # Hires Expected to Live in Economic Region | Hourly / Salary Range | % of Avg Wage vs LMAs | % of Avg Wage vs Economic Region |
|---|---|---|---|---|---|
| **UG Equipment Operator** | 16 | 32 | $23.80 - $34.50/ hr | 150% | 127% |
| **Underground Mechanic** | 22 | 44 | $22.70 - $40.00/ hr | 161% | 136% |
| **Underground Laborer** | 23 | 46 | $15.40 - $36.30/ hr | 133% | 112% |
| **Underground Miner** | 26 | 52 | $20.10 - $45.00/ hr | 167% | 141% |
| **Supervisor** | 4 | 8 | $50.00 - $62.00/ hr | 288% | 243% |
| **Mill Operations** | 12 | 24 | $47,450 - $71,200/ yr | 147% | 124% |
| **Mill Staff** | 7 | 14 | $48,800 - $73,200/ yr | 151% | 127% |
| **Total / Average** | 110 | 220 | $63,690/ yr | 157% | 133% |

*Note that the numbers in the Daily Positions column (110) reflect the fact that there are two shifts each 24-hour period; the numbers in the # of Hires Expected to Live in the Economic Region column (220) reflects that fact that employees work seven days on and then have seven days off, resulting in a doubling of the Daily Positions numbers; also note that the average salary and comparisons to wages in LMA and economic region are calculated assuming each position is paid at the middle of the salary range; the average salary is a weighted average based on hires.*

In all, Wolfden projects to spend roughly $200 million on employee compensation over the fourteen years of the Project (Table 19).[xviii] To be consistent with the RIMS II economic impact methodology,[xix] compensation for employees hired from outside of the economic region and the portion of compensation for employee benefits and taxes are excluded from the economic modeling. This results in an input to the economic model of $119 million in total wages, or an average of $8.5 million in wages to local workers per year (although it will likely not be evenly distributed through the Project life).

*Table 19: Compensation and Wages*

| | Total | Average Per Year |
|---|---|---|
| **Compensation for All Employees** | $200,420,200 | $14,315,700 |
| **Wages for Regional Employees in Economic Model** | $118,891,400 | $8,492,200 |

[xvii] Salary ranges come from Virginia Tech University, sourced by a third-party consultant hired by Wolfden.
[xviii] Note that for the economic modeling, Project spending and compensation were used, not the estimated number of employees.
[xix] RIMS II defines earnings as consisting of wages and salaries and of proprietors' income, which is the net earnings of sole-proprietors and partnerships and includes employer contributions for health insurance.

### Direct Spending by Industry

The highest amount of direct Project spending, almost $165 million, will flow to the regional construction industry for a variety of excavation, infrastructure, and building services. Just under $10 million will be spent in the wholesale trade industry for equipment and materials ranging from drill bits to heavy machinery. About $12 million will go to the mine support industry which in Maine currently consists mostly of support for the non-metallic mining industry, and $119 million of spending will flow directly to Project employees within the region through their earnings.

Following the RIMS II model's convention, construction and investment expenses are summarized separately from the Project's operational expenses.[25] RIMS II uses a "Households" multiplier to estimate the economic impact of spending within the region related to the wages paid to Project employees (Table 21).

*Table 21: Regional Spending by Industry (not including contingency spending)*

| Industry (NAICS)[xx] | Start-up (Years 1-2) | Operations (Years 3-12) | Total Regional Spending |
|---|---|---|---|
| Construction | $34,583,300 | $130,147,300 | $164,730,700 |
| Wholesale trade | $1,866,900 | $7,677,700 | $9,544,600 |
| **Total Construction and Investment** | **$36,450,200** | **$137,825,000** | **$174,275,300** |
| | | | |
| Project Employee Earnings (Households) | $2,065,200 | $116,826,200 | $118,891,400 |
| Utilities | $8,629,700 | $16,956,400 | $25,586,100 |
| Support activities for mining | $3,703,700 | $7,895,700 | $11,599,400 |
| Professional, scientific, and technical services | * | $4,450,000 | $4,450,000 |
| Waste management and remediation services | $3,426,100 | * | $3,426,100 |
| Truck transportation | * | $550,000 | $550,000 |
| Administrative and support services | * | $500,000 | $500,000 |
| General merchandise stores | * | $350,000 | $350,000 |
| Financial investments and related activities | * | $100,000 | $100,000 |
| **Total Mine Operations** | $17,824,700 | $147,628,300 | $165,453,000 |
| | | | |
| **Total** | **$54,274,900** | **$285,453,200** | **$339,728,200** |

** indicates that no regional spending in this NAICS industry for this phase of the project was used in the economic impact analysis. It does not, however, necessarily mean that no spending in this industry will occur during the phase (spending may occur outside of the region) or that no spending for this type of work will occur (for example, spending related to trucking materials may be classified within the support activities for mining industry as opposed to the truck transportation industry).*

[xx] Industries are defined by the North American Industry Classification System (NAICS. More information and definitions are available here: https://www.census.gov/naics/

## Indirect and Induced Economic Impacts

### Summary

The $340 million of regional spending will flow to a multitude of businesses, industries, and households within the economic region. These businesses and households will in turn purchase additional goods and services, multiplying the Project's initial investment through the regional economy. In total, the Project's spending within the economic region will support almost $715 million in economic output (business sales, including the Project's), $248 million in earnings (including the Project's paychecks to its employees), and 4,540 job years (roughly 324 full- and part-time jobs each year for 14 years, inclusive of the Project's direct hires) (Table 20). The estimated 324 annual jobs represent 0.4% of the total jobs in the economic region and 4.1% of jobs in the Houlton and Millinocket labor market areas. The derivation of this impact is described in the sections below and Appendices G and H have additional information on the methodology. To provide context for the magnitude of this impact, implied multipliers are also provided in Table 20; these appear reasonable and conservative compared to other industries and impact studies.

*Table 20: Economic Impact (not including contingency spending)*

| Total Spending | Total Output | Total Earnings | Total Job-Years |
|---|---|---|---|
| **$622,123,219** | $714,523,300 | $247,845,700 | 4,540 |
| Implied Multipliers* | 1.1 | 0.40 | 7.3 |

**The implied multipliers follow the methodology used in the RIMS II model: the multiplier for output equals the total output divided by total spending; the earnings multiplier = total earnings divided by total spending; the multiplier for job-years equals total job-years per million dollars of total spending.*

### Economic Multipliers

The RIMS II economic model is used to derive economic multipliers specifically for the Project's economic region, defined as Aroostook County and Penobscot County. The RIMS II multipliers for output (i.e., business sales), earnings, and jobs are derived based on publicly available data that reflect the unique inter-industry and consumption patterns within the economic region. In essence, they represent the regional economic impact across all industries per-dollar of projected spending by the Project (or per-million dollars in the case of the jobs multiplier). For example, the earnings multiplier for construction of 0.50 means that for every dollar the Project spends in the local construction industry, roughly 50 cents of earnings are generated across all households in all industries in the economic region. The jobs multiplier for construction, 10.67, means that for every $1 million the Project spends in the local construction industry, roughly 11 part- or full-time jobs are created (Table 22).

*Table 22: Industry Multipliers*

| | | Multipliers | | |
|---|---|---|---|---|
| **Industry** | **Total Regional Spending** | **Output per Dollar** | **Earnings per Dollar** | **Jobs per Million Dollars** |
| Construction | $164,730,700 | 1.59 | 0.50 | 10.67 |
| Wholesale trade | $9,544,600 | 1.45 | 0.36 | 6.66 |
| **Total Construction and Investment** | **$174,275,300** | | | |
| | | | | |
| Project Employee Earnings (Households) | $118,891,400 | 0.74 | 0.23 | 6.12 |
| Utilities | $25,586,100 | 1.37 | 0.25 | 3.79 |
| Support activities for mining | $11,599,400 | 1.46 | 0.42 | 8.48 |
| Professional, scientific, and technical services | $4,450,000 | 1.51 | 0.59 | 11.42 |
| Waste management and remediation services | $3,426,100 | 1.50 | 0.37 | 7.98 |
| Truck transportation | $550,000 | 1.63 | 0.49 | 10.14 |
| Administrative and support services | $500,000 | 1.57 | 0.60 | 17.67 |
| General merchandise stores | $350,000 | 1.47 | 0.45 | 16.17 |
| Financial investments and related activities | $100,000 | 1.56 | 0.56 | 15.97 |
| **Total Mine Operations** | **$165,453,000** | | | |
| | | | | |
| **Total Regional Spending** | **$339,728,300** | | | |

### Total Output, Earnings, and Job-Years

In total, the proposed Project will create 4,540 job-years within the region and provide almost $248 million in earnings, stemming from $715 million in new business sales. These estimates are inclusive of the Project's initial spending and hires. The estimated 4,540 job-years represents 1,760 job-years related to spending within the construction industry and 730 job-years related to the spending in the local economy from Project employees. On an annual basis over 14 years, it represents 324 jobs per year (inclusive of the Project's direct hires). Roughly 11% (510 job-years) are expected to be created in the start-up phase and 89% (4,030 job years) in the operations phase. For both phases, spending in the construction industry creates the majority of job-years. See Table 23 for details and Appendix K for the impact by phase (i.e., start-up and operations).

*Table 23: Economic Impact (not including contingency spending)*

| | Industry In Which Project Spending Occurs | Total Regional Spending | Output | Earnings | Job-Years |
|---|---|---|---|---|---|
| | Construction | $164,730,700 | $262,547,700 | $82,661,800 | 1,760 |
| | Wholesale trade | $9,544,600 | $13,834,000 | $3,405,500 | 60 |
| **1** | **Total Investment Expenditures** | $174,275,300 | $276,381,700 | $86,067,400 | 1,820 |
| | | | | | |
| **1a** | Project Employee Earnings (Households) | $118,891,400 | $88,514,600 | $26,928,900 | 730 |
| | Utilities | $25,586,100 | $34,976,200 | $6,404,200 | 100 |
| | Support activities for mining | $11,599,400 | $16,910,800 | $4,907,700 | 100 |
| | Professional services | $4,450,000 | $6,723,500 | $2,603,700 | 50 |
| | Waste management | $3,426,100 | $5,143,900 | $1,261,100 | 30 |
| | Truck transportation | $550,000 | $898,200 | $269,600 | 10 |
| | Administrative and support services | $500,000 | $783,100 | $299,600 | 10 |
| | General merchandise stores | $350,000 | $515,700 | $156,000 | 10 |
| | Financial investments and related | $100,000 | $156,000 | $56,100 | 0 |
| **2** | **Total Intermediate Expenditures** | **$165,453,000** | **$154,622,100** | **$42,886,900** | **1,020** |
| | | | | | |
| **3** | **Regional Impact (1+2)** | **$339,728,300** | **$431,003,800** | **$128,954,300** | **2,840** |
| | | | | | |
| **4** | Non-Regional Spending – Investment Expenditures | $164,329,600 | | | |
| **5** | Non-Regional Spending - Intermediate Expenditures | $118,065,300 | | | |
| **6** | **Total Project Spending (3+4+5)** | $622,123,200 | | | |
| | | | | | |
| **7** | Initial Spending on Intermediate Expenditures (2+5) | | $283,518,400 | | |
| **8** | Initial Wages to Project Employees (1a) | | | $118,891,400 | |
| **9** | Initial Project Job-Years (projections of 120 employees/year) | | | | 1,700 |
| | | | *Output* | *Earnings* | *Job-Years* |
| **10** | **Total Impact (3+7+8+9)** | | $714,522,200 | $247,845,700 | 4,540 |
| **11** | Implied Multiplier | | 1.1 | 0.4 | 7.3 |

## Output, Earnings, and Job-Years by Industry

The Project's total economic impact described above will be spread among the major industries in the region. Whereas Table 23 reports the economic impacts related to spending in a given industry, Table 24 reports the total impact for each industry regardless of which industry the initial spending occurred. In other words, for the construction industry, Table 23 reports that $164.7m of direct Project spending in the construction industry results in a total of 1,760 job-years in all industries, some of which are in construction but including other industries as well. Table 24 reports that total Project spending across *all* industries, not just in the construction industry, results in a total of 1,070 job-years in the construction industry.

Not surprisingly, the largest overall impact will be in the mining industry, which includes Wolfden's direct expenditures and hiring and will realize roughly 40% of the total estimated total job-years. About a quarter of the total impact of job-years will be realized in the construction industry. Because much of the impact derives from the household spending of employees, other impacted industries follow the general industrial make-up of the region, with healthcare, retail trade, and food services collectively realizing 17% of the estimated job-years (Table 24). (Job-years by Project phase are included in Appendix L.)

*Table 24: Total Economic Impact by Industry*

| Industry In Which Economic Impact is Realized | Output | Earnings | Job-Years |
|---|---|---|---|
| **Mining, quarrying, and oil and gas extraction** | $295,135,700 | $122,191,400 | 1,760 |
| **Construction** | $167,711,000 | $56,100,000 | 1,070 |
| **Health care and social assistance** | $35,742,000 | $14,900,000 | 280 |
| **Utilities** | $33,218,000 | $4,800,000 | 40 |
| **Retail trade** | $31,322,000 | $10,200,000 | 370 |
| **Wholesale trade** | $23,730,000 | $5,200,000 | 80 |
| **Real estate and rental and leasing** | $20,664,000 | $3,300,000 | 180 |
| **Durable goods manufacturing** | $14,554,000 | $2,800,000 | 60 |
| **Professional, scientific, and technical services** | $11,826,000 | $5,100,000 | 90 |
| **Transportation and warehousing** | $11,036,000 | $3,400,000 | 70 |
| **Other services** | $10,976,000 | $3,300,000 | 90 |
| **Finance and insurance** | $10,215,000 | $2,400,000 | 40 |
| **Food services and drinking places** | $10,033,000 | $3,000,000 | 130 |
| **Administrative and support and waste management** | $9,800,000 | $3,100,000 | 90 |
| **Information** | $7,278,000 | $1,400,000 | 30 |
| **Nondurable goods manufacturing** | $7,182,000 | $1,100,000 | 20 |
| **Educational services** | $4,698,000 | $2,000,000 | 60 |
| **Accommodation** | $3,176,000 | $800,000 | 20 |
| **Management of companies and enterprises** | $2,807,000 | $1,300,000 | 20 |
| **Arts, entertainment, and recreation** | $1,767,000 | $600,000 | 20 |
| **Agriculture, forestry, fishing and hunting** | $1,642,000 | $500,000 | 20 |
| **TOTAL** | **$714,520,000** | **$247,850,000** | **4,540** |

## Maine State Taxes

The $248 million in total earnings will result in an estimated $5.3 million in state income taxes, $4.3 million in state sales taxes, and $4.3 million in local property taxes (Table 25). These estimates are based on Maine Revenue Services (MRS) 2019 tax incidence estimates.[xxi] The total earnings are first reduced by 30% as a way to conservatively align the RIMS II earnings definition with MRS's methodology of taxable income. Average tax incidence rates for all households are applied to this earnings estimate. The tax estimates in Table 25 do not include any taxes that Wolfden, itself, pays to the state or local taxing

[xxi] Maine Revenue Services, available here: https://www.maine.gov/revenue/taxes/tax-policy-office

jurisdictions. They only include the taxes related to the economic impacts described above that results in earnings for workers within the Pickett region.

*Table 25: Maine Taxes (not including contingency spending)*

| | Sales | Property | Income |
|---|---|---|---|
| **Taxable Income** | 2.47% | 2.48% | 3.07% |
| **$173,492,000** | $4,285,300 | $4,302,600 | $5,326,200 |

### Economic and Fiscal Impact Including Contingency Spending

Wolfden's financial projections includes a $25 million contingency spending allocation. This was not included in the estimates above because it was not attached to specific budget items. However, given that contingency funds are an important part of Wolfden's financial model and likely will be spent, it is appropriate to include them in the economic assessment. Table 26 re-estimates the economic impacts described above by assuming the contingency spending is distributed equally across all spending categories. Essentially, all impact estimates are increased by 4.0%, reflecting the percent increase in total spending if contingency spending is included.

*Table 26: Economic Impact Including Contingency Spending*

| Total Spending | Total Output | Total Earnings | Total Job-Years |
|---|---|---|---|
| **$646,864,600** | $742,939,300 | $257,702,300 | 4,720 |
| Implied Multipliers | 1.1 | 0.4 | 7.3 |

*Table 27: Maine Taxes Including Contingency Spending*

| | Sales | Property | Income |
|---|---|---|---|
| **Earnings** | 2.47% | 2.48% | 3.07% |
| **$180,391,600** | $4,455,700 | $4,473,700 | $5,538,000 |

### Caveats and Limitations

The economic impact estimates above are subject to important caveats and limitations. The inputs to the economic model are wholly dependent on A-Z Mining Professionals Inc. estimates of spending and Wolfden's projections for the level of spending to occur within the economic region. If less spending occurs than projected, or if a higher portion of spending goes to businesses or workers outside of the region, the economic impact will be less than the estimates contained in this report. Conversely, if more spending occurs, or if more spending goes to local businesses or workers, the economic impact will be greater. The primary constraint to hiring local employees will be the skills of workers in the labor market. If qualified laborers are lacking in the economic region, the Project will have to import labor from elsewhere. Unless workers permanently relocate to the region, this would reduce the economic benefit to the Pickett region. To get a rough sense of the scale of potential over- or underestimation, Table 28 below provides estimates of the economic impact under the scenarios that the portion of spending to regional business is 80% to 120% of projected. In the low scenario, 3,630 job-years are created, while 5,450 job-years are created in the high scenario.

*Table 28: Low and High Economic Impact Scenarios*

| | Low | Estimate | High |
|---|---|---|---|
| **Total Regional Spending** | $497,698,600 | $622,123,200 | $746,547,900 |
| **Output** | $571,618,600 | $714,523,300 | $857,427,900 |
| **Earnings** | $198,276,500 | $247,845,700 | $297,414,800 |
| **Job Years** | 3,630 | 4,540 | 5,450 |

Further, the analysis assumes that no unforeseen environmental damage occurs as a result of the Project. The likelihood of environmental damage or the sufficiency of the Project's environmental safeguards (including a reclamation fund committed at the start of the Project) and the state's oversight of those safeguards are beyond the scope of this report. If environmental damage did occur that exceeded the level that could be mitigated by the reclamation fund or other means, negative economic impacts could occur that could offset the positive impacts detailed above in terms of jobs and earnings. Speaking more broadly, the analysis in this report, like any economic analysis that follows an input-output methodology, presents only one part of the total costs and benefits related to the proposed project. The Project's economic impact, although critical to consider, should be weighed alongside other important environmental, community, social, tribal, and other values. In short, the economic impact described in this report should not be viewed as an endorsement for the Project, but rather as critical context for policymakers and stakeholders to consider.

# 3. Other Economic Impacts (Qualitative Assessments)

## Key Findings

This section provides a qualitative assessment of the impact of the proposed Project on tourism, housing, and job training. As long as the Project is successful in its plan to hire local workers within an hour travel distance of the Project, the impact on the local housing market will likely be negligible. Likewise, based on the Project footprint and expected operations, the impact on the Maine Highlands tourism market will also likely be negligible. Finally, if the Project provides formal training to the region's workers in partnership with a regional college, additional positive economic impacts related to professional developments may accrue to the region and its residents and extend beyond the timeline of the Pickett Project.

## Impact on the Tourism Industry

The tourism industry is often conflated with the local demand from residents for recreation and entertainment. From an economic development perspective, a region's tourism industry represents the regional spending by visitors from outside of the region (preferably overnight visitors outside of the state). The Maine Office of Tourism researched the most popular attractions for overnight visitors in the Maine Highlands Region, which includes the Pickett region. Table 29 lists those attractions and their approximate distance by road to the Pickett Project. With the exception of the Patten Lumberman's Museum, all are located at a considerable distance from the Project (more than an hour's drive away) and none are expected to be negatively affected by the Project's operations, noise, or infrastructure. It is reasonable to assume that the Pickett Project will have no impact on visits to the region's primary tourism attractions.

*Table 29: Maine Highlands Top Attractions for Overnight Visitors, 2019*[26]

| Attraction | % Visiting | Aprox. Driving Miles from Pickett Mine |
|---|---|---|
| **Bangor Mall** | 35% | 97 |
| **Baxter State Park** | 29% | 49 (to Millinocket) |
| **Hollywood Casino (Bangor)** | 21% | 102 |
| **Moosehead Lake** | 17% | 117 |
| **Maine Beer Trail** | 14% | n/a |
| **Lily Bay State Park (Greenville)** | 13% | 109 |
| **UMaine Museum of Art (Orono)** | 13% | 93 |
| **Sebec Lake** | 13% | 107 |
| **Bangor Waterfront Concert Series** | 12% | 99 |
| **Dysart's Restaurant and Truck Stop (Bangor)** | 12% | 104 |
| **Maine Discovery Museum (Bangor)** | 10% | 100 |
| **Collins Center for the Performing Arts (Orono)** | 10% | 93 |
| **Cole Land Transportation Museum (Bangor)** | 10% | 102 |
| **Moosehead Marine Museum (Greenville)** | 9% | 133 |
| **Mt. Katahdin** | 9% | 74 |
| **Peaks Kenny State Park (Dover-Foxcroft)** | 7% | 105 |
| **Mt. Kineo** | 7% | 123 |
| **Page Farm & Home Museum (Orono)** | 6% | 93 |

| Attraction | % Visiting | Aprox. Driving Miles from Pickett Mine |
|---|---|---|
| **Patten Lumberman's Museum** | 6% | 10 |
| **Gulf Hagas** | 5% | 99 |
| **Maine Forest and Logging Museum (Bradley)** | 5% | 97 |
| **Penobscot Theatre (Bangor)** | 5% | 100 |
| **Curran Homestead (Orrington)** | 5% | 108 |
| **Katahdin Iron Works (Brownville)** | 4% | 83 |
| **Wabanaki Art Center** | 4% | 118 |
| **Thomas Hill Standpipe (Bangor)** | 4% | 100 |

Snowmobiling and ATV riding are also important parts of tourism and local recreation in the Maine Highlands region. For snowmobilers, the Highlands region is the most visited tourism region with residents and the second most visited with non-residents;[27] for ATV riders, it is the most visited.[28] Both snowmobilers and ATV riders generally ride long distances: for example, resident snowmobilers drove an average of 780 miles in 2018-19, while non-residents drove an average of 973 miles. No snowmobile or ATV trails are within the proposed rezone area.

Publicly available data on other forms of recreation like hiking, hunting, and fishing taking place within the Pickett region are sparse and it is unclear how large an economic market these forms of recreation make up, and how many people from outside the region come to the Pickett region to recreate. While there are trails nearby, none are within the Project boundaries. Pickett Mountain is not a world-class tourism attraction like Mount Katahdin, nor does it have "gateway-community" amenities close by. The Project's footprint will be less than a square mile in a region of thousands of square miles of recreational opportunities. Wolfden has also publicly stated it does not intend to revoke public access to its more than 6,800 acres of adjacent land for hunting or trail use. All of these factors lead to the reasonable conclusion that the proposed Project will have little to no negative effect on the regional tourism industry, with one caveat: the assessment of little-to-no negative tourism impact assumes, importantly, that the Project does not harm the environmental quality of the larger region.[xxii]

## Impact on the Housing Market

Home prices and rents in the Pickett region are affected by myriad factors that drive the overall supply and demand for housing in the region. Two primary drivers of demand, today, are a declining population and residents' relatively low incomes, both of which constrain demand for both new and/or higher-end housing options. A third demand driver – an aging population – is poised to impact preferences for the type and location of housing in the region as the housing needs for older residents change as they age. The supply of the region's housing is also complex, influenced in large part by its history as an industrial powerhouse. The region's housing stock is predominantly single-family homes, which are relatively older and less expensive than in other regions. Today, all these factors interact in the form of house prices and rents that are lower than the statewide average and a housing vacancy rate that is above the state average, particularly in Houlton LMA (32%) and Millinocket LMA (41%). There are over 6,900 vacant housing units in the two labor market areas.

[xxii] Note that this is a qualitative assessment only as we are not aware of studies that have quantified or correlated the economic impact, if any, of small-scale mining on broader regional tourism.

Will the proposed mining Project increase housing prices and rents? There are several reasons to conclude the proposed Project will have little-to-no effect on housing prices and rents. First, the fundamental forces described above are long-term and deeply embedded into the market. It would be difficult for a project of finite length (14 years) to offset these long-standing trends. Second, the Project plans to hire 230 workers from the local economic region within about an hour from the site (as shown in Tables 17 and 18). While it is uncertain at this point in the planning process if the Project will be able to do so, it is certainly in its financial best interest to hire local workers. Wolfden indicates that most of these workers will work "7-on, 7-off" schedules where they are on-site each day for a full week and then off work for the following week. As long as the Project is able to successfully hire from the local population of commuters, there will not be a substantial increase in demand for housing. To the extent that some workers will prefer to rent or buy a home closer to the Project instead of commute, the high vacancy rate in the region will likely be able to absorb a modest impact on demand with little effect on overall pricing fundamentals.

This assessment is dependent on the Project's ability to hire local workers once the mine is operational. If the Project is unable to hire from the local region and instead imports workers from outside of the region, the likelihood that this change in demand for housing pushes housing prices (likely rents) higher will increase.

## Impact of Economic Incentives

The economic analysis detailed above assumes that no taxpayer-funded state or federal economic incentive programs are used to subsidize Wolfden capital or operating expenses.

## Impact of Project-Sponsored Training Programs

In order to hire local workers with the requisite skills for the proposed project, Wolfden has stated its intention to:

- develop a training program in conjunction with a local community college
- work directly with high schools to offer science fairs and job fairs for local students to develop knowledge of mining in potential future employees
- develop a series of educational programs for employees focused on financial planning and management, and
- provide supports for employees in finding their next job within the mining industry.

The direct impact from the spending on these trainings during the construction and operation phases of the Project are embedded in the economic analysis detailed above. However, since these training and support programs will teach mining skills that are transferable to other mining projects, the economic benefit may extend beyond the Project's timeline as some of the region's skilled workers find work and earn wages at other mines around the country (and spend a portion of those wages in the regional economy). To fully quantify the economic impact of professional development on the regional economy one would need to know the number of trainees expected to go through the program and their expected wages before and after training. However, one way to appreciate the *potential* impact is to note that the average wage in the Pickett economic region is roughly $48,000, 30% less than the expected average wage of $69,000 for on-site workers at the Pickett project. Additional details on the planned training programs is provided elsewhere in the petition (Exhibit 10).

## Geographic Location of Businesses in Economic Area and Impact of Transportation

The maps in Appendix O and Figures 21-1 and 21-2 in the Petition, created by Stantec, show, respectively, the geographic location of businesses within the regional labor market area and the Project's anticipated transportation route for shipping concentrate. Population data by road is not publicly available but the population information provided in Section 1 of this report describe the general population and density characteristics of the closest towns and for the economic region as a whole. In terms of the economic impact of the of the transportation, the Project's spending associated with trucking materials to and from the mine and the regional spending associated with the wages paid to truck drivers are included in this report's economic analysis. The economic impact to specific businesses along the route is impossible to quantify at this point in time.

# 4. Appendices

## Appendix A: Population

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **POPULATION**[29] | | | | | |
| 1970 | 993,722 | 92,463 | 125,393 | 20,541 | 13,364 |
| 1980 | 1,125,043 | 91,331 | 137,015 | 20,300 | 13,799 |
| 1990 | 1,227,928 | 86,936 | 146,601 | 20,102 | 13,240 |
| 2000 | 1,274,923 | 73,938 | 144,919 | 18,969 | 11,035 |
| 2010 | 1,328,361 | 71,870 | 153,923 | 18,683 | 9,770 |
| 2020 | 1,362,359 | 67,105 | 152,199 | 18,048 | 9,092 |
| | | | | | |
| **POPULATION DENSITY** | | | | | |
| Land area (square miles)[30] | 30,845 | 6,671 | 3,397 | 1,086 | 3,378 |
| People per square mile (2020) | 44.2 | 10.1 | 44.8 | 13.5 | 2.7 |
| | | | | | |
| **AGE**[31] | | | | | |
| Percentage of population by age | | | | | |
| 0-4 years | 4.8% | 4.9% | 4.6% | 4.7% | 2.9% |
| 5 to 9 years | 5.1% | 5.1% | 5.1% | 5.6% | 7.2% |
| 10 to 14 years | 5.4% | 4.9% | 5.1% | 5.6% | 3.5% |
| 15 to 19 years | 5.8% | 5.6% | 6.9% | 6.6% | 3.7% |
| 20 to 24 years | 5.6% | 5.2% | 6.9% | 5.2% | 2.6% |
| 25 to 29 years | 6.0% | 5.0% | 6.8% | 4.1% | 5.0% |
| 30 to 34 years | 6.0% | 4.9% | 6.5% | 4.6% | 4.8% |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| 35 to 39 years | 5.8% | 5.3% | 5.4% | 5.4% | 5.3% |
| 40 to 44 years | 5.7% | 5.1% | 5.8% | 5.6% | 3.9% |
| 45 to 49 years | 6.4% | 6.1% | 6.3% | 5.6% | 6.4% |
| 50 to 54 years | 7.1% | 7.2% | 6.9% | 8.8% | 7.0% |
| 55 to 59 years | 8.0% | 8.5% | 7.7% | 7.6% | 9.6% |
| 60 to 64 years | 7.8% | 8.0% | 7.4% | 7.7% | 10.1% |
| 65 to 69 years | 7.0% | 7.7% | 6.1% | 7.5% | 9.1% |
| 70 to 74 years | 5.2% | 6.0% | 4.9% | 6.2% | 6.4% |
| 75 to 79 years | 3.5% | 3.6% | 3.2% | 2.9% | 6.7% |
| 80 to 84 years | 2.3% | 3.2% | 2.1% | 2.8% | 3.3% |
| 85+ years | 2.6% | 3.7% | 2.3% | 3.5% | 2.6% |
| | | | | | |
| 0-19 years | 21.1% | 20.5% | 21.7% | 22.5% | 17.3% |
| 65+ years | 20.6% | 24.1% | 18.5% | 22.9% | 28.0% |
| | | | | | |
| Median age 2006-10 (years, weighted by population) | 42.0 | 44.4 | 39.4 | 45.3 | 48.6 |
| Median age 2016-20 (years, weighted by population) | 44.8 | 48.0 | 42.2 | 46.3 | 54.3 |
| Change from 2006-10 to 2016-20 (years) | +2.8 | +3.6 | +2.8 | +1.0 | +5.7 |
| | | | | | |
| **RACE/ETHNICITY**[32] | | | | | |
| White alone, not Hispanic or Latino | 90.2% | 92.6% | 90.9% | 91.4% | 94.2% |
| Black alone, not Hispanic or Latino | 1.8% | 0.6% | 0.9% | 0.4% | 0.3% |
| Hispanic or Latino | 2.0% | 1.4% | 1.8% | 1.4% | 1.0% |
| American Indian or Alaska Native | 0.5% | 1.8% | 0.9% | 3.3% | 0.4% |
| Asian | 1.2% | 0.6% | 1.2% | 0.4% | 0.3% |
| Native Hawaiian and Other Pacific Islander | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| One other race | 0.3% | 0.2% | 0.3% | 0.1% | 0.1% |
| | | | | | |
| **HOUSEHOLDS**[33] | | | | | |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| Total households | 569,551 | 29,594 | 63,073 | 7,502 | 4,698 |
| Average household size (weighted by number of households) | 2.3 | 2.2 | 2.3 | 2.3 | 2.1 |
| | | | | | |
| **FAMILIES**[34] | | | | | |
| Total families | 349,955 | 18,198 | 38,100 | 4,671 | 2,920 |
| Average family size (weighted by number of families) | 2.82 | 2.77 | 2.82 | 2.93 | 2.55 |
| | | | | | |
| Married family households | 275,146 | 14,380 | 29,173 | 3,670 | 2,417 |
| Married families with individuals under 18 | 33.9% | 30.9% | 34.7% | 33.6% | 24.6% |
| Married families with individual age 60+ | 45.7% | 48.5% | 41.5% | 44.6% | 49.4% |
| | | | | | |
| Male householder, no spouse present | 6.8% | 7.7% | 7.1% | 6.7% | 5.9% |
| Male householder, no spouse present, with children | 3.8% | 4.3% | 3.9% | 3.4% | 3.9% |
| | | | | | |
| Female householder, no spouse present | 14.6% | 13.3% | 16.3% | 14.7% | 11.3% |
| Female householder, no spouse present, with children | 8.1% | 6.5% | 9.0% | 7.2% | 8.5% |
| | | | | | |
| **HOUSEHOLD INCOME**[35] | | | | | |
| Percentage of households with incomes (weighted by number of households) | | | | | |
| Less than $10,000 | 5.3% | 7.6% | 5.9% | 9.3% | 4.7% |
| $10,000 to $14,999 | 4.9% | 8.6% | 5.4% | 6.6% | 6.5% |
| $15,000 to $24,999 | 9.7% | 13.6% | 11.9% | 14.6% | 16.2% |
| $25,000 to $34,999 | 9.3% | 11.3% | 11.0% | 12.8% | 14.6% |
| $35,000 to $49,999 | 13.1% | 14.8% | 14.3% | 12.8% | 18.8% |
| $50,000 to $74,999 | 18.5% | 18.0% | 18.4% | 18.1% | 16.6% |
| $75,000 to $99,999 | 13.8% | 11.6% | 12.5% | 10.4% | 11.7% |
| $100,000 to $149,999 | 15.0% | 9.3% | 12.8% | 10.5% | 8.4% |
| $150,000 to $199,999 | 5.5% | 2.8% | 4.5% | 2.2% | 1.5% |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| $200,000 or more | 4.9% | 2.5% | 3.4% | 2.7% | 1.2% |
| Median household income ($) | $59,489 | $43,791 | $52,128 | $43,740 | $41,847 |
| | | | | | |
| **POVERTY RATE** | | | | | |
| Individuals in households with incomes below poverty level (weighted by population) | | | | | |
| Total population (2016-20)[36] | 11.1% | 14.3% | 13.4% | 18.1% | 13.7% |
| 0-4 years | 15.4% | 19.8% | 17.7% | 28.8% | 34.8% |
| 5-17 years | 13.5% | 16.9% | 15.4% | 25.1% | 18.3% |
| 18-34 years | 14.8% | 15.5% | 20.6% | 19.3% | 13.8% |
| 35-64 years | 9.3% | 12.9% | 10.8% | 15.3% | 14.9% |
| 65+ years | 8.5% | 13.2% | 8.0% | 15.1% | 7.3% |
| | | | | | |
| Total population (2006-10)[37] | 12.6% | 15.4% | 15.7% | 17.0% | 11.6% |
| 0-4 years | 21.8% | 24.3% | 25.9% | 34.5% | 17.1% |
| 5-17 years | 15.4% | 19.2% | 18.5% | 21.4% | 15.7% |
| 18-34 years | 17.9% | 22.6% | 25.8% | 21.8% | 17.0% |
| 35-64 years | 9.3% | 11.8% | 10.4% | 13.9% | 9.9% |
| 65+ years | 9.6% | 11.7% | 9.2% | 11.7% | 8.3% |
| | | | | | |
| Change 2006-10 to 2016-20 (percentage point) | | | | | |
| Total population | -1.5% | -1.1% | -2.3% | +1.1% | +2.1% |
| 0-4 years | -6.4% | -4.5% | -8.2% | -5.7% | +17.7% |
| 5-17 years | -1.9% | -2.3% | -3.1% | +3.7% | +2.6% |
| 18-34 years | -3.1% | -7.1% | -5.2% | -2.5% | -3.2% |
| 35-64 years | +0.0% | +1.1% | +0.4% | +1.4% | +5.0% |
| 65+ years | -1.1% | +1.5% | -1.2% | +3.4% | -1.0% |

## Appendix B: Labor Force

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **EMPLOYMENT** | | | | | |
| Labor force[38] | 681,884 | 29,056 | 74,855 | 7,328 | 3,281 |
| Employment[39] | 650,334 | 27,408 | 71,312 | 6,876 | 3,033 |
| Unemployment[40] | 31,550 | 1,648 | 3,543 | 452 | 248 |
| Unemployment rate[41] | 4.6% | 5.7% | 5.7% | 6.2% | 7.6% |
| | | | | | |
| Labor force participation rate 2016-20[42] (weighted by population age 16+) | 63.0% | 54.1% | 60.9% | 52.6% | 49.4% |
| Labor force participation rate 2011-15[43] (weighted by population age 16+) | 63.6% | 56.7% | 61.1% | 55.5% | 49.9% |
| Change 2011-15 to 2016-20 (percentage points) | -0.6% | -2.6% | -0.2% | -2.9% | -0.5% |
| | | | | | |
| Population age 16+ (2016-20)[44] | 1,120,778 | 56,773 | 127,672 | 14,916 | 8,425 |
| Population age 16+ in labor force | 706,090 | 30,714 | 77,752 | 7,851 | 4,165 |
| Population age 16+ in labor force if participation matched state | | 35,767 | 80,433 | 9,397 | 5,308 |
| Difference | | +5,053 | +2,681 | +1,546 | +1,143 |
| | | | | | |
| Labor force participation by age 2016-2020 | | | | | |
| 16-19 years | 50.9% | 43.9% | 42.1% | 46.9% | 19.1% |
| 20-24 years | 80.4% | 76.0% | 73.9% | 78.9% | 68.6% |
| 25-29 years | 84.1% | 82.3% | 84.4% | 71.8% | 87.8% |
| 30-34 years | 85.0% | 79.1% | 81.5% | 78.6% | 73.2% |
| 35-44 years | 84.7% | 79.9% | 83.2% | 75.1% | 88.2% |
| 45-54 years | 82.9% | 76.6% | 79.2% | 73.9% | 76.2% |
| 55-59 years | 74.6% | 68.4% | 69.8% | 63.4% | 64.4% |
| 60-64 years | 60.9% | 49.3% | 56.7% | 47.1% | 39.0% |
| 65-74 years | 28.8% | 20.6% | 25.5% | 23.6% | 16.6% |
| 75+ years | 6.7% | 3.4% | 5.4% | 4.0% | 5.6% |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| | | | | | |
| **SEASONALITY** | | | | | |
| Employment (2021)[45] | | | | | |
| January | 634,359 | 27,221 | 69,518 | 6,778 | 2,918 |
| February | 638,271 | 27,581 | 70,609 | 6,838 | 2,962 |
| March | 640,976 | 27,596 | 71,005 | 6,852 | 2,964 |
| April | 643,034 | 27,055 | 71,017 | 6,718 | 2,936 |
| May | 645,240 | 27,372 | 70,105 | 6,857 | 3,026 |
| June | 655,937 | 27,756 | 70,476 | 7,017 | 3,137 |
| July | 668,843 | 28,191 | 71,278 | 7,169 | 3,209 |
| August | 667,385 | 27,936 | 71,147 | 7,105 | 3,205 |
| September | 655,157 | 27,000 | 72,258 | 6,805 | 3,019 |
| October | 656,386 | 27,201 | 73,123 | 6,815 | 3,043 |
| November | 649,082 | 26,920 | 72,789 | 6,743 | 2,974 |
| December | 649,342 | 27,066 | 72,416 | 6,819 | 3,001 |
| Ratio peak/trough month employment | 95% | 98% | 98% | 95% | 92% |
| | | | | | |
| Unemployment Rate (2021)[46] | | | | | |
| January | 5.5% | 6.0% | 5.5% | 6.2% | 8.0% |
| February | 5.5% | 5.9% | 5.3% | 6.1% | 8.2% |
| March | 5.4% | 6.0% | 5.3% | 6.3% | 8.5% |
| April | 5.3% | 7.0% | 5.4% | 8.0% | 9.0% |
| May | 5.0% | 6.6% | 5.1% | 7.4% | 8.3% |
| June | 5.1% | 6.5% | 5.4% | 7.1% | 8.2% |
| July | 4.6% | 5.6% | 5.0% | 5.9% | 7.7% |
| August | 4.2% | 5.2% | 4.6% | 5.6% | 6.9% |
| September | 3.8% | 5.0% | 3.9% | 5.7% | 6.5% |
| October | 3.7% | 4.6% | 3.9% | 5.2% | 6.1% |
| November | 3.8% | 4.9% | 3.9% | 5.5% | 6.9% |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| December | 3.5% | 4.6% | 3.6% | 4.9% | 6.3% |
| Ratio peak/trough unemployment | 125% | 110% | 113% | 107% | 111% |
| | | | | | |
| **EDUCATIONAL ATTAINMENT**[47] | | | | | |
| Population age 25+ | | | | | |
| Total | 982,385 | 50,068 | 108,311 | 13,048 | 7,865 |
| Less than 9th grade | 2.3% | 4.2% | 2.3% | 3.9% | 1.6% |
| 9-12 grade, no diploma | 4.5% | 6.0% | 4.9% | 7.0% | 6.3% |
| High school diploma or equivalent | 31.3% | 37.2% | 33.4% | 41.8% | 42.7% |
| Some college, no degree | 19.2% | 20.9% | 19.9% | 20.0% | 23.9% |
| Associate's degree | 10.2% | 12.0% | 10.9% | 10.1% | 12.8% |
| Bachelor's degree | 20.3% | 13.6% | 17.7% | 12.1% | 9.1% |
| Graduate or professional degree | 12.2% | 6.1% | 10.9% | 5.1% | 3.6% |
| Bachelor's degree or higher (above two categories combined) | 32.5% | 19.8% | 28.6% | 17.2% | 12.7% |
| | | | | | |
| **AGE**[48] | | | | | |
| Percentage of working-age population (25-64 years) | | | | | |
| 25-34 years | 16.4% | 13.4% | 18.6% | 12.1% | 12.2% |
| 35-44 years | 15.7% | 14.0% | 15.8% | 15.2% | 11.4% |
| 45-64 years | 39.8% | 40.1% | 39.7% | 41.1% | 41.3% |
| | | | | | |
| **OCCUPATIONS**[49] | | | | | |
| Civilian employed population 16 years and over | 675,784 | 29,147 | 73,848 | 7,342 | 3,808 |
| Management, business, and financial | 102,043 | 3,627 | 8,723 | 907 | 351 |
| Computer, engineering, and science | 33,219 | 599 | 2,993 | 117 | 56 |
| Education, legal, community service, arts, and media | 81,031 | 2,903 | 9,314 | 767 | 361 |
| Healthcare practitioners and technical | 45,866 | 1,894 | 5,941 | 396 | 257 |
| Healthcare support | 27,468 | 1,514 | 3,666 | 390 | 222 |
| Protective service | 11,423 | 716 | 1,333 | 229 | 97 |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| Food preparation and serving related | 36,787 | 1,479 | 4,535 | 376 | 197 |
| Building and grounds cleaning and maintenance | 24,385 | 1,003 | 2,771 | 229 | 227 |
| Personal care and service | 17,806 | 714 | 2,252 | 165 | 109 |
| Sales and related | 65,889 | 2,674 | 8,234 | 861 | 360 |
| Office and administrative support | 76,108 | 3,597 | 8,440 | 724 | 484 |
| Farming, fishing, and forestry | 10,166 | 994 | 571 | 210 | 74 |
| Construction and extraction | 40,034 | 1,805 | 4,315 | 431 | 339 |
| Installation, maintenance, and repair | 22,603 | 1,205 | 2,935 | 326 | 208 |
| Production | 35,486 | 1,726 | 2,651 | 384 | 141 |
| Transportation | 24,520 | 1,574 | 2,907 | 474 | 126 |
| Material moving | 20,950 | 1,123 | 2,267 | 356 | 199 |
| | | | | | |
| Percentage of total | | | | | |
| Management, business, and financial | 15% | 12% | 12% | 12% | 9% |
| Computer, engineering, and science | 5% | 2% | 4% | 2% | 1% |
| Education, legal, community service, arts, and media | 12% | 10% | 13% | 10% | 9% |
| Healthcare practitioners and technical | 7% | 6% | 8% | 5% | 7% |
| Healthcare support | 4% | 5% | 5% | 5% | 6% |
| Protective service | 2% | 2% | 2% | 3% | 3% |
| Food preparation and serving related | 5% | 5% | 6% | 5% | 5% |
| Building and grounds cleaning and maintenance | 4% | 3% | 4% | 3% | 6% |
| Personal care and service | 3% | 2% | 3% | 2% | 3% |
| Sales and related | 10% | 9% | 11% | 12% | 9% |
| Office and administrative support | 11% | 12% | 11% | 10% | 13% |
| Farming, fishing, and forestry | 2% | 3% | 1% | 3% | 2% |
| Construction and extraction | 6% | 6% | 6% | 6% | 9% |
| Installation, maintenance, and repair | 3% | 4% | 4% | 4% | 5% |
| Production | 5% | 6% | 4% | 5% | 4% |
| Transportation | 4% | 5% | 4% | 6% | 3% |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| Material moving | 3% | 4% | 3% | 5% | 5% |
| | | | | | |
| Ratio local/state occupation percentage | | | | | |
| Management, business, and financial | 1.00 | 0.82 | 0.78 | 0.82 | 0.61 |
| Computer, engineering, and science | 1.00 | 0.42 | 0.82 | 0.32 | 0.30 |
| Education, legal, community service, arts, and media | 1.00 | 0.83 | 1.05 | 0.87 | 0.79 |
| Healthcare practitioners and technical | 1.00 | 0.96 | 1.19 | 0.79 | 0.99 |
| Healthcare support | 1.00 | 1.28 | 1.22 | 1.31 | 1.43 |
| Protective service | 1.00 | 1.45 | 1.07 | 1.85 | 1.51 |
| Food preparation and serving related | 1.00 | 0.93 | 1.13 | 0.94 | 0.95 |
| Building and grounds cleaning and maintenance | 1.00 | 0.95 | 1.04 | 0.86 | 1.65 |
| Personal care and service | 1.00 | 0.93 | 1.16 | 0.85 | 1.09 |
| Sales and related | 1.00 | 0.94 | 1.14 | 1.20 | 0.97 |
| Office and administrative support | 1.00 | 1.10 | 1.01 | 0.88 | 1.13 |
| Farming, fishing, and forestry | 1.00 | 2.27 | 0.51 | 1.90 | 1.29 |
| Construction and extraction | 1.00 | 1.05 | 0.99 | 0.99 | 1.50 |
| Installation, maintenance, and repair | 1.00 | 1.24 | 1.19 | 1.33 | 1.63 |
| Production | 1.00 | 1.13 | 0.68 | 1.00 | 0.71 |
| Transportation | 1.00 | 1.49 | 1.08 | 1.78 | 0.91 |
| Material moving | 1.00 | 1.24 | 0.99 | 1.56 | 1.69 |
| | | | | | |
| **COMMUTING**[50] | | | | | |
| Workers age 16+ | 662,547 | 28,743 | 72,067 | 7,161 | 3,729 |
| Workers not working at home (number) | 608,861 | 27,630 | 67,524 | 6,754 | 3,442 |
| (percentage) | 91.9% | 96.1% | 93.7% | 94.3% | 92.3% |
| | | | | | |
| Travel time to work (number) | | | | | |
| Less than 10 minutes | 105,353 | 8,721 | 12,037 | 2,228 | 1,128 |
| 10 to 29 minutes | 305,121 | 13,363 | 37,552 | 3,138 | 1,364 |

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| 30 to 59 minutes | 158,159 | 4,033 | 13,814 | 988 | 474 |
| 60 minutes or longer | 40,228 | 1,513 | 4,121 | 400 | 476 |
| | | | | | |
| Travel time to work (percentage) | | | | | |
| Less than 10 minutes | 17.3% | 31.6% | 17.8% | 33.0% | 32.8% |
| 10 to 29 minutes | 50.1% | 48.4% | 55.6% | 46.5% | 39.6% |
| 30 to 59 minutes | 26.0% | 14.6% | 20.5% | 14.6% | 13.8% |
| 60 minutes or longer | 6.6% | 5.5% | 6.1% | 5.9% | 13.8% |

## Appendix C: Industries

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| **ESTABLISHMENTS**[52] | | | | | | |
| Total, all industries | 10 | 59,795 | 2032 | 4512 | 622 | 246 |
| Agriculture, forestry, fishing and hunting | 11 | 1,703 | 228 | 99 | 51 | 11 |
| Mining, quarrying, and oil and gas extraction | 21 | 37 | -- | -- | -- | -- |
| Utilities | 22 | 280 | | 14 | 7 | 6 |
| Construction | 23 | 6,134 | 186 | 526 | 51 | 26 |
| Manufacturing | 31-33 | 1,885 | 80 | 151 | 20 | 6 |
| Wholesale trade | 42 | 3,054 | 80 | 210 | 18 | 5 |
| Retail trade | 44-45 | 6,010 | 307 | 645 | 74 | 36 |
| Transportation and warehousing | 48-49 | 1,879 | 160 | 188 | 65 | 20 |
| Information | 51 | 1,112 | 33 | 60 | 13 | 4 |
| Finance and insurance | 52 | 2,243 | 83 | 201 | 19 | 10 |
| Real estate and rental and leasing | 53 | 1,961 | 62 | 201 | 19 | 4 |
| Professional and technical services | 54 | 7,578 | 147 | 497 | 38 | 10 |
| Management of companies and enterprises | 55 | 1,782 | 26 | 96 | 10 | -- |
| Administrative and waste services | 56 | 3,807 | 94 | 262 | 22 | 16 |
| Educational services | 61 | 1,392 | 18 | 49 | 14 | 7 |
| Health care and social assistance | 62 | 5,120 | 230 | 558 | 78 | 15 |
| Arts, entertainment, and recreation | 71 | 1,057 | 24 | 75 | 7 | 11 |
| Accommodation and food services | 72 | 4,340 | 138 | 338 | 40 | 27 |
| Other services, except public administration | 81 | 3,954 | 128 | 338 | 27 | 13 |
| Public administration | 92 | 1,179 | -- | -- | 47 | 14 |
| Unclassified | 99 | 3,288 | -- | -- | -- | -- |
| | | | | | | |
| Percentage of total | | | | | | |
| Agriculture, forestry, fishing and hunting | 11 | 2.8% | 11.2% | 2.2% | 8.2% | 4.5% |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Mining, quarrying, and oil and gas extraction | 21 | 0.1% | -- | -- | -- | -- |
| Utilities | 22 | 0.5% | 0.0% | 0.3% | 1.1% | 2.4% |
| Construction | 23 | 10.3% | 9.2% | 11.7% | 8.2% | 10.6% |
| Manufacturing | 31-33 | 3.2% | 3.9% | 3.3% | 3.2% | 2.4% |
| Wholesale trade | 42 | 5.1% | 3.9% | 4.7% | 2.9% | 2.0% |
| Retail trade | 44-45 | 10.1% | 15.1% | 14.3% | 11.9% | 14.6% |
| Transportation and warehousing | 48-49 | 3.1% | 7.9% | 4.2% | 10.5% | 8.1% |
| Information | 51 | 1.9% | 1.6% | 1.3% | 2.1% | 1.6% |
| Finance and insurance | 52 | 3.8% | 4.1% | 4.5% | 3.1% | 4.1% |
| Real estate and rental and leasing | 53 | 3.3% | 3.1% | 4.5% | 3.1% | 1.6% |
| Professional and technical services | 54 | 12.7% | 7.2% | 11.0% | 6.1% | 4.1% |
| Management of companies and enterprises | 55 | 3.0% | 1.3% | 2.1% | 1.6% | -- |
| Administrative and waste services | 56 | 6.4% | 4.6% | 5.8% | 3.5% | 6.5% |
| Educational services | 61 | 2.3% | 0.9% | 1.1% | 2.3% | 2.8% |
| Health care and social assistance | 62 | 8.6% | 11.3% | 12.4% | 12.5% | 6.1% |
| Arts, entertainment, and recreation | 71 | 1.8% | 1.2% | 1.7% | 1.1% | 4.5% |
| Accommodation and food services | 72 | 7.3% | 6.8% | 7.5% | 6.4% | 11.0% |
| Other services, except public administration | 81 | 6.6% | 6.3% | 7.5% | 4.3% | 5.3% |
| Public administration | 92 | 2.0% | -- | -- | 7.6% | 5.7% |
| Unclassified | 99 | 5.5% | -- | -- | -- | -- |
| | | | | | | |
| Goods-producing establishments | 101 | | | | | |
| 2001 | | 8,699 | 547 | 738 | 150 | 54 |
| 2011 | | 8,622 | 527 | 714 | 134 | 41 |
| 2021 | | 9,759 | 494 | 779 | 124 | 43 |
| Change 2001 to 2021 (number) | | +1,060 | -53 | +41 | -26 | -11 |
| (percentage) | | +12.2% | -9.7% | +5.6% | -17.3% | -20.4% |
| | | | | | | |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Service-providing establishments | 102 | | | | | |
| 2001 | | 37,874 | 2,041 | 3,642 | 564 | 249 |
| 2011 | | 40,510 | 1,895 | 3,810 | 491 | 203 |
| 2021 | | 50,036 | 1,538 | 3,733 | 498 | 203 |
| Change 2001 to 2021 (number) | | +12,162 | -503 | +91 | -66 | -46 |
| (percentage) | | +32.1% | -24.6% | +2.5% | -11.7% | -18.5% |
| | | | | | | |
| Ratio goods-producing /service-providing | | | | | | |
| 2001 | | 0.23 | 0.27 | 0.20 | 0.27 | 0.22 |
| 2011 | | 0.21 | 0.28 | 0.19 | 0.27 | 0.20 |
| 2021 | | 0.20 | 0.32 | 0.21 | 0.25 | 0.21 |
| | | | | | | |
| **EMPLOYMENT** (annual average)[53] | | | | | | |
| Total, all industries | 10 | 609,907 | 19,728 | 56,441 | 5,893 | 1,974 |
| Agriculture, forestry, fishing and hunting | 11 | 8,400 | 1,436 | 717 | 275 | 33 |
| Mining, quarrying, and oil and gas extraction | 21 | 241 | -- | -- | -- | -- |
| Utilities | 22 | 2,935 | -- | 312 | 36 | 41 |
| Construction | 23 | 34,213 | 827 | 3,424 | 238 | 65 |
| Manufacturing | 31-33 | 60,220 | 2,659 | 2,672 | 500 | 104 |
| Wholesale trade | 42 | 19,081 | 504 | 2,186 | 89 | 24 |
| Retail trade | 44-45 | 79,400 | 3,674 | 10,194 | 952 | 343 |
| Transportation and warehousing | 48-49 | 20,751 | 907 | 2,617 | 272 | 81 |
| Information | 51 | 7,126 | 251 | 722 | 59 | 13 |
| Finance and insurance | 52 | 23,335 | 794 | 1,420 | 135 | 76 |
| Real estate and rental and leasing | 53 | 7,412 | 243 | 742 | 45 | 8 |
| Professional and technical services | 54 | 30,508 | 416 | 2,066 | 62 | 16 |
| Management of companies and enterprises | 55 | 14,707 | 243 | 2,894 | 80 | -- |
| Administrative and waste services | 56 | 28,797 | 415 | 2,752 | 126 | 23 |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Educational services | 61 | 56,760 | 218 | 1,043 | 634 | 234 |
| Health care and social assistance | 62 | 108,342 | 4,890 | 14,889 | 1,333 | 454 |
| Arts, entertainment, and recreation | 71 | 9,922 | 113 | 821 | 52 | 118 |
| Accommodation and food services | 72 | 52,031 | 1,545 | 5,240 | 396 | 198 |
| Other services, except public administration | 81 | 16,755 | 467 | 1,726 | 100 | 50 |
| Public administration | 92 | 27,150 | -- | -- | 511 | 55 |
| Unclassified | 99 | 1,822 | -- | -- | -- | -- |
| | | | | | | |
| Goods-producing | 101 | 103,075 | 4,921 | 6,816 | 1,014 | 203 |
| Service-providing | 102 | 506,832 | 14,807 | 49,625 | 4,879 | 1,772 |
| | | | | | | |
| Percentage of total annual average | | | | | | |
| Agriculture, forestry, fishing and hunting | 11 | 1.4% | 7.3% | 1.3% | 4.7% | 1.7% |
| Mining, quarrying, and oil and gas extraction | 21 | 0.0% | -- | -- | -- | -- |
| Utilities | 22 | 0.5% | -- | 0.6% | 0.6% | 2.1% |
| Construction | 23 | 5.6% | 4.2% | 6.1% | 4.0% | 3.3% |
| Manufacturing | 31-33 | 9.9% | 13.5% | 4.7% | 8.5% | 5.3% |
| Wholesale trade | 42 | 3.1% | 2.6% | 3.9% | 1.5% | 1.2% |
| Retail trade | 44-45 | 13.0% | 18.6% | 18.1% | 16.2% | 17.4% |
| Transportation and warehousing | 48-49 | 3.4% | 4.6% | 4.6% | 4.6% | 4.1% |
| Information | 51 | 1.2% | 1.3% | 1.3% | 1.0% | 0.7% |
| Finance and insurance | 52 | 3.8% | 4.0% | 2.5% | 2.3% | 3.9% |
| Real estate and rental and leasing | 53 | 1.2% | 1.2% | 1.3% | 0.8% | 0.4% |
| Professional and technical services | 54 | 5.0% | 2.1% | 3.7% | 1.1% | 0.8% |
| Management of companies and enterprises | 55 | 2.4% | 1.2% | 5.1% | 1.4% | -- |
| Administrative and waste services | 56 | 4.7% | 2.1% | 4.9% | 2.1% | 1.2% |
| Educational services | 61 | 9.3% | 1.1% | 1.8% | 10.8% | 11.9% |
| Health care and social assistance | 62 | 17.8% | 24.8% | 26.4% | 22.6% | 23.0% |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Arts, entertainment, and recreation | 71 | 1.6% | 0.6% | 1.5% | 0.9% | 6.0% |
| Accommodation and food services | 72 | 8.5% | 7.8% | 9.3% | 6.7% | 10.0% |
| Other services, except public administration | 81 | 2.7% | 2.4% | 3.1% | 1.7% | 2.5% |
| Public administration | 92 | 4.5% | -- | -- | 8.7% | 2.8% |
| Unclassified | 99 | 0.3% | -- | -- | -- | -- |
| | | | | | | |
| Goods-producing | 101 | 16.9% | 24.9% | 12.1% | 17.2% | 10.3% |
| Service-providing | 102 | 83.1% | 75.1% | 87.9% | 82.8% | 89.8% |
| | | | | | | |
| Ratio local/state employment percentage | | | | | | |
| Agriculture, forestry, fishing and hunting | | 1.00 | 5.29 | 0.92 | 3.39 | 1.21 |
| Mining, quarrying, and oil and gas extraction | | 1.00 | -- | -- | -- | -- |
| Utilities | | 1.00 | -- | 1.15 | 1.27 | 4.32 |
| Construction | | 1.00 | 0.75 | 1.08 | 0.72 | 0.59 |
| Manufacturing | | 1.00 | 1.37 | 0.48 | 0.86 | 0.53 |
| Wholesale trade | | 1.00 | 0.82 | 1.24 | 0.48 | 0.39 |
| Retail trade | | 1.00 | 1.43 | 1.39 | 1.24 | 1.33 |
| Transportation and warehousing | | 1.00 | 1.35 | 1.36 | 1.36 | 1.21 |
| Information | | 1.00 | 1.09 | 1.09 | 0.86 | 0.56 |
| Finance and insurance | | 1.00 | 1.05 | 0.66 | 0.60 | 1.01 |
| Real estate and rental and leasing | | 1.00 | 1.01 | 1.08 | 0.63 | 0.33 |
| Professional and technical services | | 1.00 | 0.42 | 0.73 | 0.21 | 0.16 |
| Management of companies and enterprises | | 1.00 | 0.51 | 2.13 | 0.56 | -- |
| Administrative and waste services | | 1.00 | 0.45 | 1.03 | 0.45 | 0.25 |
| Educational services | | 1.00 | 0.12 | 0.20 | 1.16 | 1.27 |
| Health care and social assistance | | 1.00 | 1.40 | 1.49 | 1.27 | 1.29 |
| Arts, entertainment, and recreation | | 1.00 | 0.35 | 0.89 | 0.54 | 3.67 |
| Accommodation and food services | | 1.00 | 0.92 | 1.09 | 0.79 | 1.18 |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Other services, except public administration | | 1.00 | 0.86 | 1.11 | 0.62 | 0.92 |
| Public administration | | 1.00 | -- | -- | 1.95 | 0.63 |
| Unclassified | | 1.00 | -- | -- | -- | -- |
| | | | | | | |
| Employment at goods-producing establishments | 101 | | | | | |
| 2001[54] | | 116,840 | 6,497 | 10,982 | 1,326 | 1,378 |
| 2011 | | 89,308 | 5,228 | 7,318 | 995 | 427 |
| 2021 | | 103,075 | 4,921 | 6,816 | 1,014 | 203 |
| Change 2001 to 2021 (number) | | -13,765 | -1,576 | -4,166 | -312 | -1,175 |
| (percentage) | | -11.8% | -24.3% | -37.9% | -23.5% | -85.3% |
| | | | | | | |
| Employment at service-providing establishments | 102 | | | | | |
| 2001 | | 476,195 | 23,371 | 58,935 | 4,947 | 2,660 |
| 2011 | | 490,571 | 22,990 | 60,954 | 5089 | 2,055 |
| 2021 | | 506,832 | 14,807 | 49,625 | 4,879 | 1,772 |
| Change 2001 to 2021 (number) | | +30,637 | -8,564 | -9,310 | -68 | -888 |
| (percentage) | | +6.4% | -36.6% | -15.8% | -1.4% | -33.4% |
| | | | | | | |
| Ratio goods-producing /service-providing | | | | | | |
| 2001 | | 0.25 | 0.28 | 0.19 | 0.27 | 0.52 |
| 2011 | | 0.18 | 0.23 | 0.12 | 0.20 | 0.21 |
| 2021 | | 0.20 | 0.33 | 0.14 | 0.21 | 0.11 |
| | | | | | | |
| Percentage of employment at goods-producing establishments | | | | | | |
| 2001 | | 19.7% | 21.8% | 15.7% | 21.1% | 34.1% |
| 2011 | | 15.4% | 18.5% | 10.7% | 16.4% | 17.2% |
| 2021 | | 16.9% | 24.9% | 12.1% | 17.2% | 10.3% |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| | | | | | | |
| Average employees per establishment | | | | | | |
| 2001 | | 12.73 | 11.54 | 15.96 | 8.79 | 13.33 |
| 2011 | | 11.80 | 11.65 | 15.09 | 9.73 | 10.17 |
| 2021 | | 10.20 | 9.71 | 12.51 | 9.47 | 8.03 |
| | | | | | | |
| **WAGES** (average weekly, $)[55] | | | | | | |
| Total, all industries | 10 | $1,051 | $836 | $951 | $798 | $720 |
| Agriculture, forestry, fishing and hunting | 11 | $803 | $719 | $918 | $651 | $810 |
| Mining, quarrying, and oil and gas extraction | 21 | $1,180 | -- | -- | -- | -- |
| Utilities | 22 | $1,501 | -- | $1,825 | $1,468 | $1,470 |
| Construction | 23 | $1,109 | $906 | $1,134 | $989 | $840 |
| Manufacturing | 31-33 | $1,241 | $1,069 | $1,047 | $915 | $833 |
| Wholesale trade | 42 | $1,546 | $1,189 | $1,192 | $897 | $1,231 |
| Retail trade | 44-45 | $684 | $604 | $666 | $603 | $502 |
| Transportation and warehousing | 48-49 | $995 | $862 | $948 | $811 | $785 |
| Information | 51 | $1,299 | $851 | $1,051 | $885 | $723 |
| Finance and insurance | 52 | $1,760 | $1,160 | $1,470 | $1,018 | $778 |
| Real estate and rental and leasing | 53 | $996 | $691 | $858 | $566 | $618 |
| Professional and technical services | 54 | $1,640 | $1,113 | $1,238 | $906 | $1,469 |
| Management of companies and enterprises | 55 | $1,878 | $1,096 | $1,426 | $1,317 | -- |
| Administrative and waste services | 56 | $869 | $637 | $649 | $814 | $306 |
| Educational services | 61 | $929 | $709 | $795 | $733 | $635 |
| Health care and social assistance | 62 | $1,091 | $961 | $1,157 | $821 | $960 |
| Arts, entertainment, and recreation | 71 | $589 | $361 | $362 | $339 | $583 |
| Accommodation and food services | 72 | $538 | $382 | $453 | $351 | $333 |
| Other services, except public administration | 81 | $794 | $632 | $703 | $610 | $472 |
| Public administration | 92 | $1,144 | -- | -- | $1,265 | $614 |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| Unclassified | 99 | $1,614 | -- | -- | -- | -- |
| | | | | | | |
| Goods-producing | 101 | $1,161 | $940 | $1,077 | $862 | $831 |
| Service-providing | 102 | $1,029 | $801 | $934 | $784 | $708 |
| | | | | | | |
| Ratio local/state average weekly wage | | | | | | |
| Total, all industries | 10 | 1.00 | 0.80 | 0.90 | 0.76 | 0.69 |
| Agriculture, forestry, fishing and hunting | 11 | 1.00 | 0.90 | 1.14 | 0.81 | 1.01 |
| Mining, quarrying, and oil and gas extraction | 21 | 1.00 | -- | -- | -- | -- |
| Utilities | 22 | 1.00 | -- | 1.22 | 0.98 | 0.98 |
| Construction | 23 | 1.00 | 0.82 | 1.02 | 0.89 | 0.76 |
| Manufacturing | 31-33 | 1.00 | 0.86 | 0.84 | 0.74 | 0.67 |
| Wholesale trade | 42 | 1.00 | 0.77 | 0.77 | 0.58 | 0.80 |
| Retail trade | 44-45 | 1.00 | 0.88 | 0.97 | 0.88 | 0.73 |
| Transportation and warehousing | 48-49 | 1.00 | 0.87 | 0.95 | 0.82 | 0.79 |
| Information | 51 | 1.00 | 0.66 | 0.81 | 0.68 | 0.56 |
| Finance and insurance | 52 | 1.00 | 0.66 | 0.84 | 0.58 | 0.44 |
| Real estate and rental and leasing | 53 | 1.00 | 0.69 | 0.86 | 0.57 | 0.62 |
| Professional and technical services | 54 | 1.00 | 0.68 | 0.75 | 0.55 | 0.90 |
| Management of companies and enterprises | 55 | 1.00 | 0.58 | 0.76 | 0.70 | -- |
| Administrative and waste services | 56 | 1.00 | 0.73 | 0.75 | 0.94 | 0.35 |
| Educational services | 61 | 1.00 | 0.76 | 0.86 | 0.79 | 0.68 |
| Health care and social assistance | 62 | 1.00 | 0.88 | 1.06 | 0.75 | 0.88 |
| Arts, entertainment, and recreation | 71 | 1.00 | 0.61 | 0.61 | 0.58 | 0.99 |
| Accommodation and food services | 72 | 1.00 | 0.71 | 0.84 | 0.65 | 0.62 |
| Other services, except public administration | 81 | 1.00 | 0.80 | 0.89 | 0.77 | 0.59 |
| Public administration | 92 | 1.00 | -- | -- | 1.11 | 0.54 |
| Unclassified | 99 | 1.00 | -- | -- | -- | -- |

| | NAICS Code [51] | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|---|
| | | | | | | |
| Goods-producing | 101 | | | | | |
| 2001 | | 1.00 | 0.86 | 0.98 | 0.70 | 1.10 |
| 2011 | | 1.00 | 0.77 | 0.89 | 0.68 | 0.99 |
| 2021 | | 1.00 | 0.81 | 0.93 | 0.74 | 0.72 |
| | | | | | | |
| Service-providing | 102 | | | | | |
| 2001 | | 1.00 | 0.81 | 0.98 | 0.75 | 0.94 |
| 2011 | | 1.00 | 0.85 | 0.95 | 0.81 | 0.74 |
| 2021 | | 1.00 | 0.78 | 0.91 | 0.76 | 0.69 |
| | | | | | | |
| Ratio goods-producing/service-providing average weekly wage | | | | | | |
| 2001 | | 1.29 | 1.37 | 1.31 | 1.21 | 1.52 |
| 2011 | | 1.31 | 1.19 | 1.23 | 1.10 | 1.76 |
| 2021 | | 1.13 | 1.17 | 1.15 | 1.10 | 1.17 |
| | | | | | | |
| Weekly Living Wage, 2020 ($)[56] | | | | | | |
| 1 adult, 0 children | | $715 | $624 | $664 | -- | -- |
| 1 adult, 1 child | | $1,392 | $1,216 | $1,329 | -- | -- |
| 1 adult, 2 children | | $1,735 | $1,492 | $1,662 | -- | -- |
| 2 adults (both working), 0 children | | $478 | $458 | $464 | -- | -- |
| 2 adults (both working), 1 child | | $766 | $678 | $734 | -- | -- |
| 2 adults (both working), 2 children | | $991 | $869 | $955 | -- | -- |

"—" indicates no data disclosed or calculated for this industry in this geography.

| | Employer | Employment Range | Employer | Employment Range |
|---|---|---|---|---|
| **LARGEST EMPLOYERS**[57] | | | | |
| Top 25 employers by average monthly employment, 2021 | Northern Light AR Gould Hospital | 501 to 1,000 | Northern Light Eastern Maine Medical Center | 3,501 to 4,000 |
| | Northern Maine Medical Center | 501 to 1,000 | Northern Light Health | 1,501 to 2,000 |
| | Wal Mart / Sam's Club | 501 to 1,000 | Hannaford Bros Co | 1,001 to 1,500 |
| | Twin Rivers Paper Company LLC | 1 to 500 | Wal Mart / Sam's Club | 1,001 to 1,500 |
| | McCain Foods USA Inc | 1 to 500 | St Joseph Hospital Inc | 501 to 1,000 |
| | Houlton Regional Hospital | 1 to 500 | Penobscot Community Health Care | 501 to 1,000 |
| | Caribou Nursing Home Inc | 1 to 500 | Bangor Savings Bank | 501 to 1,000 |
| | Maine Mutual Fire Insurance Co | 1 to 500 | Husson University | 501 to 1,000 |
| | Aroostook Mental Health Services Inc | 1 to 500 | Northern Light Acadia Hospital | 501 to 1,000 |
| | Aroostook County Action | 1 to 500 | UPS Solutions | 1 to 500 |
| | Hannaford Bros Co | 1 to 500 | Penquis C.A.P., Inc. | 1 to 500 |
| | Pineland Farms Potato Company | 1 to 500 | Production Services Of Maine LLC | 1 to 500 |
| | Maple Grove Nursing Home Inc | 1 to 500 | Lowes Home Centers LLC | 1 to 500 |
| | Community Living Association | 1 to 500 | Versant Power | 1 to 500 |
| | Louisiana Pacific Corporation | 1 to 500 | Sargent Corporation | 1 to 500 |
| | McDonalds | 1 to 500 | Dysarts Service Inc | 1 to 500 |
| | Columbia Forest Products Inc | 1 to 500 | Community Health and Counseling Svc | 1 to 500 |
| | Huber Engineered Woods LLC | 1 to 500 | Darlings | 1 to 500 |
| | Aroostook Home Health Services | 1 to 500 | General Electric Co | 1 to 500 |
| | Daigle Oil Company | 1 to 500 | Ohi | 1 to 500 |
| | Katahdin Trust Co | 1 to 500 | Wayfair Maine LLC | 1 to 500 |
| | Lowes Home Centers LLC | 1 to 500 | Target Corporation | 1 to 500 |
| | Smith & Wesson Inc | 1 to 500 | Northern Light Laboratory | 1 to 500 |
| | Pines Health Services Inc | 1 to 500 | HC Bangor LLC | 1 to 500 |
| | Paradis Shop 'N Save | 1 to 500 | Millinocket Regional Hospital | 1 to 500 |

| | Maine | Houlton ESA[58] | Millinocket ESA[59] | Patten ESA[60] |
|---|---|---|---|---|
| **RETAIL SALES[61]** | | | | |
| Total taxable retail sales, 2021 ($ thousand) | $32,474,400 | $180,696 | $60,864 | $38,219 |
| Percentage of sales to consumers | 89% | 93% | 92% | -- |
| Percentage of sales to businesses | 11% | 7% | 8% | -- |
| | | | | |
| Total taxable retail sales, 2010 ($ thousand) | $16,446,734 | $131,119 | $45,961 | $25,577 |
| Change 2010 to 2021, not adjusted for inflation | $16,027,666 | $49,577 | $14,903 | $12,642 |
| (percentage) | 97% | 38% | 32% | 49% |
| Inflation, 2010-2021 (CPI-U, nationwide) | 24% | | | |
| | | | | |
| Taxable retail sales at restaurants and lodging establishments | | | | |
| 2010 ($ thousand) | $2,672,972 | $13,248 | $9,823 | $3,403 |
| (percentage) | 16.3% | 10.1% | 21.4% | 13.3% |
| 2021 ($ thousand) | $4,766,321 | $18,104 | $13,762 | $4,402 |
| (percentage) | 14.7% | 10.0% | 22.6% | 11.5% |
| Change, 2010-21 | 78.3% | 36.7% | 40.1% | 29.4% |

"—" indicates no data disclosed for this sales category in this geography.

| | Maine | Maine Highlands[62] | |
|---|---|---|---|
| | | Value | Percentage of state* |
| **TOURISM**[63] | | | |
| Estimated annual visitors | 15,601,800 | 907,200 | 5.8% |
| Day visitors | 4,368,500 | 226,800 | 5.2% |
| Overnight visitors | 11,233,300 | 680,400 | 6.1% |
| | | | |
| Estimated visitor spending ($) | | | |
| Total | $7,853,094,700 | $538,820,900 | 6.9% |
| Lodging | $1,874,899,800 | $128,641,668 | 6.9% |
| Restaurants/food | $2,328,295,600 | $159,750,312 | 6.9% |
| Retail sales | $1,404,976,300 | $96,399,015 | 6.9% |
| Recreation | $908,595,300 | $62,341,046 | 6.9% |
| Gasoline | $982,932,100 | $67,441,484 | 6.9% |
| Other transportation | $353,395,600 | $24,247,375 | 6.9% |
| | | | |
| Estimated economic impact | | | |
| Jobs | 143,100 | 9,400 | 6.6% |
| Earnings ($) | $5,050,181,600 | $296,048,200 | 5.9% |
| Tax revenue ($) | $1,147,884,700 | $75,152,700 | 6.5% |

*Note that as data was available in aggregate only for the estimated visitor spending in the Maine Highlands, the breakout of $538.8 million total spending by categories was done with proportional analysis. As a result, the Maine Highlands' percentage of state estimated visitor spending is 6.9% across all categories.

## Appendix D: Housing

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **AGE OF HOUSING STOCK**[64] | | | | | |
| Total | 746,793 | 40,007 | 76,088 | 11,140 | 7,991 |
| 1939 or earlier | 177,985 | 8,580 | 16,547 | 2,550 | 1,130 |
| 1940-49 | 34,280 | 2,946 | 2,331 | 546 | 372 |
| 1950-59 | 53,704 | 4,551 | 6,104 | 916 | 1,316 |
| 1960-69 | 51,460 | 3,389 | 6,443 | 781 | 1,157 |
| 1970-79 | 103,247 | 6,741 | 10,803 | 1,737 | 1,644 |
| 1980-89 | 107,106 | 4,672 | 10,833 | 1,324 | 1,001 |
| 1990-99 | 91,258 | 4,310 | 9,115 | 1,466 | 544 |
| 2000-09 | 94,235 | 3,675 | 10,268 | 1,257 | 693 |
| 2010-13 | 17,456 | 758 | 1,930 | 354 | 92 |
| 2014 or later | 16,062 | 385 | 1,714 | 209 | 42 |
| | | | | | |
| Percentage of total | | | | | |
| 1939 or earlier | 24% | 21% | 22% | 23% | 14% |
| 1940-49 | 5% | 7% | 3% | 5% | 5% |
| 1950-59 | 7% | 11% | 8% | 8% | 16% |
| 1960-69 | 7% | 8% | 8% | 7% | 14% |
| 1970-79 | 14% | 17% | 14% | 16% | 21% |
| 1980-89 | 14% | 12% | 14% | 12% | 13% |
| 1990-99 | 12% | 11% | 12% | 13% | 7% |
| 2000-09 | 13% | 9% | 13% | 11% | 9% |
| 2010-13 | 2% | 2% | 3% | 3% | 1% |
| 2014 or later | 2% | 1% | 2% | 2% | 1% |
| | | | | | |
| Before 1950 | 28% | 29% | 25% | 28% | 19% |
| 1950-1990 | 42% | 48% | 45% | 43% | 64% |
| Since 1990 | 29% | 23% | 30% | 29% | 17% |

WORKING DRAFT - NOT FOR DISTRIBUTION

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| | | | | | |
| **OCCUPANCY**[65] | | | | | |
| Total housing units | 746,793 | 40,007 | 76,088 | 11,140 | 7,991 |
| Occupied housing units | 569,551 | 29,594 | 63,073 | 7,502 | 4,698 |
| Vacant housing units | 177,242 | 10,413 | 13,015 | 3,638 | 3,293 |
| Occupancy rate | 76.3% | 74.0% | 82.9% | 67.3% | 58.8% |
| Vacancy rate | 23.7% | 26.0% | 17.1% | 32.7% | 41.2% |
| | | | | | |
| **HOMEOWNERSHIP**[66] | | | | | |
| 2021 | | | | | |
| Median home price ($) | $295,000 | $122,000 | $200,000 | $115,000 | $109,000 |
| Median income ($) | $63,427 | $42,713 | $52,150 | $40,779 | $41,103 |
| Income needed to afford median home price ($) | $79,201 | $34,383 | $55,594 | $32,548 | $30,647 |
| Household able to afford median home | 38.4% | 58.8% | 47.1% | 59.6% | 62.0% |
| Households unable to afford median home | 61.6% | 41.2% | 52.9% | 40.4% | 38.0% |
| | | | | | |
| 2010 | | | | | |
| Median home price ($) | $165,000 | $82,250 | $125,000 | $71,150 | $47,000 |
| Median income ($) | $48,405 | $36,429 | $43,337 | $34,070 | $35,157 |
| Income needed to afford median home price ($) | $55,282 | $28,547 | $42,469 | $24,830 | $16,153 |
| Household able to afford median home | 42.5% | 60.3% | 50.6% | 62.6% | 78.2% |
| Households unable to afford median home | 57.5% | 39.7% | 49.4% | 37.4% | 21.8% |
| | | | | | |
| **RENTALS**[67] | | | | | |
| 2020 | | | | *(2017)*[68] | |
| Median 2-bedroom rent ($) | $1,088 | $846 | $1,017 | $617 | $703 |
| Renter household median income ($) | $38,231 | $29,261 | $33,675 | $24,333 | $27,465 |
| Income needed to afford 2-bedroom rent ($) | $43,517 | $33,858 | $40,694 | $24,696 | $28,131 |
| Households able to afford median 2-bedroom rent | 45.0% | 44.1% | 43.0% | 49.2% | 48.9% |

WORKING DRAFT - NOT FOR DISTRIBUTION

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| Households unable to afford median 2-bedroom rent | 55.0% | 55.9% | 57.0% | 50.8% | 51.1% |
| | | | | | |
| 2010 | | | | | |
| Average 2-bedroom rent ($) | $814 | $657 | $818 | $618 | $548 |
| Renter household median income ($) | $30,571 | $24,262 | $27,470 | $22,604 | $21,085 |
| Income needed to afford 2-bedroom rent ($) | $32,560 | $26,275 | $32,710 | $24,720 | $21,921 |
| Households able to afford average 2-bedroom rent | 47.0% | 46.8% | 42.1% | 46.0% | 48.2% |
| Households unable to afford average 2-bedroom rent | 53.0% | 53.2% | 57.9% | 54.0% | 51.8% |

WORKING DRAFT - NOT FOR DISTRIBUTION

## Appendix E: Public Health

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| **HEALTH INSURANCE**[69] | | | | | |
| Total civilian noninstitutionalized population | 1,325,025 | 66,151 | 149,991 | 17,696 | 9,776 |
| Insured | 92.4% | 91.6% | 91.7% | 88.2% | 92.4% |
| Uninsured | 7.6% | 8.4% | 8.3% | 11.8% | 7.6% |
| | | | | | |
| **HEALTH RISK FACTORS**[70] | | | | | |
| Percentage of adults who are current smokers | 19% | 22% | 20% | -- | -- |
| Percentage of adults who are obese | 31% | 38% | 35% | -- | -- |
| | | | | | |
| **HEALTH CONDITIONS** (age adjusted per 100,000 population) | | | | | |
| Cancer rates (See right for year)[71] | *2016-2018* | *2016-2018* | *2016-2018* | | |
| All cancers | 473.2 | 460.2 | 525.2* | -- | -- |
| | | *2015-2017* | *2015-2017* | | |
| Brain and other nervous system tumors | Not Avail. | 14.0 | 14.4 | -- | -- |
| Colon and rectum cancer | 36.5 | 48.6* | 39.0 | -- | -- |
| Female breast cancer | 126.8 | 124.8 | 123.3 | -- | -- |
| Lung and bronchus cancer | 71.1 | 77.8 | 79.8 | -- | -- |
| Prostate cancer | 90.4 | 83.1 | 109.7* | -- | -- |
| Tobacco-related cancers | Not Avail. | 142.9 | 143.8 | -- | -- |
| Urinary bladder cancer | 26.7 | 26.0 | 27.4 | -- | -- |
| | | | | | |
| Cancer rates 2008-10[72] | | | | | |
| All cancers | 496.6 | 476.7 | 529.7* | -- | -- |
| Brain and other nervous system tumors | 15.3 | 15.1 | 17.8 | -- | -- |
| Colon and rectum cancer | 43.1 | 52.5 | 46.7 | -- | -- |
| Female breast cancer | 124.5 | 98.9 | 131.8 | -- | -- |
| Lung and bronchus cancer | 76.2 | 84.1 | 92.2* | -- | -- |
| Prostate cancer | 129.3 | 106.4 | 129.5 | -- | -- |

WORKING DRAFT - NOT FOR DISTRIBUTION

| | Maine | Aroostook County | Penobscot County | Houlton LMA | Millinocket LMA |
|---|---|---|---|---|---|
| Tobacco-related cancers | 90.5 | 92.8 | 91.5 | -- | -- |
| Urinary bladder cancer | 27.5 | -- | -- | -- | -- |
| | | | | | |
| Change in cancer rates 2008-10 to 2016-2018 or 2015-2017 | *2016-2018* | *2015-2017* | *2015-2017* | | |
| All cancers | -4.7% | -3.5% | -0.8% | -- | -- |
| Brain and other nervous system tumors | -- | -7.3% | -19.1% | -- | -- |
| Colon and rectum cancer | -19.3% | -7.4% | -16.5% | -- | -- |
| Female breast cancer | -0.2% | +26.2% | -6.4% | -- | -- |
| Lung and bronchus cancer | -9.3% | -7.5% | -13.4% | -- | -- |
| Prostate cancer | -24.1% | -21.9% | -15.3% | -- | -- |
| Tobacco-related cancers | -- | +54.0% | +57.2% | -- | -- |
| Urinary bladder cancer | -8.4% | -- | -- | -- | -- |
| | | | | | |
| Diabetes death rates[73] | | | | | |
| 2006-10 | 21.30 | 22.90 | 23.70 | -- | -- |
| 2012-16 | 22.00 | 27.10 | 26.60 | -- | -- |
| Change 2006-10 to 2012-16 | +3.3% | +18.3% | +12.2% | -- | -- |
| | | | | | |
| Coronary heart disease death rates[74] | | | | | |
| 2006-10 | 102.1 | 122.3 | 116.2 | -- | -- |
| 2012-16 | 84.1 | 106.3 | 96.6 | -- | -- |
| Change 2006-10 to 2012-16 | -17.6% | -13.1% | -16.9% | -- | -- |
| Stroke death rates[75] | | | | | |
| 2006-10 | 38.6 | 39.2 | 43.3 | -- | -- |
| 2012-16 | 33.4 | 35.4 | 35.6 | -- | -- |
| Change 2006-10 to 2012-16 | -13.5% | -9.7% | -17.8% | -- | -- |

*Indicates the difference between the county and state rates is statistically significant.

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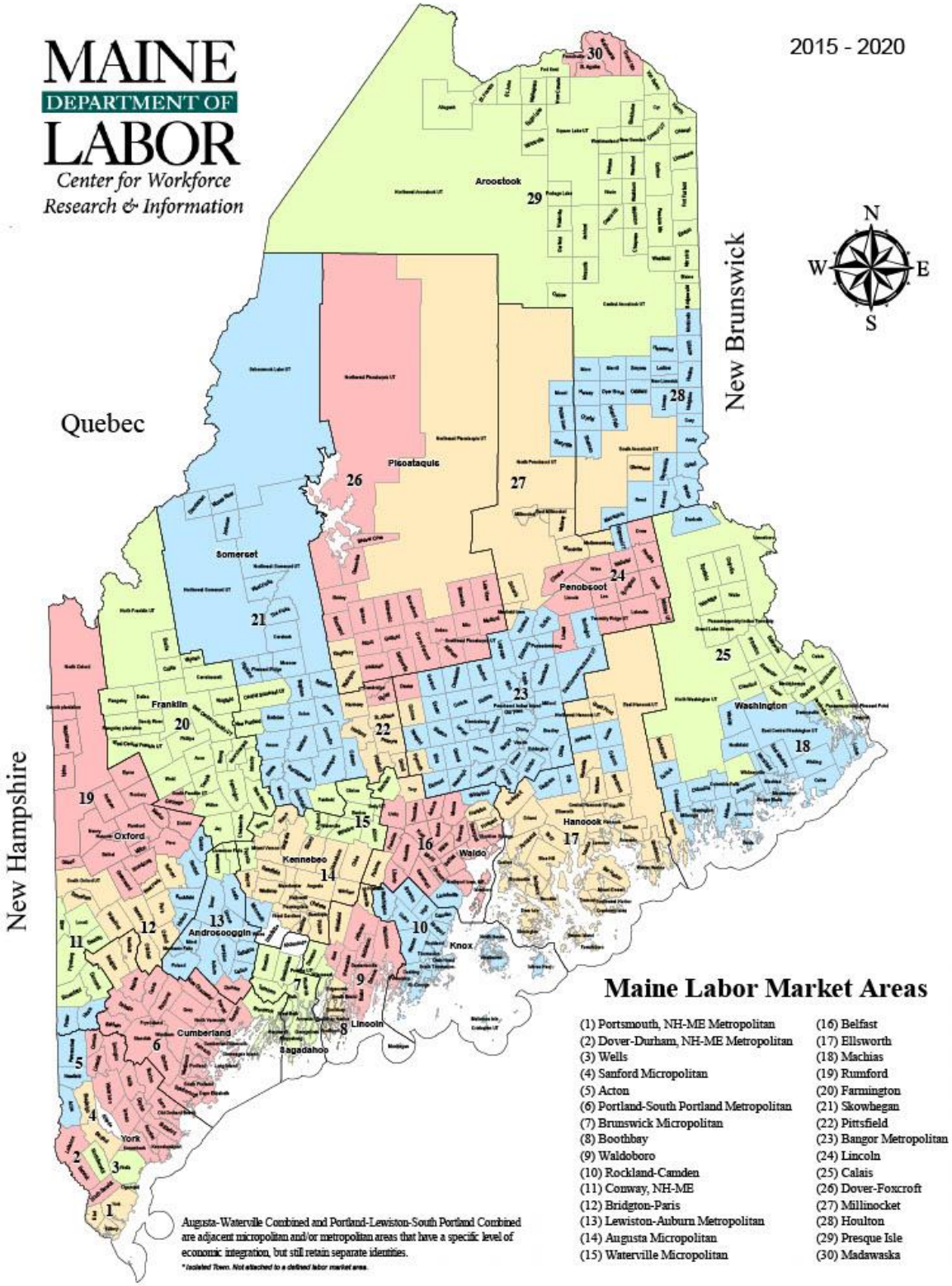
## Appendix F: Labor Market Area Map



## Appendix G: RIMS II Multipliers

The Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS II) provides multipliers for 406 detailed industries and 62 aggregate industries, defined by the North American Industry Classification System (NAICS). For this report we derived multipliers for the combined two-county economic region of Aroostook and Penobscot counties. To estimate the change in final demand generated by the Project to the region economy, one must first exclude the amount of spending that occurs outside of the region.

*Change in Final Demand = Total Spending * (% of Spending Within Economic Region)*

The RIMS II multipliers are based on analyses of inter-industry linkages that track how revenues and expenditures in one industry relate to other industries and estimate the total change in economic activity across all industries in the region resulting from an initial change in economic activity from the project. For instance, the RIMS II output multiplier for construction in the economic region (Aroostook and Penobscot counties) is 1.59, meaning that a $1 increase in final demand for construction services increases output across all industries in the region by $1.59. The following equation summarizes that relationship.

*Change in Final Demand from Project * RIMS II Output Multiplier = Total Economic Impact for Output*

RIMS II jobs multipliers represent the number of part- and full-time jobs created across all industries from a $1 million increase in final demand in one industry. For instance, the RIMS II jobs multiplier for construction in the economic region is 10.67. That means that a $1 million increase in final demand for farm products increases employment in Cumberland County by the equivalent of 10.67 jobs.

*Change in Final Demand from Project/$1m * RIMS II Jobs Multiplier = Total Economic Impact in Jobs*

More information can be found here: https://www.bea.gov/resources/methodologies/RIMSII-user-guide

## Appendix H: Economic Impact Methodology

The following steps were taken to derive the economic impact related to employment, earnings, output, and value-added.

1. First, Wolfden's estimated budget expenses were extracted from their financial model. The financial model includes more than a dozen linked spreadsheets and 150 separate budget line items with descriptions.

2. For each budget line item, Wolfden then estimated the portion of each expense line expected to be spent on materials and labor, and the portion expected to be purchased from businesses within the economic region. The regional percentage was estimated separately for materials and labor.

3. Purchases within the economic region for each budget line item were then derived by multiplying the total line item expense by the percentage expected to be purchased within the region, weighted by materials and labor.

   *Regional Purchase by Line Item = Projected Expense by Line Item * (% Materials * % Materials Purchased in Region + % Labor * % Labor Purchased in Region)*

4. Based on the descriptions of the expense, each line item expense was then mapped to the appropriate RIMS II industry and the corresponding multipliers. Line item expenses were then summarized by RIMS II industry.

   *Regional Purchases by Industry = Sum of Regional Purchases by Line Item*

5. For several industries, while the purchase is expected to be made from a business within the economic region, the underlying commodity is not produced in Maine. For example, of the $3 million projected to be spent on manufactured drill bits, $1.5 million is expected to be purchased from regional businesses; but roughly $1.1 million (77%) of that is estimated to be the value for production of the drill bits which happens outside of the region. Therefore, only $0.4 million – the portion of spending that goes to transportation and wholesale margins for selling drill bits within the economic region – is included in the economic impact analysis below.

   For these industries, national input-output tables[76] are used to exclude the production value of the purchase; that is, only the transportation, wholesale and retail trade margins are included. This has the effect of substantially reducing the economic impact within the region. These expenses were then mapped to the wholesale trade RIMS II multipliers.

| RIMS II Industry | % Excluded Production Value | % Included Transportation, Wholesale and Retail Margin |
|---|---|---|
| **Machinery manufacturing** | 77% | 23% |
| **Fabricated metal product manufacturing** | 88% | 12% |
| **Plastics and rubber products manufacturing** | 81% | 19% |
| **Electrical equipment, appliance, and component manufacturing** | 74% | 26% |
| **Computer and electronic product manufacturing** | 86% | 14% |
| **Industrial gas manufacturing** | 78% | 22% |

*Adjusted Regional Purchases by Industry = Regional Purchases by Industry * (1-% Excluded Production Value)*

6. The total spending by industry was then multiplied by the RIMS II multiplier for each industry, resulting in the total economic impact including direct, indirect, and induced impacts.

   *Total Economic Impact = Adjusted Regional Purchases by Industry * RIMS II Industry Multiplier*

   Spending by year was further summarized into two time periods: "start-up," which includes the two years prior to the project's operations; and "operations," which includes ten years operations and two years of closure (twelve years in all).

   In terms of output, RIMS II defines earnings as consisting of wages and salaries and of proprietors' income, which is the net earnings of sole-proprietors and partnerships and includes employer contributions for health insurance. Output is defined as total business sales. Employment includes both full- and part-time jobs.

## Appendix I: Budget Line Items to Industries, with Local Consumption Assumptions

The table below provides more details on the inputs to the economic model. It maps 125 budget items to the specific Maine industries used in the RIMS II economic model. (The costs in the table are aggregated to the category level for reasons of confidentiality.) The table also displays the assumptions about local consumption for equipment and labor costs, by line item. These assumptions were supplied by Wolfden based on their expectations of sourcing materials and labor locally and provide a range of the plausible percentage of equipment and labor that the Project intends to procure locally for each category of spending. The difference between the lower and upper bounds of the range is roughly 20%. The upper value is used in the economic modeling. See Table 28 in the body of this report for estimates of the economic impact based on a low and high estimate of local procurement.

| **Project Category** | **Spending** | **Final RIMS II Industry Used in Economic Model** | **Description** | **Detailed Description** | Est. **%** Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| **Capital Expenses, per cash flow model** | | | | | | |
| **Infrastructure** | $20,112,000 | Construction | **Buildings earthworks** | General earthworks for building construction (Foundation prep) | 80-100% | 80-100% |
| | | | **Dry facility** | Building complex with working clothes area, civilian clothes area and showers for mining and concentrator employees | 0% | 80-100% |
| | | | **Effluent pond** | Clean water is stored in this pond and tested to confirm quality prior to discharging to the environment via diffusers | 80-100% | 80-100% |
| | | | **Main Access Road (Expand logging road)** | Expand sections of the access roadway to provide safe passage for delivery and smaller vehicles. | 80-100% | 80-100% |
| | | | **Main operations pad prep** | Site grading and contouring to support access to various infrastructure | 80-100% | 80-100% |
| | | | **Office buildings** | Building complex with working clothes area, civilian clothes area and showers for mining and concentrator employees | 0% | 80-100% |
| | | | **Ore Pad/Temp Stockpile** | Storage pad construction to ensure impacted water is collected. Various pads required for ore, waste rock, and organics storages. | 80-100% | 80-100% |
| | | | **Pad construction** | Storage pad construction to ensure impacted water is collected. Various pads required for ore, waste rock, and organics storages. | 80-100% | 80-100% |
| | | | **Parking** | Parking area for employee and visitor vehicles | 80-100% | 80-100% |
| | | | **Potable Water System** | Water system required for water potability (Toilets, sinks, showers). Not drinking water. | 80-100% | 80-100% |
| | | | **Septic System** | Septic system for employee and visitor waste | 80-100% | 80-100% |
| | | | **Shop Facility** | Shop building and bridge crane for servicing and maintaining mobile equipment (Surface) | 80-100% | 80-100% |
| | | | **Waste dump Construction (Acid Generating)** | Storage pad construction to ensure impacted water is collected. Various pads required for ore, waste rock, and organics storages. | 80-100% | 80-100% |

| Project Category | Spending | Final RIMS II Industry Used in Economic Model | Description | Detailed Description | Est. % Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| | | | **Waste dump Construction (Clean)** | Storage pad construction to ensure impacted water is collected. Various pads required for ore, waste rock, and organics storages. | 80-100% | 80-100% |
| | | Utilities | **Emera Power Transition** | Electrical power supply with 6MW capacity from Houlton to site | 80-100% | 80-100% |
| | | | **Fuel storage** | Fuel storage | 80-100% | 80-100% |
| | | | **Power distribution** | Electrical power transformation and distribution from the 6MW supply to individual infrastructure around the project. | 80-100% | 80-100% |
| | | Wholesale trade | **Propane** | Prepare storage facility (General heating fuel) | 80-100% | 80-100% |
| **Mill** | $34,581,000 | Construction | **Coating & Sealants (@ 1%)** | Coating in flotation cells pump tanks, grinding mills, etc. | 80-100% | 80-100% |
| | | | **Concrete (@ 10%)** | Foundation work for concentrator components | 80-100% | 80-100% |
| | | | **Electrical (@ 12%)** | Electrical distribution within the concentrator | 80-100% | 80-100% |
| | | | **Installation Labor (@ 70%)** | Fitting labor (Generally millwrights, electricians, mechanics, steel fitters, welders, etc..) | 0% | 56-70% |
| | | | **Instrumentation (@ 7%)** | Instrumentation including reagent dosing, throughput and grade feedback, moisture feedback of the material, human machine interface, remote reporting, etc. | 80-100% | 56-70% |
| | | | **Insulation (@ 3%)** | Insulation | 80-100% | 80-100% |
| | | | **Mill Building** | Concentrator building | 80-100% | 80-100% |
| | | | **Piping (@ 30%)** | Plumbing throughout the concentrator | 80-100% | 80-100% |
| | | | **Process Water Treatment** | Process water conditioning used to ensure efficient circulation of concentrator discharge water to intake. | 0% | 40-50% |
| | | | **Structural Steel (@ 10%)** | Steel structures for supporting components, flooring, etc. | 80-100% | 80-100% |
| | | Wholesale trade | **Equipment** | Specialized milling equipment (Grinding mills, floatation cells, froth pumps etc.) | 0% | 0% |
| **Mine Equipment Leasing and Remanufacturing** | $17,252,300 | Wholesale trade | **Light Service Vehicle / Utility Boom Truck** | Light vehicles and service vehicles to support mining operations | 80-100% | 0% |
| **Mine Facilities and Equipment** | $17,189,000 | Construction | **Cemented Backfill Plant** | Standard concrete mixing station within a building and on a concrete pad. | 80-100% | 80-100% |
| | | | **Engineering & Geology Equipment** | Survey equipment, ventilation equipment, environmental equipment | 80-100% | 80-100% |
| | | | **Explosives & Detonators Magazines Construction & Equipping** | Underground explosives magazine (Excavation and room construction) | 80-100% | 16-20% |
| | | | **Fueling Station (Marcotte)** | Underground fueling station (Excavation and room construction) | 0% | 16-20% |
| | | | **Hoisting plant system** | Large steel building to support vertical hoisting of rocks from underground | 0% | 40-50% |
| | | | **Main Dewatering Sump Construction & Equipping** | Underground dewatering sumps (Excavations, construction, and plumbing) | 80-100% | 16-20% |

| Project Category | Spending | Final RIMS II Industry Used in Economic Model | Description | Detailed Description | Est. % Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| | | | **Main Storage Area Construction & Equipping** | Underground storage area (Excavation and construction and stocking) | 80-100% | 16-20% |
| | | | **Maintenance Breakdown Shop** | Shop excavation and bridge crane for servicing and maintaining mobile equipment (Underground) | 80-100% | 16-20% |
| | | | **Mine Portal** | Excavation and securing the mine entrance (Portal) | 0% | 0-10% |
| | | | **Mob, Setup & Demob** | All contracts and supplies mobilization to and from site. | 20-25% | 10-33% |
| | | | **Portable Toilets** | Portapotti type toilets with removable and replaceable storage pods. | 80-100% | 16-20% |
| | | | **Refuge Station Construction & Equipping** | Underground refuge location (Excavation, construction). Used in case of fire underground for safe retreat of workforce | 80-100% | 16-20% |
| | | Support activities for mining | **Backfill Distribution System** | Distribution from the backfill plant to underground | 80-100% | 16-20% |
| | | | **Explosives Magazines (Supplier Provided)** | Temporary explosives storage typically supplied by the explosives supplier and federally regulated. | 80-100% | 0% |
| | | Wholesale trade | **Compressors** | Machines supply compressed air to both mine and concentrator. | 80-100% | 0% |
| | | | **Computers, Peripherals & Software** | Computer hardware and software | 80-100% | 80-100% |
| | | | **Exhaust Ventilation Fans Installations** | Main ventilation fans to supply all fresh air into the mine workings | 0% | 40-50% |
| | | | **Mine Air Heaters** | Main heating system to manage mine temperature during cold months (Typically propane fired) | 0% | 80-100% |
| | | | **Mine Communication** | Communication link to site, and throughout site and underground | 0% | 16-20% |
| | | | **Mine Lamps** | Headlamps used by miners to provide lighting underground | 0% | 0% |
| | | | **Mine Rescue and Fire Fighting Equipment** | BG4/SCBA or similar as well as general firefighting equipment and vehicle | 0% | 0% |
| | | | **Portable Substations** | Substations used for transforming power voltage (Typically from 4160v to 454v or 600v) | 80-100% | 16-20% |
| | | | **Surface Intake Vent Fan Installation** | Main ventilation fans to supply all fresh air into the mine workings | 0% | 80-100% |
| | | | **Underground Booster Fans & Auxiliary Ventilation** | Smaller auxiliary fans to force clean air into dead end drifts and tunnels | 0% | 40-50% |
| **Owners Indirect** | $6,333,000 | Accommodation | **Travel** | Employee travel for training, conference, etc.. | 0% | 0% |
| | | Construction | **Road and Yard Maintenance** | General contract maintenance. Snow removal etc. | 80-100% | 80-100% |
| | | Households | **G&A** | Admin and technical employment | 0% | 0% |
| | | Utilities | **Power** | Power consumption | 80-100% | 0% |
| | | Wholesale trade | **Mine Air Heating** | Propane consumption | 80-100% | 80-100% |
| **Reclamation and Closure** | $5,004,500 | Construction | **Mine Backfill** | Placing final bits of waste rock material back underground into voids | 80-100% | 80-100% |
| | | | **Revegetation** | Mulching, haying, seeding, planting, and promoting regrowth of vegetation post closure | 80-100% | 80-100% |

| Project Category | Spending | Final RIMS II Industry Used in Economic Model | Description | Detailed Description | Est. % Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| | | Waste management and remediation services | **Mine Building Removal** | Demolition and sale/removal of building and associated materials | 80-100% | 80-100% |
| **Surface Mobile Equipment** | $1,000,000 | Wholesale trade | **Front end loader / zoom boom purchase** | Loader and forklifts for receiving and moving materials onsite, clearing snow, etc.. | 80-100% | |
| **Tailings Storage Facility** | $13,672,200 | Construction | **Earthworks and liners** | Construction of a 2-3' thick clay liner, seepage collection system and HDPE liner. (Similar design to landfills) | 80-87% | 80-87% |
| **Underground Development** | $87,423,500 | Households | **Manpower Year 3 On** | Hired labor, supervision and management | | 64-80% |
| | | Support activities for mining | **Explosives & Accessories** | Ammonium Nitrate Fuel Oil. Typical explosives in mining and quarrying. | 180-100% | |
| | | | **Manpower before Year 3** | Contract mining and milling while continued workforce training | | 8-10% |
| | | Wholesale trade | **Drilling Bits & Steel** | metal drill bits used to bore through dirt and rock | 40-50% | 0% |
| | | | **Electrical Power** | Electrical cabling and components (Junction boxes etc..) | 80-100% | 0% |
| | | | **Equipment Leasing Cost** | Leasing costs for major mining equipment. Scoops, trucks, drills, bolters, etc. | 0% | 0% |
| | | | **Equipment Operating** | Maintenance supplies and replacement parts for operating equipment | 80-100% | 0% |
| | | | **Ground Support (Rebar, mesh screen, 3/4 cables)** | Fabricated rebar and screen mesh, chain, d rings, etc. | 0% | 0% |
| | | | **Services Infrastructure** | Piping, hangers, communications, etc. | 80-100% | 0% |
| | | | **Ventilation** | Ventilation tubing used for carrying clean air to the face for workers. | 0% | 0% |
| **Operating Expenses, per cash flow model** | | | | | | |
| **Dry Stack Placement of Tailings** | $5,424,800 | Construction | **Earthworks and liners** | placing tailings on the tailing's facility. Truck, loader, and roller compactor | 80-87% | 80-87% |
| **Environmental and Sustainable Development ($/t)** | $15,957,400 | Construction | **Environmental and Sustainable Development ($/t)** | (blank) | 0% | 80-100% |
| **General and Administration** | $33,230,000 | Accommodation | **Travel & Accommodations** | Travel & Accommodations | 0% | 0% |
| | | Administrative and support services | **Cleaning contract** | Cleaning contract | 80-100% | 80-100% |
| | | | **Roads and Yards Maintenance** | Roads and Yards Maintenance | 0% | 80-100% |
| | | Construction | **Buildings Maintenance** | Buildings Maintenance | 80-100% | 0% |
| | | | **Office Equipment Leases** | Office Equipment Leases | 80-100% | 0% |
| | | | **Safety Equipment** | Safety Equipment | 64-80% | 16-20% |
| | | General merchandise stores | **Computer Supplies** | Computer Supplies | 80-100% | 0% |

| Project Category | Spending | Final RIMS II Industry Used in Economic Model | Description | Detailed Description | Est. % Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| | | | **Office Supplies** | Office Supplies | 80-100% | 0% |
| | | Households | **Government Relations** | Government Relations | 0% | 40-50% |
| | | | **Salaries & Overhead** | Salaried employees | 0% | 32-40% |
| | | | **Surface ITC** | (blank) | 0% | 80-100% |
| | | | **Training** | In house training (not including miner and mill operator training courses) | 0% | 0% |
| | | Professional, scientific, and technical services | **Communications** | Communications | 40-50% | 40-50% |
| | | | **Consultants & Vendors** | Consultants & Vendors | 0% | 50% |
| | | | **Dues & Subscriptions** | Dues & Subscriptions | 80-100% | 80-100% |
| | | | **Human Resources** | Human Resources | 0% | 80-100% |
| | | | **Insurance** | Insurance | 0% | 80-100% |
| | | | **Legal and Accounting** | Legal and Accounting | 0% | 40-50% |
| | | | **Marketing** | Marketing | 0% | 40-50% |
| | | | **Public Relations** | **Public Relations** | 80-100% | 80-100% |
| | | Securities, commodity contracts, and other financial investments and related activities | **Bank Costs** | Bank Costs | 0% | 80-100% |
| | | Truck transportation | **Light Vehicles Operation** | Light Vehicles Operation | 80-100% | 0% |
| | | | **Shipping, Courier and light freight** | Shipping, Courier, and light freight | 0% | 80-100% |
| | | Utilities* | **Power** | Power | 80-100% | 0% |
| | | Wholesale trade | **Electrical Distribution Repair** | Electrical Distribution Repair | 80-100% | 80-100% |
| | | | **Medical, Health & Safety** | (blank) | 80-100% | 0% |
| | | | **Security Supplies** | Security Supplies | 80-100% | 0% |
| | | | **Water Supply & Water Treatment** | Water Supply & Water Treatment | 40-50% | 64-80% |
| **Haulage to Concentrator** | $23,784,700 | Construction | **(blank)** | (blank) | 40-50% | 80-100% |
| **Surface Services ($/t)** | $11,000,000 | Households | **Surface Services ($/t)** | Surface labor incl general construction work, cleaning staff, etc. | 0% | 80-100% |
| **Processing** | $130,627,900 | Construction | **Equipment Operation** | General pumps and tanks maintenance and operation | 40-50% | 0% |
| | | | **Sundry Items** | Sundry Items | 80-100% | 0% |

| Project Category | Spending | Final RIMS II Industry Used in Economic Model | Description | Detailed Description | Est. % Equipment Spend in Economic Region | Est. % Labor Spend in Economic Region |
|---|---|---|---|---|---|---|
| | | | **Supplies** | General pumps and tanks maintenance and operation | 0% | 0% |
| | | | **Tailings Dewatering** | Tailings thickener and filter press to remove water from tailings | 40-50% | 64-80% |
| | | Households | **Administration** | Admin labor | 0% | 64-80% |
| | | | **Labor** | Labor operating all sections of the concentrator | 0% | 50-75% |
| **Underground Mining** | $199,531,000 | Construction | **Backfill** | Transporting and placement of backfill material to underground voids | 80-100% | 80-100% |
| | | Households | **Longhole Blasting** | Explosives and labor related to loading and blasting ore tonnes | 80-100% | 80-100% |
| | | | **Longhole Drilling Manpower** | drillers related to drilling and blasting ore tonnes | 0% | 80-100% |
| | | | **Services Manpower** | manpower for installing pipe and cable and ventilation and coms, etc.… | 0% | 50-75% |
| | | Utilities* | **Electrical Power** | Electrical supply to underground | 80-100% | 0% |
| | | Wholesale trade | **Cable Bolting** | Drilling and installation of long steel cables into the top of underground openings for ground support. Making safe work environments | 40-50% | 0% |
| | | | **Haul Truck** | Servicing and maintenance of material handlings fleet | 20-25% | 80-100% |
| | | | **Heating Costs** | Propane consumption | 80-100% | 0% |
| | | | **Longhole Drilling Operating Costs** | drilling supplies related to drilling and blasting ore tonnes | 50% | 80-100% |
| | | | **Services Equipment** | Plumbing throughout the mine | 80-100% | 0% |
| | | | **Stope Development** | Equipment, tooling and supplies used for developing drifts (tunneling) | 40-50% | 0% |
| | | | **Stope Mucking** | Servicing and maintenance of material handlings fleet | 20-25% | 80-100% |
| **Total** | $622,123,300 | | | | | |

## Appendix J: Estimate of Direct Costs by LUPC Jurisdiction

| | Total | In Region | In LUPC Jurisdiction | % in LUPC (of total) | % in LUPC (of region) |
|---|---|---|---|---|---|
| **Capex** | $202,567,400 | $91,935,200 | $57,067,900 | 28% | 62% |
| **Underground Development** | $87,423,500 | $33,486,400 | $33,486,400 | 38% | 100% |
| **Mill** | $34,581,000 | $17,546,900 | $0 | 0% | 0% |
| **Infrastructure** | $20,112,000 | $17,255,900 | $14,702,100 | 73% | 85% |
| **Mine Equipment Leasing and Remanufacturing** | $17,252,300 | $154,000 | $154,000 | 1% | 100% |
| **Mine Facilities and Equipment** | $17,189,000 | $5,394,800 | $5,394,800 | 31% | 100% |
| **Tailings Storage Facility** | $13,672,200 | $11,894,800 | $0 | 0% | 0% |
| **Owners Indirect** | $6,333,000 | $970,400 | $414,600 | 7% | 43% |
| **Reclamation and Closure** | $5,004,500 | $5,004,500 | $2,802,200 | 56% | 56% |
| **Surface Mobile Equipment** | $1,000,000 | $227,500 | $113,800 | 11% | 50% |
| **Opex** | $419,555,800 | $247,793,000 | $175,316,600 | 42% | 71% |
| **Underground Mining** | $199,531,000 | $134,405,500 | $134,405,500 | 67% | 100% |
| **Processing** | $130,627,900 | $48,251,900 | $0 | 0% | 0% |
| **General and Administration** | $33,230,000 | $14,590,800 | $7,295,400 | 22% | 50% |
| **Haulage to Concentrator** | $23,784,700 | $21,406,300 | $21,406,300 | 90% | 100% |
| **Environmental and Sustainable Development ($/t)** | $15,957,400 | $15,957,400 | $7,978,700 | 50% | 50% |
| **Surface Services ($/t)** | $11,000,000 | $8,461,500 | $4,230,800 | 38% | 50% |
| **Dry Stack Placement of Tailings** | $5,424,800 | $4,719,600 | $0 | 0% | 0% |
| **Grand Total** | $622,123,200 | $339,728,200 | $232,384,500 | 37% | 68% |

## Appendix K: Economic Impact by Phase

***Economic Impact – Start-up (first 2 years)***

| | | Total Regional Spending | Output | Earnings | Job-Years |
|---|---|---|---|---|---|
| | Construction | $34,583,300 | $55,118,900 | $17,353,900 | 370 |
| | Wholesale trade | $1,866,900 | $2,705,900 | $666,100 | 10 |
| **1** | Total Investment Expenditures | $36,450,200 | $57,824,700 | $18,020,000 | 380 |
| | | | | | |
| **1a** | Project Employee Earnings (Households) | $2,065,200 | $1,537,500 | $467,800 | 10 |
| | Utilities | $8,629,700 | $11,796,800 | $2,160,000 | 30 |
| | Support activities for mining | $3,703,700 | $5,399,600 | $1,567,000 | 30 |
| | Professional services | $0 | $0 | $0 | 0 |
| | Waste management | $3,426,100 | $5,143,900 | $1,261,100 | 30 |
| | Truck transportation | $0 | $0 | $0 | 0 |
| | Administrative and support services | $0 | $0 | $0 | 0 |
| | General merchandise stores | $0 | $0 | $0 | 0 |
| | Financial investments and related | $0 | $0 | $0 | 0 |
| **2** | **Total Intermediate Expenditures** | $17,824,600 | $23,877,800 | $5,455,900 | 100 |
| | | | | | |
| **3** | **Regional Impact (1+2)** | $54,274,800 | $81,702,500 | $23,475,900 | 490 |
| | | | | | |
| **4** | Non-Regional Spending – Investment Expenditures | $35,649,500 | | | |
| **5** | Non-Regional Spending - Intermediate Expenditures | $19,496,800 | | | |
| **6** | **Total Project Spending (3+4+5)** | $109,421,100 | | | |
| | | | | | |
| **7** | Initial Spending on Intermediate Expenditures (2+5) | | $37,321,400 | | |
| **8** | Initial Wages to Project Employees (1a) | | | $2,065,200 | |
| **9** | Initial Project Job-Years (projections) | | | | 30 |
| | | | Output | Earnings | Job-years |
| **10** | **Total Impact (3+7+8+9)** | | $119,024,000 | $25,541,100 | 510 |
| **11** | Implied Multiplier | | 1.1 | 0.2 | 4.6 |

***Economic Impact – Operations (12 years)***

| | | Total Regional Spending | Output | Earnings | Job-Years |
|---|---|---|---|---|---|
| | Construction | $130,147,300 | $207,428,800 | $65,307,900 | 1,390 |
| | Wholesale trade | $7,677,700 | $11,128,100 | $2,739,400 | 50 |
| **1** | **Total Investment Expenditures** | $137,825,100 | $218,557,000 | $68,047,400 | 1,440 |
| | | | | | |
| **1a** | Project Employee Earnings (Households) | $116,826,200 | $86,977,100 | $26,461,100 | 710 |
| | Utilities | $16,956,400 | $23,179,400 | $4,244,200 | 60 |
| | Support activities for mining | $7,895,700 | $11,511,200 | $3,340,700 | 70 |
| | Professional services | $4,450,000 | $6,723,500 | $2,603,700 | 50 |
| | Waste management | $0 | $0 | $0 | 0 |
| | Truck transportation | $550,000 | $898,200 | $269,600 | 10 |
| | Administrative and support services | $500,000 | $783,100 | $299,600 | 10 |
| | General merchandise stores | $350,000 | $515,700 | $156,000 | 10 |
| | Financial investments and related | $100,000 | $156,000 | $56,100 | 0 |
| **2** | **Total Intermediate Expenditures** | $147,628,400 | $130,744,300 | $37,431,000 | 920 |
| | | | | | |
| **3** | **Regional Impact (1+2)** | $285,453,400 | $349,301,100 | $105,478,300 | 2,360 |
| | | | | | |
| **4** | Non-Regional Spending – Investment Expenditures | $128,679,000 | | | |
| **5** | Non-Regional Spending - Intermediate Expenditures | $98,569,800 | | | |
| **6** | **Total Project Spending (3+4+5)** | $512,702,200 | | | |
| | | | | | |
| **7** | Initial Spending on Intermediate Expenditures (2+5) | | $246,198,200 | | |
| **8** | Initial Wages to Project Employees (1a) | | | $116,826,200 | |
| **9** | Initial Project Job-Years (projections) | | | | 1,670 |
| | | | Output | Earnings | Job-years |
| **10** | **Total Impact (3+7+8+9)** | | $595,499,300 | $222,304,500 | 4,030 |
| **11** | Implied Multiplier | | 1.2 | 0.4 | 7.9 |

***Total Economic Impact, All Years***

| | | Total Regional Spending | Output | Earnings | Job-Years |
|---|---|---|---|---|---|
| | Construction | $164,730,700 | $262,547,700 | $82,661,800 | 1,760 |
| | Wholesale trade | $9,544,600 | $13,834,000 | $3,405,500 | 60 |
| **1** | **Total Investment Expenditures** | $174,275,300 | $276,381,700 | $86,067,400 | 1,820 |
| | | | | | |
| **1a** | Project Employee Earnings (Households) | $118,891,400 | $88,514,600 | $26,928,900 | 730 |
| | Utilities | $25,586,100 | $34,976,200 | $6,404,200 | 100 |
| | Support activities for mining | $11,599,400 | $16,910,800 | $4,907,700 | 100 |
| | Professional services | $4,450,000 | $6,723,500 | $2,603,700 | 50 |
| | Waste management | $3,426,100 | $5,143,900 | $1,261,100 | 30 |
| | Truck transportation | $550,000 | $898,200 | $269,600 | 10 |
| | Administrative and support services | $500,000 | $783,100 | $299,600 | 10 |
| | General merchandise stores | $350,000 | $515,700 | $156,000 | 10 |
| | Financial investments and related | $100,000 | $156,000 | $56,100 | 0 |
| **2** | **Total Intermediate Expenditures** | **$165,453,000** | **$154,622,100** | **$42,886,900** | **1,020** |
| | | | | | |
| **3** | **Regional Impact (1+2)** | **$339,728,300** | **$431,003,800** | **$128,954,300** | **2,840** |
| | | | | | |
| **4** | Non-Regional Spending – Investment Expenditures | $164,329,600 | | | |
| **5** | Non-Regional Spending - Intermediate Expenditures | $118,065,300 | | | |
| **6** | **Total Project Spending (3+4+5)** | $622,123,200 | | | |
| | | | | | |
| **7** | Initial Spending on Intermediate Expenditures (2+5) | | $283,518,400 | | |
| **8** | Initial Wages to Project Employees (1a) | | | $118,891,400 | |
| **9** | Initial Project Job-Years (projections) | | | | 1,700 |
| | | | *Output* | *Earnings* | *Job-years* |
| **10** | **Total Impact (3+7+8+9)** | | $714,522,200 | $247,845,700 | 4,540 |
| **11** | Implied Multiplier | | 1.1 | 0.4 | 7.3 |

## Appendix L: Job-years by Project Phase

| | Start-up | Operations | Total |
|---|---|---|---|
| **Agriculture, forestry, fishing and hunting** | 0 | 20 | 20 |
| **Mining, quarrying, and oil and gas extraction** | 290 | 1,470 | 1,760 |
| **Utilities*** | 10 | 30 | 40 |
| **Construction** | 220 | 840 | 1,070 |
| **Durable goods manufacturing** | 10 | 50 | 60 |
| **Nondurable goods manufacturing** | 0 | 20 | 20 |
| **Wholesale trade** | 10 | 70 | 80 |
| **Retail trade** | 50 | 320 | 370 |
| **Transportation and warehousing*** | 10 | 60 | 70 |
| **Information** | 0 | 20 | 30 |
| **Finance and insurance** | 0 | 30 | 40 |
| **Real estate and rental and leasing** | 20 | 160 | 180 |
| **Professional, scientific, and technical services** | 10 | 80 | 90 |
| **Management of companies and enterprises** | 0 | 10 | 20 |
| **Administrative and support and waste management and remediation services** | 30 | 60 | 90 |
| **Educational services** | 10 | 50 | 60 |
| **Health care and social assistance** | 30 | 260 | 280 |
| **Arts, entertainment, and recreation** | 0 | 20 | 20 |
| **Accommodation** | 0 | 20 | 20 |
| **Food services and drinking places** | 10 | 110 | 130 |
| **Other services*** | 10 | 80 | 90 |
| **Total** | 720 | 3,780 | 4,540 |

## Appendix M: Comparison of cash-flow summary to economic input estimates

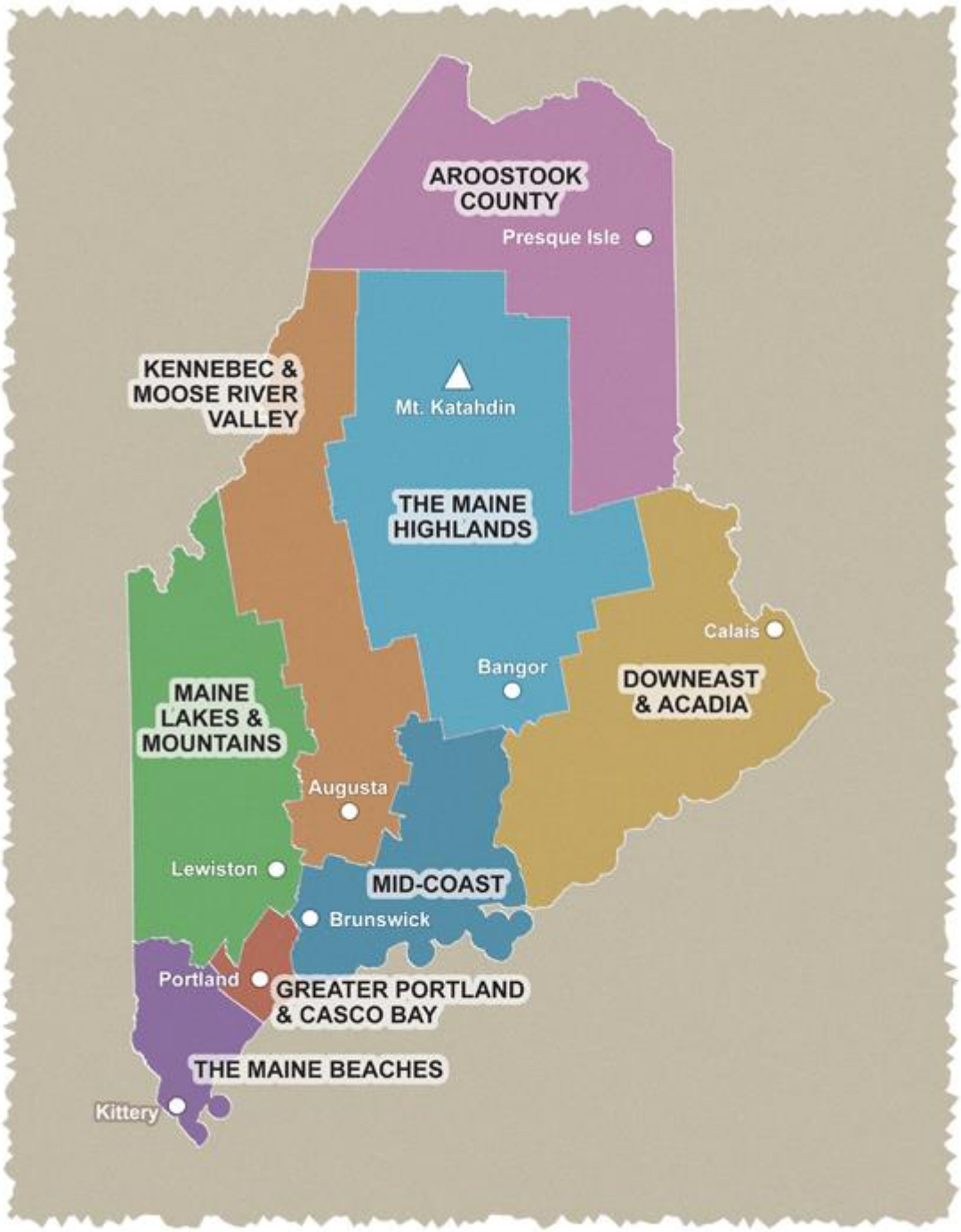
The table below reconciles the Project's expenses reported in the updated Preliminary Economic Assessment (PEA) petition (Exhibit 10) with the expenses used as inputs to the economic model in this report. Expenses related to working capital, contingency spending, and reclamation were excluded from the economic model because they have not yet been committed to specific purposes. The Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS II) provides multipliers for 406 industries.

| | Start-up | Operations | Total |
|---|---|---|---|
| **OPERATING COSTS – WOLFDEN CASH FLOW** | | | |
| Underground Mining | $196,437,800 | $199,531,000 | $196,437,800 |
| Processing | $128,602,900 | $130,627,900 | $128,602,900 |
| Dry Stack Placement of Tailings | $5,340,700 | $5,424,800 | $5,340,700 |
| Surface Services | $10,000,000 | $11,000,000 | $10,000,000 |
| General and Administration | $23,416,000 | $23,784,700 | $23,416,000 |
| Environmental and Sustainable Development | $33,230,000 | $33,230,000 | $33,230,000 |
| **TOTAL OPERATING COSTS** | **$6,811,000** | **$412,744,800** | **$419,555,800** |
| **CAPITAL EXPENDITURES – WOLFDEN CASH FLOW** | | | |
| Underground Development | $21,435,700 | $65,987,800 | $87,423,500 |
| Mine Facilities and Equipment | $10,167,500 | $7,021,500 | $17,189,000 |
| Mine Equipment Leasing and Remanufacturing | $1,974,900 | $15,277,500 | $17,252,300 |
| Infrastructure | $20,112,000 | $0 | $20,112,000 |
| Surface Mobile Equipment | $1,000,000 | $0 | $1,000,000 |
| Tailings Storage Facility | $2,001,500 | $11,670,700 | $13,672,200 |
| Build and equip mill | $34,581,000 | $0 | $34,581,000 |
| Owners Indirects | $6,333,000 | $0 | $6,333,000 |
| Financial Assurance Trust-Reclamation and Closure | $13,684,600 | $0 | $13,684,600 |
| Working Capital | $12,417,000 | -$12,417,000 | $0 |

| | Start-up | Operations | Total |
|---|---|---|---|
| Contingency @ 20% | $24,741,400 | $0 | $24,741,400 |
| **TOTAL CAPITAL EXPENDITURES** | **$148,448,500** | **$87,540,400** | **$235,988,900** |
| **TOTAL ALL EXPENSES** | **$155,259,600** | **$500,285,200** | **$655,544,700** |
| **EXCLUDED FROM ECONOMIC MODEL (subtract from above)** | | | |
| Working Capital | $12,417,000 | -$12,417,000 | $0 |
| Contingency @ 20% (summarized separately) | $24,741,400 | $0 | $24,741,400 |
| Reclamation not committed | $8,680,100 | $0 | $8,680,100 |
| **TOTAL EXPENSES EXCLUDED FROM MODEL** | **$45,838,500** | **-$12,417,000** | **$33,421,500** |
| **TOTAL EXPENSES, ECONOMIC MODEL** | **$109,421,100** | **$512,702,200** | **$622,123,200** |

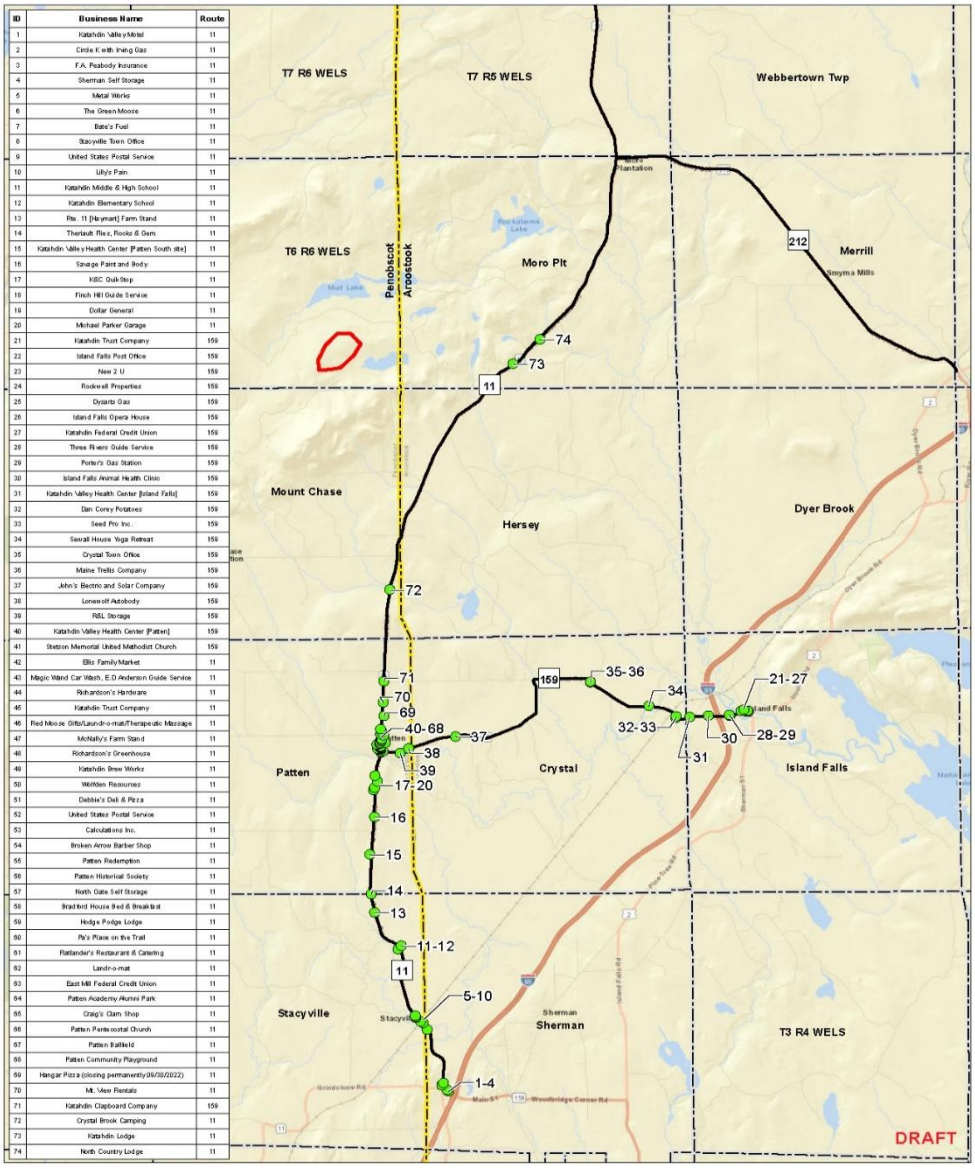
## Appendix N: Map of Maine Tourism Regions

*From Maine Department of Transportation at exploremaine.org*



# Appendix O: Map of Businesses Along Transportation Routes

| ID | Business Name | Route |
|---|---|---|
| 1 | Katahdin Valley Motel | 11 |
| 2 | Circle K with Irving Gas | 11 |
| 3 | F.A. Peabody Insurance | 11 |
| 4 | Sherman Self Storage | 11 |
| 5 | Metal Works | 11 |
| 6 | The Green Moose | 11 |
| 7 | Bate's Fuel | 11 |
| 8 | Stacyville Town Office | 11 |
| 9 | United States Postal Service | 11 |
| 10 | Lilly's Pain | 11 |
| 11 | Katahdin Middle & High School | 11 |
| 12 | Katahdin Elementary School | 11 |
| 13 | Rte. 11 [Heyman] Farm Stand | 11 |
| 14 | Thertault Flies, Rocks & Gem | 11 |
| 15 | Katahdin Valley Health Center [Patten South site] | 11 |
| 16 | Savage Paint and Body | 11 |
| 17 | KBC Quik Stop | 11 |
| 18 | Finch Hill Guide Service | 11 |
| 19 | Dollar General | 11 |
| 20 | Michael Parker Garage | 11 |
| 21 | Katahdin Trust Company | 159 |
| 22 | Island Falls Post Office | 159 |
| 23 | New 2 U | 159 |
| 24 | Rockwell Properties | 159 |
| 25 | Dysarts Gas | 159 |
| 26 | Island Falls Opera House | 159 |
| 27 | Katahdin Federal Credit Union | 159 |
| 28 | Three Rivers Guide Service | 159 |
| 29 | Porter's Gas Station | 159 |
| 30 | Island Falls Animal Health Clinic | 159 |
| 31 | Katahdin Valley Health Center [Island Falls] | 159 |
| 32 | Dan Corey Potatoes | 159 |
| 33 | Seed Pro Inc. | 159 |
| 34 | Sewall House Yoga Retreat | 159 |
| 35 | Crystal Town Office | 159 |
| 36 | Maine Trellis Company | 159 |
| 37 | John's Electric and Solar Company | 159 |
| 38 | Lonewolf Autobody | 159 |
| 39 | RBL Storage | 159 |
| 40 | Katahdin Valley Health Center [Patten] | 159 |
| 41 | Stetson Memorial United Methodist Church | 159 |
| 42 | Ellis Family Market | 11 |
| 43 | Magic Wand Car Wash, E.D Anderson Guide Service | 11 |
| 44 | Richardson's Hardware | 11 |
| 45 | Katahdin Trust Company | 11 |
| 46 | Red Moose Gifts/Laundro-mat/Therapeutic Massage | 11 |
| 47 | McNally's Farm Stand | 11 |
| 48 | Richardson's Greenhouse | 11 |
| 49 | Katahdin Brew Works | 11 |
| 50 | Wolfden Resources | 11 |
| 51 | Debbie's Deli & Pizza | 11 |
| 52 | United States Postal Service | 11 |
| 53 | Calculations Inc. | 11 |
| 54 | Broken Arrow Barber Shop | 11 |
| 55 | Patten Redemption | 11 |
| 56 | Patten Historical Society | 11 |
| 57 | North Gate Self Storage | 11 |
| 58 | Bradford House Bed & Breakfast | 11 |
| 59 | Hodge Podge Lodge | 11 |
| 60 | Pa's Place on the Trail | 11 |
| 61 | Rattlander's Restaurant & Catering | 11 |
| 62 | Landro-mat | 11 |
| 63 | East Mill Federal Credit Union | 11 |
| 64 | Patten Academy Alumni Park | 11 |
| 65 | Craig's Clam Shop | 11 |
| 66 | Patten Pentecostal Church | 11 |
| 67 | Patten Ballfield | 11 |
| 68 | Patten Community Playground | 11 |
| 69 | Hangar Pizza (closing permanently 09/30/2022) | 11 |
| 70 | Mt. View Rentals | 11 |
| 71 | Katahdin Clapboard Company | 159 |
| 72 | Crystal Brook Camping | 11 |
| 73 | Katahdin Lodge | 11 |
| 74 | North Country Lodge | 11 |



Legend
- Business Location
- Transportation Corridor
- Approximate Pickett Mountain Project Area
- County Boundary
- Town Boundary

0 2.5 5 Miles
(At original document size of 11x17)
1:150,000

Stantec

Project Location
Aroostook County, Maine

Prepared by MM on 2022-10-13
IR Review by KH on 2022-10-13

Client/Project
Wolfden Resources Corporation
Pickett Mountain Metallic Mine Project

Figure No.
1

DRAFT

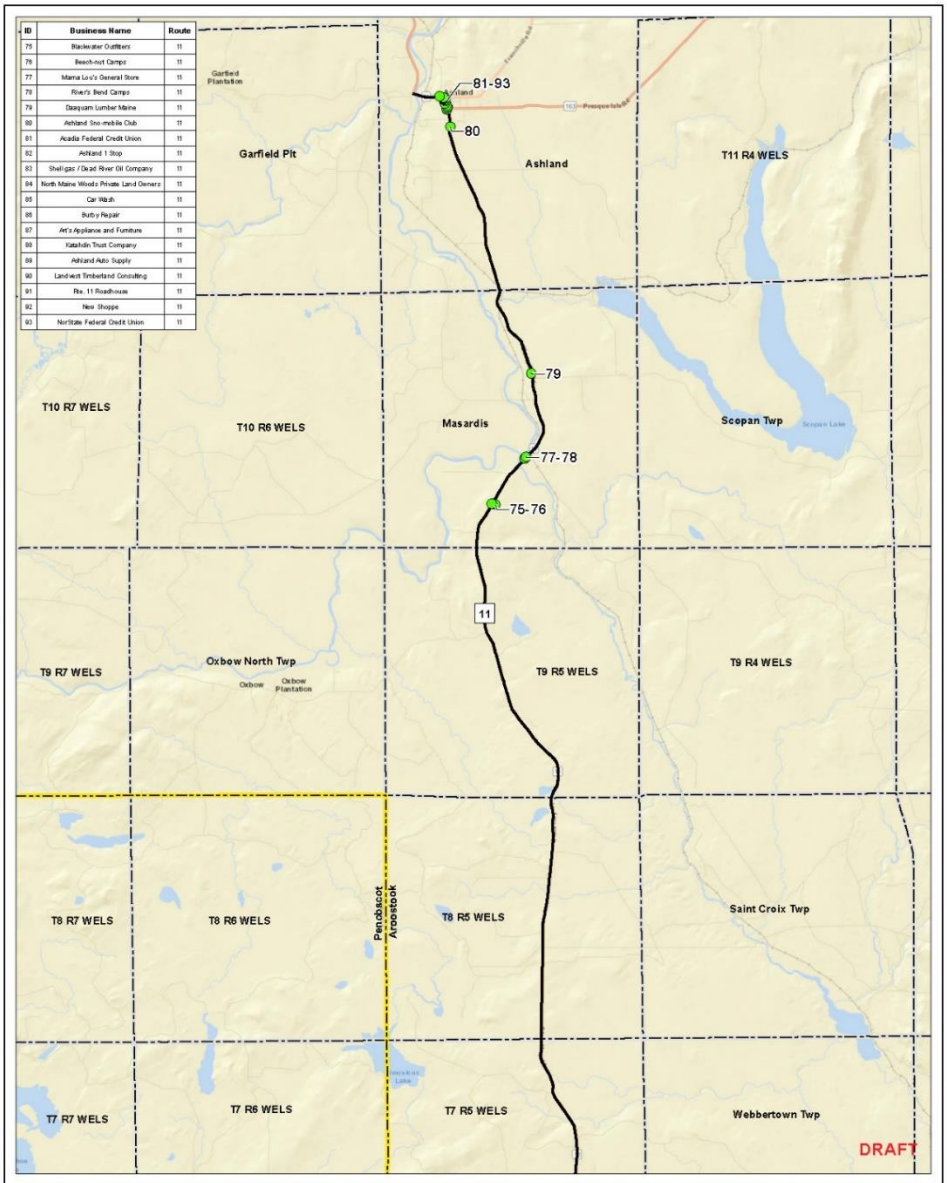
Title
**Businesses Along Pickett Transportation Corridor**

Page 1 of 2

Notes
1. Coordinate System: NAD 1983 UTM Zone 19N
2. Data Sources: Wolfden, Maine GIS
3. Background: ESRI World Street Map

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

| ID | Business Name | Route |
|---|---|---|
| 75 | Blackwater Outfitters | 11 |
| 76 | Beech-nut Camps | 11 |
| 77 | Mama Lou's General Store | 11 |
| 78 | River's Bend Camps | 11 |
| 79 | Daaquam Lumber Maine | 11 |
| 80 | Ashland Sno-mobile Club | 11 |
| 81 | Acadia Federal Credit Union | 11 |
| 82 | Ashland 1 Stop | 11 |
| 83 | Shell/gas / Dead River Oil Company | 11 |
| 84 | North Maine Woods Private Land Owners | 11 |
| 85 | Car Wash | 11 |
| 86 | Burby Repair | 11 |
| 87 | Art's Appliance and Furniture | 11 |
| 88 | Katahdin Trust Company | 11 |
| 89 | Ashland Auto Supply | 11 |
| 90 | Landwert Timberland Consulting | 11 |
| 91 | Rte. 11 Roadhouse | 11 |
| 92 | New Shoppe | 11 |
| 93 | Northstate Federal Credit Union | 11 |



Legend
- Business Location
- Transportation Corridor
- Approximate Pickett Mountain Project Area
- County Boundary
- Town Boundary

Notes
1. Coordinate System: NAD 1983 UTM Zone 19N
2. Data Sources: Wolfden, Maine GIS
3. Background: ESRI World Street Map

0 2.5 5 Mile
(At original document size of 11x17)
1:150,000

N

Stantec

Project Location
Aroostook County, Maine

Prepared by MM on 2022-10-13
IR Review by KK on 2022-10-13

Client/Project
195602317
Wolfden Resources Corporation
Pickett Mountain Metallic Mine Project

Figure No.
1

DRAFT

Title
**Businesses Along Pickett Transportation Corridor**

Page 2 of 2

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# ENDNOTES

[1] Two economic development districts are nearby: Northern Maine Development Commission serves all of Aroostook and Washington counties and several towns in Penobscot County, including Houlton and Patten; Eastern Maine Development Commission serves towns in Penobscot, Piscataquis, Hancock, and Waldo counties, including Millinocket.
[2] U.S. Census Bureau, Geography Division, TIGER/Geographic Identification Code Scheme.
[3] The median age is the age at which half an area's residents are older and half are younger. For the HLMA and MLMA, median age is estimated as the population-weighted average of the median age of the towns in the region.
[4] Houlton Band of Maliseet Indians, http://maliseets.net, accessed June 16, 2022.
[5] The U.S. Census Bureau defines a household as all people who occupy the same housing unit, regardless of their relationship; the members of a family occupy the same housing unit and are related by marriage, birth, or adoption.
[6] Amy K. Glasmeier, Living Wage Calculator, Massachusetts Institute of Technology, 2020. The weekly living wage assumes full-time work and is calculated by multiplying the hourly living wage by 40. Average weekly wages calculated by the Maine Department of Labor do not control for number of hours worked.
[7] These combined areas align closely with the combined Houlton and Millinocket LMAs. See Appendix F for additional detail.
[8] Maine Department of Administrative and Financial Services, Maine Revenue Service, Sales Tax Reports, accessed June 12, 2022.
[9] The Houlton Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Amity, Bancroft, Danforth, Eaton, Forest City, Glenwood, Hammond Plantation, Haynesville, Hodgdon, Houlton, Linneus, Littleton, Ludlow, Macwachoc Plantation, Molunkus Township, Monticello, New Limerick, Orient, Reed Plantation, Selden, Weston, and Wytopitlock.
[10] The Millinocket Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of East Millinocket, Grindstone, Medway, Millinocket, West Seboeis, and Woodville.
[11] The Patten Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Benedicta, Crystal, Dyer Brook, Hersey, Island Falls, Merrill, Monarda, Moro Plantation, Oakfield, Patten, Sherman, Shin Pond, Silver Ridge Township, Smyrna, Smyrna Mills, and Stacyville.
[12] Maine Department of Economic and Community Development, Maine Office of Tourism, "Maine Highlands 2021 Economic Impact and Visitor Tracking Report," 2022.
[13] Maine Department of Economic and Community Development, Maine Office of Tourism, "Maine Highlands 2021 Economic Impact and Visitor Tracking Report," 2022. Accessed at https://motpartners.com/wp-content/uploads/2022/04/Maine-Highlands-2021-Economic-Impact-and-Visitor-Tracking-Report-FINAL.pdf.
[14] Maine Department of Administrative and Financial Services, Maine Revenue Service, Sales Tax Reports, accessed June 12, 2022.
[15] The Houlton Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Amity, Bancroft, Cary Plantation, Danforth, Eaton, Forest City, Glenwood, Hammond Plantation, Haynesville, Hodgdon, Houlton, Linneus, Littleton, Ludlow, Macwachoc Plantation, Molunkus Township, Monticello, New Limerick, Orient, Reed Plantation, Selden, Weston, and Wytopitlock.
[16] The Millinocket Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of East Millinocket, Grindstone, Medway, Millinocket, West Seboeis, and Woodville.
[17] The Patten Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Benedicta, Crystal, Dyer Brook, Hersey, Island Falls, Merrill, Monarda, Moro Plantation, Oakfield, Patten, Sherman, Shin Pond, Silver Ridge Township, Smyrna, Smyrna Mills, and Stacyville.
[18] Ian Hathaway, Jessica Leahy, and Mindy Crandall, The Economic Contribution of Snowmobiling. Forest Resources Student Scholarship (2). 2020. Available at:
https://digitalcommons.library.umaine.edu/sfr_studentpub/2
[19] A series of documents are available from the Governor's Task Force on All-Terrain Vehicle Trail Initiatives. Available at: https://www.maine.gov/ifw/atv-snowmobile/atv/governors_task_force.html

[20] Jonathon Rubin and Charles Morris, Economic Contributions of ATV-Related Activity in Maine. Articles (1). 2005.
[21] Town of Millinocket, 2021.
[22] Maine Department of Agriculture, Conservation, and Forestry, available here: https://www.maine.gov/dacf/municipalplanning/docs/2012_service_centers_large.pdf
[23] Land Use Planning Commission, https://www.maine.gov/dacf/lupc/projects/location_of_development/AdjacencyConcepts_April2019_Adopted.pdf
[24] U.S. Bureau of Economic Analysis, Regional Input Output Model System Users Guide, page 3-3; see https://www.bea.gov/resources/methodologies/RIMSII-user-guide
[25] The RIMS II methodology does not match the definition that A-Z Mining Professionals Inc. uses in listing capital expenses and operating expenses. To be consistent with the RIMS II methodology, each budget line was classified as construction and investment or operations.
[26] Maine Department of Economic and Community Development, Maine Office of Tourism, "Regional Insights 2019: Maine Highlands," 2020.
[27] Ian Hathaway, Jessica Leahy, and Mindy Crandall, The Economic Contribution of Snowmobiling. Forest Resources Student Scholarship (2). 2020. Available at: https://digitalcommons.library.umaine.edu/sfr_studentpub/2
[28] Jonathon Rubin and Charles Morris, Economic Contributions of ATV-Related Activity in Maine. Articles (1). 2005.
[29] U.S. Census Bureau, Decennial Censuses, 1970-2020, and American Community Survey (ACS), 2016-2020. Note that in 2019, Cary Plantation in Aroostook County reported a population of 291. By the 2020 Census, Cary Plantation had disorganized as a town. While Cary Plantation's population is still included in the Maine and Aroostook County numbers, for the purposes of year-over-year comparison, the population of 291 is adjusted into the Houlton LMA population total for 2020.
[30] U.S. Census Bureau, Geography Division, TIGER/Geographic Identification Code Scheme.
[31] U.S. Census Bureau, American Community Survey (ACS), 2016-2020 five-year average.
[32] U.S. Census Bureau, Decennial Census, 2020.
[33] U.S. Census Bureau, American Community Survey (ACS), 2016-2020 five-year average.
[34] Ibid.
[35] Ibid.
[36] Ibid.
[37] U.S. Census Bureau, ACS, 2006-2010 five-year average.
[38] Maine Department of Labor, Local Area Unemployment Statistics, 2021.
[39] Ibid.
[40] Ibid.
[41] Ibid.
[42] U.S. Census Bureau, American Community Survey (ACS), 2016-2020 five-year estimate.
[43] U.S. Census Bureau, ACS, 2011-2015 five-year estimate. This is the earliest year for which the ACS reports this statistic.
[44] U.S. Census Bureau, American Community Survey (ACS), 2016-2020 five-year estimate.
[45] Maine Department of Labor, Local Area Unemployment Statistics, 2021.
[46] Ibid.
[47] U.S. Census Bureau, American Community Survey (ACS), 2016-2020 five-year estimate.
[48] Ibid.
[49] Ibid.
[50] Ibid.
[51] North American Industry Classification System
[52] U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW), 2021.
[53] Ibid.
[54] 2001 is the earliest year for which LMA-level occupation QCEW is available from the Maine Department of Labor.
[55] U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW), 2021.

[56] Amy K. Glasmeier, Living Wage Calculator, Massachusetts Institute of Technology, 2020. The weekly living wage assumes full-time work and is calculated by multiplying the hourly living wage by 40.
[57] Maine Department of Labor, Center for Workforce Research and Information, "Top 25 Private Employers in Maine by Average Monthly Employment by County (2021 Annual)", accessed June 12, 2022.
[58] The Houlton Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Amity, Bancroft, Cary Plantation, Danforth, Eaton, Forest City, Glenwood, Hammond Plantation, Haynesville, Hodgdon, Houlton, Linneus, Littleton, Ludlow, Macwachoc Plantation, Molunkus Township, Monticello, New Limerick, Orient, Reed Plantation, Selden, Weston, and Wytopitlock.
[59] The Millinocket Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of East Millinocket, Grindstone, Medway, Millinocket, West Seboeis, and Woodville.
[60] The Patten Economic Summary Area (ESA) as defined by Maine Revenue Services, includes the towns of Benedicta, Crystal, Dyer Brook, Hersey, Island Falls, Merrill, Monarda, Moro Plantation, Oakfield, Patten, Sherman, Shin Pond, Silver Ridge Township, Smyrna, Smyrna Mills, and Stacyville.
[61] Maine Department of Administrative and Financial Services, Maine Revenue Service, Sales Tax Reports, accessed June 12, 2022.
[62] Maine Office of Tourism designated region, encompasses Penobscot and Piscataquis counties.
[63] Maine Department of Economic and Community Development, Maine Office of Tourism, "2019 Annual Report," "Regional Insights 2019: Maine Highlands," "2019 Maine Office of Tourism Highlights," 2020.
[64] U.S. Census Bureau, American Community Survey, 2016-2020 five-year average.
[65] Ibid.
[66] MaineHousing, 2021 Homeownership Housing Facts and Affordability Index for Maine, https://www.mainehousing.org/policy-research/housing-data/housing-affordability-indexes, accessed June 13, 2022.
[67] MaineHousing, 2020 Rental Housing Facts and Affordability Index for Maine, https://www.mainehousing.org/policy-research/housing-data/housing-affordability-indexes, accessed June 13, 2022.
[68] 2017 is the most recent year for which MaineHousing has data for Houlton LMA. For 2017, MaineHousing used average 2-bedroom rent, rather than median.
[69] U.S. Census Bureau, American Community Survey, 2016-2020 five-year average.
[70] University of Wisconsin Population Health Institute, 2022 County Health Rankings, data for 2019 (smoking) and 2019 (obesity). Municipal data not published.
[71] Maine DHHS, Maine CDC, *The Maine 2020 Annual Report of Cancer*, March 28, 2021, 2013-2017 data for brain and other nervous system tumors, 2015-2017 for all others, municipal data not published.
[72] Maine DHHS, Maine CDC, *Maine Annual Report of Cancer 2013*, September 2013, 2006-2010 data for brain and other nervous system tumors, 2008-2010 for all others, county-level urinary bladder cancer data not published, municipal data not published.
[73] Maine Department of Health and Human Services (DHHS), Maine Center of Disease Control (CDC) and Prevention, Maine Diabetes Prevention and Control Program.
[74] Ibid.
[75] Ibid.
[76] U.S. Bureau of Economic Analysis, Input-Output Commodity Composition of Intermediate Purchases by Mining (except oil and gas); Table F - Composition of Intermediate Inputs.

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 10-B: Research Productivity Council Report

**CONFIDENTIAL**

# Final Report

## Static Acid Rock Drainage (ARD) Testing; Wolfden Resources Corp.

**Reference No.: MIS-J10082**

Prepared for:

Mr. Jeremy Ouellette
Wolfden Resources Corp.
1100 Russel Street
Thunder Bay, ON  P7B 5N2

April 16, 2021

Prepared by:

Neri Botha, P.Eng.
Extractive Metallurgist
Minerals & Industrial Services

Reviewed by:

Leo Cheung, P.Eng.
Department Head
Minerals & Industrial Services

## INTRODUCTION

Wolfden Resources Corp. initiated a study at RPC to conduct static Acid Rock Drainage (ARD) test work. The Pickett Mountain property is being investigated by Wolfden Resources Corp. to look at ways of expanding current operations.

RPC was thus contacted to conduct static testing as follows:

- Acid Base Accounting (ABA by Modified Sobek method)
- Multi-Element Assay of Solids
- Sulphur and Carbon Speciation

This report serves to summarize the findings as well as recommendations for the way forward.

## PROGRAM RESULTS

### Sample Preparation

Seven samples were received in preparation for the static testing and are listed in Table 1. Each of the samples were dried, crushed to 80 % passing 5 mm and split into sub-samples for ABA, multi-element assay and sulfur and carbon speciation analyses.

**Table 1**
**Wolfden Samples Received**

| Sample ID | Mass (kg) |
|---|---|
| ABA - 001 | 2.10 |
| ABA - 002 | 2.95 |
| ABA - 003 | 2.20 |
| ABA - 004 | 2.30 |
| ABA - 005 | 2.25 |
| ABA - 006 | 2.85 |
| ABA - 007 | 2.90 |

### Acid Rock Drainage (ARD) Static Analyses and Sulphur and Carbon Speciation Results

The results from sulfur and carbon speciation analyses and acid-base accounting (utilizing the Modified Sobek method) on the 7 samples (see Table 1) are given in Table 2.

**Table 2**
**Acid Base Accounting Results on Wolfden Samples**

| Sample ID | Paste pH | Total Sulfur | Sulfate† (as S) | Sulfide | Carbon Total Inorganic | Carbon Total | Acid Production Potential | Neutralizing Potential pH 8.3 | Net NP pH 8.3 | NP/AP |
|---|---|---|---|---|---|---|---|---|---|---|
| | | % | % | % | % | % | Kg $CaCO_3$/tonne | | | |
| ABA-001 | 9.5 | 0.124 | 0.009 | 0.114 | 0.15 | 0.21 | 3.8 | 17.4 | 13.6 | 4.6 |
| ABA-002 | 9.4 | 0.021 | 0.005 | 0.016 | < 0.01 | < 0.01 | 0.5 | 5.5 | 5.0 | 11.0 |
| ABA-003 | 8.3 | 2.70 | 0.008 | 2.69 | < 0.01 | < 0.01 | 84.1 | 1.7 | -82.4 | 0.0 |
| ABA-004 | 9.7 | 0.262 | 0.002 | 0.260 | < 0.01 | 0.02 | 8.1 | 3.7 | -4.4 | 0.5 |
| ABA-005 | 9.7 | 0.085 | 0.002 | 0.083 | 0.05 | 0.07 | 2.6 | 8.5 | 5.9 | 3.3 |
| ABA-006 | 8.9 | 0.926 | 0.003 | 0.923 | 0.05 | 0.08 | 28.8 | 7.7 | -21.2 | 0.3 |
| ABA-007 | 9.3 | 0.005 | 0.003 | 0.002 | 0.01 | 0.04 | 0.1 | 8.2 | 8.1 | 131 |

† Acid soluble, non-volatile sulfur species (sulfate (as S)).
Sulfide was determined as the difference between Total Sulfur and Sulfate (as S).

The Total Inorganic Carbon analyses seen in Table 2 indicated that the inorganic carbon content was low over all 7 samples (ranging from <0.01 % to 0.15 % in the Wolfden samples). In addition, the Total Sulfur contents of the 7 samples were also relatively low (see Table 2), ranging from 0.005 % to 2.70 % in the ABA-003 sample.

As seen from Table 2, four of the Wolfden samples obtained positive Net Neutralizing Potential values with NP/AP ratio values (ratio between Neutralizing Potential and Acid Production Potential) above 2.0. This indicated that these specific samples were not net acid producers. On three of the Wolfden samples the Net Neutralizing Potential values were negative, and the NP/AP ratio was less than 1.0, indicating that these were potentially acid producing. These samples were as follows:

- ABA-003
- ABA-004
- ABA-006

It is recommended that a specialized consultant be contacted for the full MEND Report 1.20.1 analysis and interpretation prior to follow up with the regulatory agent.

Multi-Element Assay of Solids Results

Whole rock analyses as well as ICP multi-element analyses were conducted with the results reported in Table 3 to Table 4.

**Table 3**
**ICP Multi-Element Analyses Results on Wolfden Samples**

| **Sample ID:** | | | **ABA-001** | **ABA-002** | **ABA-003** | **ABA-004** | **ABA-005** | **ABA-006** | **ABA-007** |
|---|---|---|---|---|---|---|---|---|---|
| **Analytes** | **Units** | **RL** | | | | | | | |
| Aluminium | mg/kg | 1 | 80900 | 96200 | 37300 | 58700 | 74800 | 61800 | 75900 |
| Antimony | mg/kg | 0.1 | 2.4 | 2.7 | 11.5 | 7.5 | 4.7 | 8.4 | 3.6 |
| Arsenic | mg/kg | 1 | 2 | 10 | 32 | 5 | 2 | 7 | 10 |
| Barium | mg/kg | 1 | 1995 | 283 | 980 | 190 | 730 | 901 | 112 |
| Beryllium | mg/kg | 0.1 | 2.5 | 1.2 | 1.3 | 1.4 | 2.3 | 2.0 | 0.6 |
| Bismuth | mg/kg | 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Boron | mg/kg | 1 | 17 | 12 | 10 | 4 | 10 | 11 | 6 |
| Cadmium | mg/kg | 0.01 | 1.67 | 1.00 | 3.45 | 0.69 | 0.20 | 4.75 | 0.20 |
| Calcium | mg/kg | 50 | 8150 | 11400 | 1030 | 5730 | 3430 | 3220 | 56800 |
| Chromium | mg/kg | 1 | 30 | 18 | 45 | 91 | 44 | 39 | 35 |
| Cobalt | mg/kg | 0.1 | 0.9 | 26.5 | 3.2 | 1.1 | 0.6 | 0.7 | 40.2 |
| Copper | mg/kg | 1 | 7 | 6 | 17 | 5 | 3 | 19 | 9 |
| Iron | mg/kg | 20 | 10250 | 60600 | 27300 | 9220 | 9470 | 21900 | 84400 |
| Lead | mg/kg | 0.1 | 37.8 | 5.3 | 658. | 15.3 | 18.0 | 1270 | 7.4 |
| Lithium | mg/kg | 0.1 | 23.4 | 52.4 | 6.2 | 13.6 | 14.6 | 5.0 | 12.1 |
| Magnesium | mg/kg | 10 | 14750 | 39300 | 2740 | 5580 | 16900 | 2900 | 30000 |
| Manganese | mg/kg | 1 | 196 | 1010 | 257 | 166 | 238 | 460 | 2220 |
| Mercury | mg/kg | 0.01 | 0.45 | 0.15 | 0.32 | 0.14 | 0.04 | 0.17 | 0.03 |
| Molybdenum | mg/kg | 0.1 | 0.9 | 0.2 | 3.4 | 2.0 | 1.5 | 2.2 | 0.5 |
| Nickel | mg/kg | 1 | 1 | 6 | 3 | 3 | 1 | < 1 | 18 |
| Potassium | mg/kg | 20 | 30500 | 16600 | 18300 | 3240 | 24000 | 28100 | 290 |
| Rubidium | mg/kg | 0.1 | 152 | 68.9 | 88.6 | 16.8 | 109. | 160. | 1.1 |
| Selenium | mg/kg | 1 | 1 | < 1 | < 1 | < 1 | 1 | < 1 | 1 |
| Silver | mg/kg | 0.1 | 0.3 | < 0.1 | 1.3 | 0.2 | < 0.1 | 0.8 | < 0.1 |
| Sodium | mg/kg | 50 | 7965 | 21500 | 210 | 32600 | 13900 | 290 | 32400 |
| Strontium | mg/kg | 1 | 67 | 64 | 5 | 133 | 40 | 17 | 219 |
| Tellurium | mg/kg | 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Thallium | mg/kg | 0.1 | 10.6 | 1.6 | 2.9 | 0.9 | 3.7 | 3.7 | < 0.1 |
| Tin | mg/kg | 0.1 | 3.7 | 1.2 | 1.2 | 2.0 | 3.2 | 2.3 | 1.5 |
| Uranium | mg/kg | 0.1 | 3.8 | 0.6 | 1.5 | 2.6 | 3.5 | 3.0 | 0.2 |
| Vanadium | mg/kg | 1 | 4 | 401 | 23 | 4 | 2 | 3 | 361 |
| Zinc | mg/kg | 1 | 571 | 384 | 1760 | 222 | 128 | 2190 | 124 |

**Table 4**
**Wolfden Samples Whole Rock Analyses Results**

| Sample | Wt. % | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $Al_2O_3$ | BaO | CaO | $Fe_2O_3$ | $K_2O$ | MgO | MnO | $Na_2O$ | $P_2O_5$ | $SiO_2$ | SrO | $TiO_2$ | $V_2O_5$ | $ZrO_2$ | LOI 1000°C | Total |
| ABA-001 | 13.78 | 0.20 | 1.05 | 1.69 | 3.92 | 2.41 | 0.02 | 1.09 | 0.03 | 72.42 | <0.01 | 0.12 | <0.01 | 0.01 | 2.71 | 99.80 |
| ABA-002 | 16.66 | 0.03 | 1.57 | 10.28 | 2.17 | 6.72 | 0.14 | 2.97 | 0.09 | 53.65 | <0.01 | 1.66 | 0.07 | 0.02 | 3.75 | 99.85 |
| ABA-003 | 6.25 | 0.10 | 0.21 | 3.78 | 2.40 | 0.46 | 0.03 | 0.06 | 0.07 | 77.94 | <0.01 | 0.19 | <0.01 | 0.01 | 2.41 | 99.91 |
| ABA-004 | 10.46 | 0.03 | 0.77 | 1.40 | 0.49 | 0.91 | 0.02 | 4.54 | 0.02 | 79.53 | 0.01 | 0.08 | <0.01 | 0.01 | 0.73 | 99.85 |
| ABA-005 | 12.83 | 0.08 | 0.47 | 1.35 | 3.26 | 2.71 | 0.03 | 1.85 | 0.03 | 74.69 | <0.01 | 0.09 | <0.01 | 0.01 | 2.23 | 99.89 |
| ABA-006 | 10.49 | 0.09 | 0.45 | 3.16 | 3.63 | 0.56 | 0.07 | 0.06 | 0.03 | 76.69 | <0.01 | 0.09 | <0.01 | 0.01 | 2.02 | 99.85 |
| ABA-007 | 13.66 | 0.02 | 8.49 | 12.83 | 0.06 | 5.29 | 0.29 | 4.46 | 0.16 | 50.93 | 0.02 | 1.75 | 0.06 | 0.02 | 1.74 | 99.84 |

## CONCLUSIONS AND RECOMMENDATIONS

Note that all results were only as representative as the sample received. All data obtained were in good agreement with each other and showed that:

- Of the 7 Wolfden samples subjected to static Acid Rock Drainage (ARD) testing, 3 were found to be potentially acid producing and 4 were found to be not potentially acid producing.
- It was recommended that a specialized consultant be contacted for the full MEND Report 1.20.1 analysis and interpretation prior to follow up with the regulatory agent.

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 10-C: Stormwater Collection Technical Memorandum

# TECHNICAL MEMORANDUM

| | |
|---|---|
| **DATE:** | May 23, 2022<br>Revised August 25, 2022 |
| **TO:** | Project File |
| **FROM:** | Mark Peters, P.E. |
| **REVIEWED BY:** | Kyle Cunniff |
| **SUBJECT:** | Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option |
| **PROJECT:** | 3617227547 |

## 1.0 INTRODUCTION

The proposed mine operation includes a number of mine facilities where stormwater runoff or melting snow could be impacted with contaminants from the mine activities. The mine operations will include measures to collection and treat stormwater and snow melt runoff from these facilities to prevent impact to downgradient surface water or underlying groundwater. In addition, a base water flow of 30 gallons per minute (gpm) from dewatering the mine is included in the total volume of water to be collected and stored for treatment. This technical memorandum provides a description of the approach to calculate the estimated volume of precipitation runoff and mine dewatering to be collected and treated. Runoff from specific identified mine facilities and water from mine dewatering will be collected in a Pre-Treatment Water Storage Pond prior to treatment. Preliminary sizing of the Pre-Treatment Water Storage Pond based on the calculated runoff volume from a 500-year design storm event and mine dewatering, as well as typical monthly runoff volumes for treatment are provided in this memorandum.

Proposed facilities providing support to the mine operations where precipitation runoff will not be collected and treated in the water treatment plant is not part of this evaluation discussed in this technical memorandum. Stormwater runoff from these areas including the employee parking area, warehouses, and solar facility will be managed with appropriate stormwater best management practices in accordance with Maine Stormwater Best Management Practices Manual and 06-096 C.M.R. Chapter 500: Stormwater Management.

## 2.0 APPROACH

A stormwater analysis was conducted that included delineating drainage areas for the proposed mine facilities where precipitation runoff will be collected and treated. The proposed mine layout with drainage areas is provided on Figure 1, the Proposed Condition Watershed (Attachment 1). The subcatchments where precipitation runoff will be collected for treatment include:

- Drainage Area DA-6A: Approximately 3.25 acres consisting of the Pre-Treatment Water Storage Pond and surrounding embankment that will receive direct precipitation from storm events that

needs to be included in the treatment and storage volume.

- Drainage Area DA-7A: Approximately 22.17 acres consisting of the Phase I primary mine facilities including ore and waste rock pads, Backfill Plant, Mine Access (portal), mine roads and other associated facilities.
- Drainage Area D-13A: Approximately 2.97 acres consisting of Phase II mine facilities that include pads for ore and waste rock and a headframe and hoist.

The total drainage area to be collected and treated is approximately 28.39 acres. The mine facilities and areas where runoff will be collected are summarized in Table 1. The table includes the Map ID and Facility Name that is provided on Figure 1 as well as the facility area in acres and the runoff curve number (CN) used in the stormwater analysis. The CN is based on the cover type as well as the soil type. The primary soil type within the area of the mine facility development is classified as hydrologic soil group (HSG) C which is somewhat poorly drained. Detailed soil descriptions are provided in Exhibit 23. Runoff curve numbers used in the modeling for HSG C and the proposed cover type include CN = 98 for buildings, structures and ponds (impervious) and CN = 96 for pads and gravel areas (also impervious but with some minor retention in voids of the ore, rock, and gravel). In addition, mine drainage areas include areas immediately adjacent to mine facilities that will be within the runoff collection area. These surrounding areas have been assumed to be poorly vegetated and assigned a CN of 86.

**Table 1 – Summary of Precipitation Runoff Collection Areas**

| Map ID | Facility Name | Facility Area (Ac) (2) | Runoff Curve Number CN |
|---|---|---|---|
| 2 | Low Grade Ore Storage Pad | 5.276 | 96 |
| 3 | Snow Storage | 2.579 | 96 |
| 4 | Pre-Treatment Water Storage Pond | 2.818 | 98 |
| 14 | Offices and Mine rescue Facility | 0.214 | 98 |
| 15 | Core Shack and Storage | 0.099 | 98 |
| 17 | Maintenance Shop | 0.110 | 98 |
| 18 | Equipment Fueling Station | 0.042 | 98 |
| 20 | Waste Rock Storage Pad #1 | 3.591 | 96 |
| 21 | Backfill Plant | 0.334 | 96 |
| 22 | Ore (Mill Feed) Storage Pad #1 | 1.259 | 96 |
| 23 | Blast Shack | 0.023 | 98 |
| 24 | Mine Access (Portal) | 0.385 | 98 |
| 28 | Headframe and Hoist | 0.071 | 98 |
| 29 | Ore (Mill Feed) Storage Pad #2 | 1.016 | 96 |
| 30 | Waste Rock Pad #2 | 1.016 | 96 |
| 35 | Site Mine Roads | 2.368 | 96 |
| -- | Area Surrounding Mine Facilities (1) | 7.188 | 86 |
| | **Total** | **28.389** | **94** |

(1) Includes the areas immediately adjacent to mine facilities listed in the table that will be within the runoff collection area including the pond surrounding berm.
(2) Areas taken from the conceptual mine layout provided on Figure 1 (Attachment 1).

The stormwater analysis was conducted by developing a stormwater model using commercially available computer software based upon the United States Department of Agriculture Technical Release 20 (TR-20) methodology. The TR-20 method is a standard engineering method used to evaluate runoff

conditions and develop stormwater controls. HydroCAD® by Applied Microcomputer Systems, Inc, a stormwater modeling software which uses the TR-20 method, combined with the standard hydraulic equations, was used to for development and evaluation of the stormwater models and drainage systems.

The design for the collection, storage and treatment of surface water runoff from the identified mine facilities is based on the following design parameters and assumptions:

Pre-Treatment Pond Sizing:

- Peak Pond Storage Design Storm: Total runoff volume from a 500-year, 24-hour storm event in accordance with 06-096 Chapter 200: Metallic Mineral Exploration, Advanced Exploration and Mining. Using precipitation data taken from NOAA Atlas 14, Volume 10, Version 3, the 500-year, 24-hour is 7.82 inches of precipitation for the mine site (Attachment 2).
- Mine Dewatering: A base water flow of 30 gallons per minute (gpm) from dewatering the mine is included in the total volume of water to be collected and stored for treatment. Seepage of bedrock water as well as the use of water during the mining process, necessitates constant mine dewatering. Although engineering/hydrologic studies have not been conducted to quantify flow rates required to keep the working areas of the mine in a dewatered state, it is currently estimated based on similar site experience and the likelihood of low transmissivity bedrock at depth, that these "seepage "flows are likely to be on the order of 30 gallons per minute (gpm) long term.
- For the Pre-Treatment Water Storage Pond sizing it is assumed that no discharge from the pond for treatment occurs during the design storm event.
- A minimum 2-foot freeboard from the stored water elevation to the top of the pond berm/embankment was used for calculating the required Pre-Treatment Water Storage Pond volume.

Peak Monthly Treatment Volume:

- Average Monthly Precipitation: Average monthly precipitation data was obtained for Patten, Maine from the U.S. Climate Data website (Attachment 3). The monthly precipitation was input into the HydroCAD® model to get an estimated monthly runoff volume.
- The monthly runoff volume was adjusted using an estimated factor for seasonal temperature affects to account for ice and snow precipitation that buildups in the winter months and then melts in the early spring months. The temperature/seasonal adjustment factors were estimated by reviewing historical mean daily discharge data for a gauge located on the Seboeis River located approximately 8.5 miles west of the mine site (Attachment 4). The discharge data shows a significant increase in stream flow for the months of April and May.
- The estimated monthly runoff volume for the months of April and May were increased by a temperature/seasonal adjustment factor of 2.3 and 1.6, respectively to provide an estimated typical peak monthly runoff volume for treatment.
- The monthly runoff volume includes the 30-gpm mine dewatering volume.

## 3.0 RESULTS

The HydroCAD® model provides the following results for the Pre-Treatment Pond storage volume and the typical monthly treatment volumes:

Pre-Treatment Pond Storage:

- Collected water volume = approximately 5.11 million gallons (mgal) for a 500-year, Type III 24- hour storm event (volume includes 30 gpm for mine dewatering).
- Required pond volume with a minimum 2-foot freeboard = approximately 6.87 mgal.
- The area shown for the Pre-Treatment Water Storage Pond on Figure 1 (Map ID 4) is adequate for the pond footprint and provides the required volume with a water depth of 6.75 feet and top of pond at 8.75 feet.

To verify the adequacy of the 2-foot freeboard, the model was run for the 500-year storm event assuming both a saturated soil condition and a frozen surface condition. The results show that an approximate 1.5-foot freeboard is maintained for these two soil conditions. In addition to the 500-year design storm event water treatment volume, Table 2 below provides collected runoff volumes for other storm events.

**Table 2 – Summary of Precipitation Runoff Treatment Volumes by Storm Event**

| Storm Event (yr.) | Collected Volume (gal) | Collected Volume (cf) |
|---|---|---|
| 1 | 1,367,449 | 182,814 |
| 2 | 1,658,009 | 221,659 |
| 5 | 2,156,132 | 288,253 |
| 10 | 2,559,836 | 342,224 |
| 25 | 3,120,873 | 417,229 |
| 50 | 3,547,375 | 474,248 |
| 100 | 3,981,050 | 532,226 |
| 500 | 5,110,433 | 683,213 |

Peak Monthly Treatment Volume:

Table 3 provides a summary of the estimated typical monthly runoff volume collected for treatment

**Table 3 - Monthly Runoff Treatment Volumes**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Precipitation in Inches** | | | | | | | | | | | |
| 3.28 | 2.57 | 3.07 | 3.85 | 4.02 | 3.81 | 4.08 | 3.99 | 4.02 | 4.27 | 4.38 | 3.69 |
| **Runoff Volume in Million Gallons** | | | | | | | | | | | |
| 2.22 | 1.72 | 2.07 | 2.29 | 2.41 | 2.26 | 2.45 | 2.39 | 2.41 | 2.59 | 2.67 | 2.51 |
| **Assumed Runoff Factor Due to Temperature** | | | | | | | | | | | |
| 0.15 | 0.10 | 0.70 | 2.30 | 1.60 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.90 |
| **Estimated Runoff Volume Adjusted for Temperature in Million Gallons** | | | | | | | | | | | |
| 0.33 | 0.17 | 1.45 | 5.28 | 3.87 | 2.26 | 2.45 | 2.39 | 2.41 | 2.59 | 2.54 | 2.26 |
| **30 GPM Mine Dewatering Monthly Volume in Million Gallons** | | | | | | | | | | | |
| 1.34 | 1.21 | 1.34 | 1.30 | 1.34 | 1.30 | 1.34 | 1.34 | 1.30 | 1.30 | 1.30 | 1.34 |
| **Total Monthly Treatment Volume in Million Gallons** | | | | | | | | | | | |
| 1.67 | 1.38 | 2.79 | 6.57 | 5.20 | 3.56 | 3.79 | 3.73 | 3.71 | 3.89 | 3.84 | 3.60 |

Blue: Winter Months - frozen conditions with reduced runoff.
Grey/Blue: Late Fall-Early Winter or Late Winter- Early Spring - some reduced runoff.
Green: Spring months - increased runoff with snow melt.

## 4.0 ATTACHMENTS

1. Attachment 1: Figure 1 - Proposed Watershed Conditions
2. Attachment 2: Precipitation Data - NOAA Atlas 14, Volume 10, Version 3
3. Attachment 3: Average Monthly Precipitation Data
4. Attachment 4: Seboeis River Gauge Discharge Data
3. Attachment 5: HydroCAD® Model Output - 500-year, 24-hour Storm Event

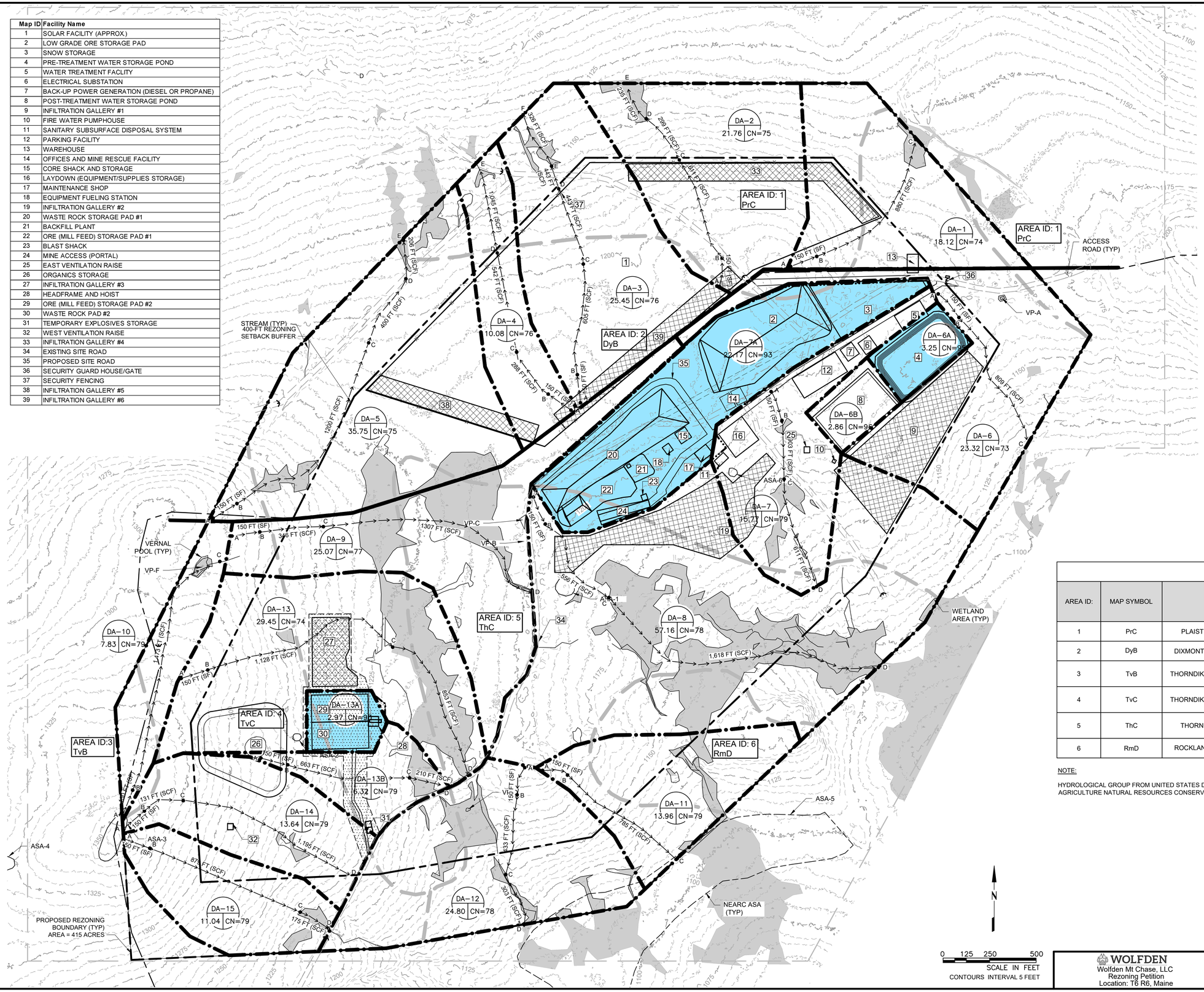
## 5.0 REFERENCES

1. Applied Microcomputer Systems, HydroCAD® Stormwater Modeling System Owner's Manual, 2020
2. NOAA Atlas 14, Volume 10, Version 3
3. U.S. Weather Service - www.usclimatedata.com/climate/patten/maine/united-states
4. U.S. Geological Survey - nwis.waterdata.usgs.gov/me/nwis
5. Rezone Petition Exhibit 23 – Soil Suitability
6. 06-096 C.M.R. Chapter 200: Metallic Mineral Exploration, Advanced Exploration and Mining
7. 06-096 C.M.R. Chapter 500: Stormwater Management

**Attachment 1:**

**Figure 1 - Proposed Condition Watershed**

| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACLITY |
| 6 | ELECTRICAL SUBSTATION |
| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
| 8 | POST-TREATMENT WATER STORAGE POND |
| 9 | INFILTRATION GALLERY #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | INFILTRATION GALLERY #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | INFILTRATION GALLERY #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | INFILTRATION GALLERY #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | INFILTRATION GALLERY #5 |
| 39 | INFILTRATION GALLERY #6 |




LEGEND:

- BOUNDARY DRAINAGE
- TC FLOW PATH
- MINE FACILITY DRAINAGE AREAS WHERE PRECIPITATION RUNOFF IS COLLECTED AND TREATED
- EXISTING CONTOURS
- SOIL SERIES BOUNDARY
- STREAM
- PICKETT MOUNTAIN POND / PLEASANT LAKE WATERSHED DIVIDE
- WETLAND
- 400-FEET REZONING SETBACK BUFFER
- PROPOSED REZONING
- VERNAL POOLS

ABBREVIATION:

DA - DRAINAGE AREA
TC - TIME OF CONCENTRATION
CN - CURVE NUMBER
POA - POINT OF ANALYSIS
SF - SHEET FLOW
SCF - SHALLOW CONCENTRATION FLOW

DA=7 — DRAINAGE AREA
25.50 CN=98 — CURVE NUMBER
AREA IN ACRES

SOIL KEY

| AREA ID: | MAP SYMBOL | SOIL SERIES | DRAINAGE CONDITION | SLOPE (%) | HYDROGRAPHICAL GROUP |
|---|---|---|---|---|---|
| 1 | PrC | PLAISTED VERY STONY LOAM | WELL DRAINED | 8-15 | C |
| 2 | DyB | DIXMONT VERY STONY SILT LOAM | SOMEWHAT POORLY DRAINED | 2-8 | C/D |
| 3 | TvB | THORNDIKE VERY STONY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 2-8 | D |
| 4 | TvC | THORNDIKE VERY STONY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 8-15 | D |
| 5 | ThC | THORNDIKE SHALY SILT LOAM | SOMEWHAT EXCESSIVELY DRAINED | 8-15 | D |
| 6 | RmD | ROCKLAND, THORNDIKE MATERIA | EXCESSIVE DRAINAGE | 15-25 | - |

NOTE:

HYDROLOGICAL GROUP FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

Prepared/Date: WJW 08/24/22
Checked/Date: MAP 08/24/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wood.
Environment & Infrastructure Solutions, Inc.
511 Congress St., Suite 200, Portland, ME 04101
P: (207) 775-5401 F: (207) 772-4762 www.woodplc.com

PROPOSED WATERSHED CONDITIONS
Project 3617-19-7478
Figure 2

C:\Users\wilson.wahlen\OneDrive - Wood PLC\Projects\Wolfden Resources\8.0 Drawings\Design 2022\Sheets\Figure 2_ Watershed Proposed Conditions.dwg Wed, 24 Aug 2022 - 8:40am wilson.wahlen

**Attachment 2**

**Precipitation Data - NOAA Atlas 14, Volume 10, Version 3**

**NOAA Atlas 14, Volume 10, Version 3**
**Location name: Millinocket, Maine, USA***
**Latitude: 46.1432°, Longitude: -68.4631°**
**Elevation: 1177.81 ft****
* source: ESRI Maps
** source: USGS

## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.225 (0.173-0.293) | 0.283 (0.217-0.369) | 0.378 (0.289-0.494) | 0.458 (0.348-0.602) | 0.567 (0.418-0.779) | 0.649 (0.470-0.911) | 0.735 (0.519-1.07) | 0.833 (0.557-1.24) | 0.975 (0.630-1.50) | 1.09 (0.691-1.71) |
| 10-min | 0.319 (0.244-0.415) | 0.401 (0.308-0.523) | 0.536 (0.409-0.700) | 0.648 (0.492-0.851) | 0.803 (0.593-1.10) | 0.919 (0.666-1.29) | 1.04 (0.736-1.52) | 1.18 (0.791-1.75) | 1.38 (0.893-2.12) | 1.55 (0.980-2.42) |
| 15-min | 0.375 (0.288-0.488) | 0.472 (0.362-0.615) | 0.631 (0.482-0.825) | 0.763 (0.580-1.00) | 0.945 (0.697-1.30) | 1.08 (0.783-1.52) | 1.23 (0.866-1.79) | 1.39 (0.931-2.06) | 1.63 (1.05-2.50) | 1.82 (1.15-2.85) |
| 30-min | 0.521 (0.400-0.678) | 0.655 (0.502-0.854) | 0.874 (0.668-1.14) | 1.06 (0.803-1.39) | 1.31 (0.966-1.80) | 1.49 (1.09-2.10) | 1.69 (1.20-2.48) | 1.93 (1.29-2.86) | 2.28 (1.47-3.50) | 2.57 (1.63-4.03) |
| 60-min | 0.667 (0.512-0.868) | 0.838 (0.642-1.09) | 1.12 (0.854-1.46) | 1.35 (1.03-1.77) | 1.67 (1.24-2.30) | 1.91 (1.39-2.69) | 2.16 (1.54-3.18) | 2.47 (1.65-3.67) | 2.93 (1.89-4.50) | 3.33 (2.11-5.21) |
| 2-hr | 0.930 (0.719-1.20) | 1.15 (0.885-1.48) | 1.50 (1.16-1.94) | 1.79 (1.37-2.33) | 2.20 (1.63-2.99) | 2.50 (1.83-3.47) | 2.82 (2.01-4.06) | 3.19 (2.15-4.67) | 3.72 (2.42-5.64) | 4.16 (2.65-6.43) |
| 3-hr | 1.13 (0.875-1.44) | 1.37 (1.07-1.76) | 1.77 (1.37-2.28) | 2.11 (1.62-2.73) | 2.57 (1.92-3.46) | 2.91 (2.13-4.01) | 3.28 (2.33-4.67) | 3.68 (2.49-5.35) | 4.25 (2.77-6.40) | 4.72 (3.01-7.24) |
| 6-hr | 1.54 (1.21-1.96) | 1.85 (1.44-2.35) | 2.34 (1.82-2.98) | 2.75 (2.13-3.52) | 3.31 (2.49-4.42) | 3.74 (2.75-5.08) | 4.18 (2.99-5.87) | 4.66 (3.17-6.70) | 5.33 (3.50-7.92) | 5.87 (3.76-8.88) |
| 12-hr | 2.05 (1.62-2.58) | 2.41 (1.90-3.04) | 3.01 (2.37-3.80) | 3.50 (2.74-4.45) | 4.18 (3.16-5.51) | 4.70 (3.48-6.31) | 5.23 (3.76-7.25) | 5.80 (3.97-8.24) | 6.61 (4.36-9.69) | 7.25 (4.66-10.8) |
| 24-hr | 2.55 (2.03-3.18) | 2.97 (2.36-3.71) | 3.66 (2.90-4.58) | 4.23 (3.34-5.32) | 5.02 (3.83-6.54) | 5.62 (4.19-7.46) | 6.23 (4.51-8.54) | 6.90 (4.75-9.68) | 7.82 (5.18-11.3) | 8.55 (5.53-12.6) |
| 2-day | 2.99 (2.40-3.69) | 3.46 (2.77-4.27) | 4.22 (3.37-5.23) | 4.86 (3.86-6.05) | 5.73 (4.40-7.39) | 6.40 (4.81-8.39) | 7.08 (5.15-9.56) | 7.80 (5.41-10.8) | 8.79 (5.86-12.6) | 9.56 (6.21-13.9) |
| 3-day | 3.29 (2.65-4.04) | 3.79 (3.05-4.65) | 4.59 (3.69-5.66) | 5.26 (4.20-6.52) | 6.19 (4.77-7.92) | 6.89 (5.19-8.97) | 7.61 (5.54-10.2) | 8.36 (5.82-11.5) | 9.37 (6.27-13.3) | 10.2 (6.62-14.7) |
| 4-day | 3.56 (2.88-4.34) | 4.07 (3.29-4.97) | 4.90 (3.95-6.01) | 5.60 (4.48-6.90) | 6.55 (5.07-8.34) | 7.29 (5.51-9.43) | 8.03 (5.86-10.7) | 8.79 (6.13-12.0) | 9.82 (6.58-13.8) | 10.6 (6.93-15.2) |
| 7-day | 4.26 | 4.80 | 5.69 | 6.43 | 7.45 | 8.24 | 9.02 | 9.81 | 10.9 | 11.6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (3.47-5.16) | (3.91-5.83) | (4.62-6.93) | (5.19-7.87) | (5.80-9.39) | (6.26-10.5) | (6.61-11.9) | (6.88-13.3) | (7.31-15.1) | (7.63-16.5) |
| **10-day** | **4.92** (4.03-5.94) | **5.50** (4.50-6.64) | **6.43** (5.24-7.79) | **7.21** (5.84-8.77) | **8.28** (6.47-10.4) | **9.11** (6.94-11.6) | **9.93** (7.29-12.9) | **10.7** (7.56-14.4) | **11.8** (7.96-16.3) | **12.5** (8.24-17.7) |
| **20-day** | **6.94** (5.73-8.29) | **7.60** (6.27-9.09) | **8.68** (7.13-10.4) | **9.57** (7.82-11.5) | **10.8** (8.49-13.3) | **11.8** (9.02-14.7) | **12.7** (9.35-16.3) | **13.6** (9.61-18.0) | **14.6** (9.93-19.9) | **15.3** (10.1-21.3) |
| **30-day** | **8.62** (7.15-10.2) | **9.36** (7.76-11.1) | **10.6** (8.73-12.6) | **11.6** (9.50-13.9) | **13.0** (10.2-15.9) | **14.1** (10.8-17.5) | **15.1** (11.1-19.1) | **16.0** (11.4-21.1) | **17.1** (11.7-23.2) | **17.8** (11.8-24.6) |
| **45-day** | **10.7** (8.93-12.6) | **11.6** (9.63-13.7) | **13.0** (10.7-15.3) | **14.1** (11.6-16.8) | **15.7** (12.5-19.1) | **17.0** (13.1-20.9) | **18.2** (13.5-22.9) | **19.2** (13.7-25.1) | **20.4** (14.0-27.4) | **21.2** (14.1-29.0) |
| **60-day** | **12.4** (10.4-14.6) | **13.4** (11.2-15.8) | **15.0** (12.5-17.6) | **16.3** (13.5-19.3) | **18.0** (14.4-21.9) | **19.5** (15.1-23.9) | **20.8** (15.5-26.0) | **21.9** (15.7-28.5) | **23.3** (16.0-31.1) | **24.2** (16.1-32.9) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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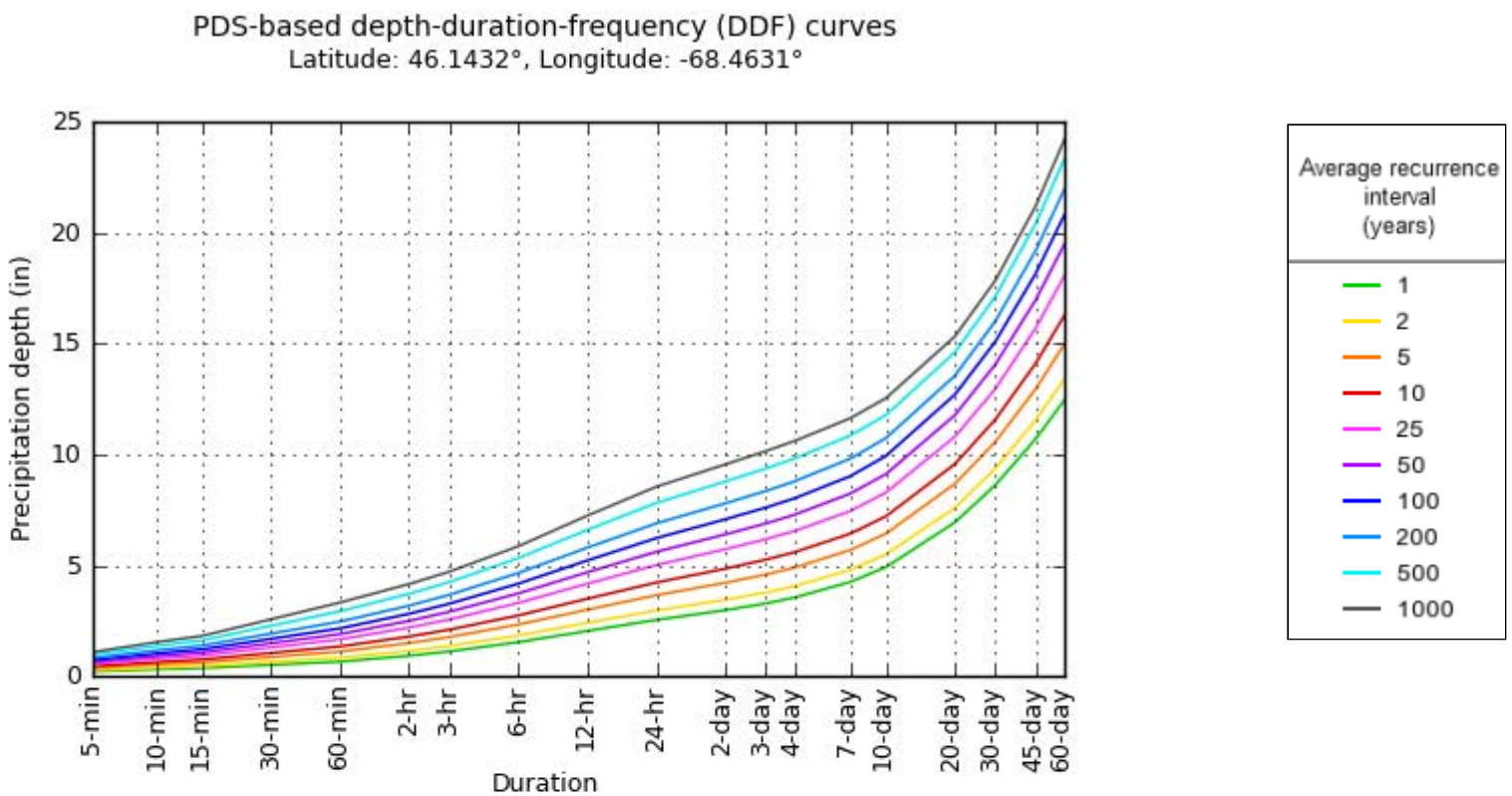
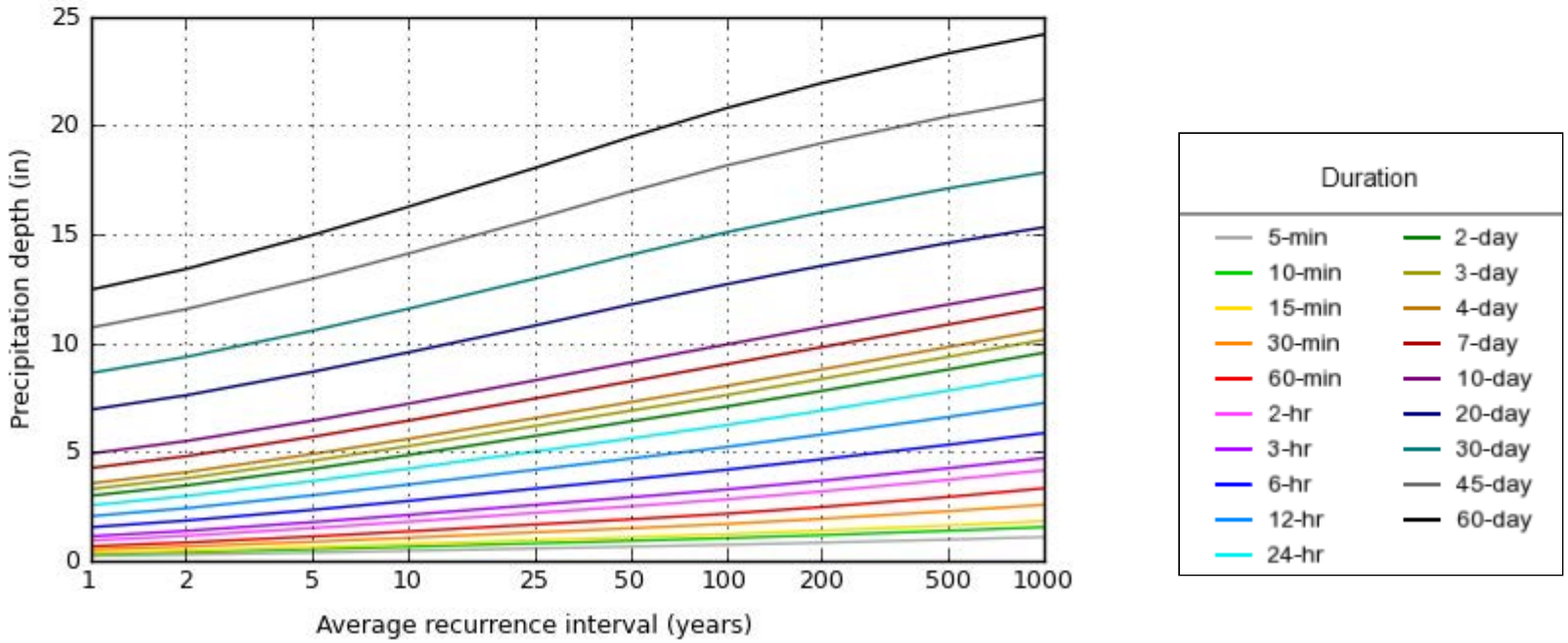
## PF graphical






NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Wed May 4 10:57:01 2022

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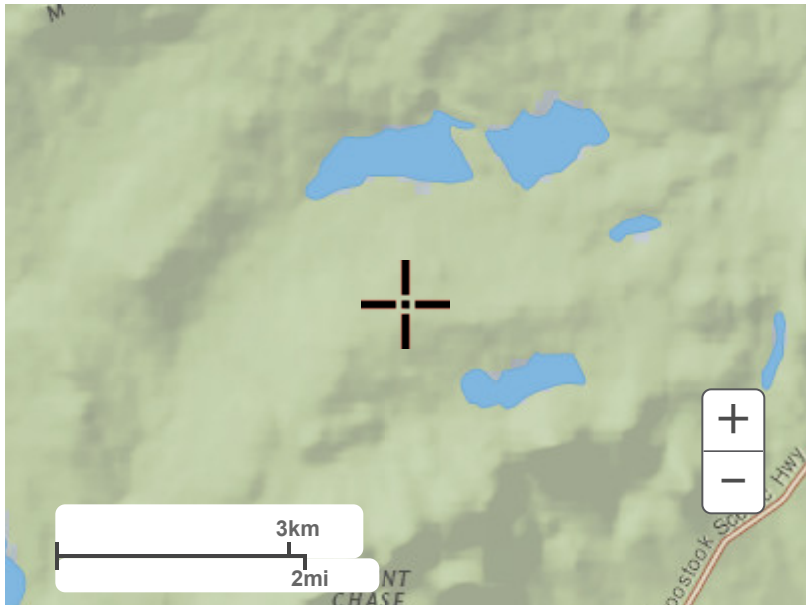
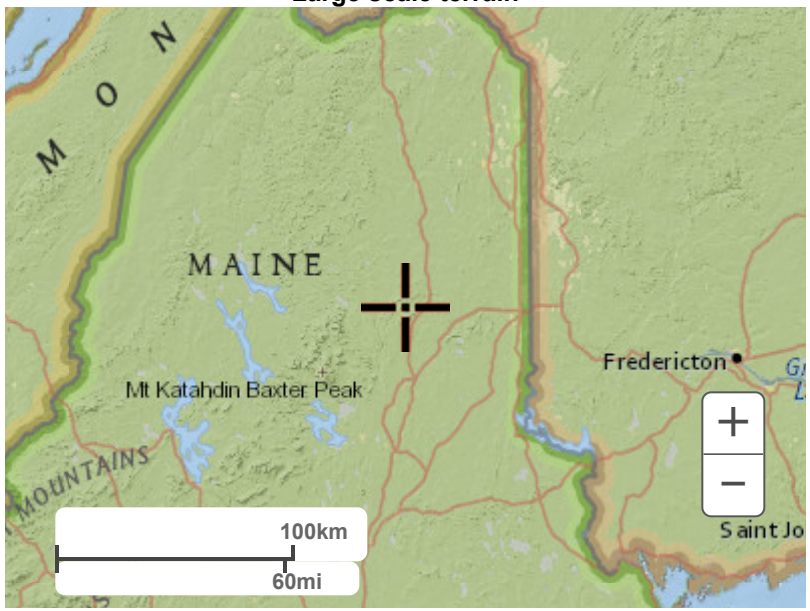
## Maps & aerials

**Small scale terrain**




**Large scale terrain**




**Large scale map**

**Attachment 3:**

**Average Monthly Precipitation Data**

U.S. Climate Data

Enter a location

Home United States Maine

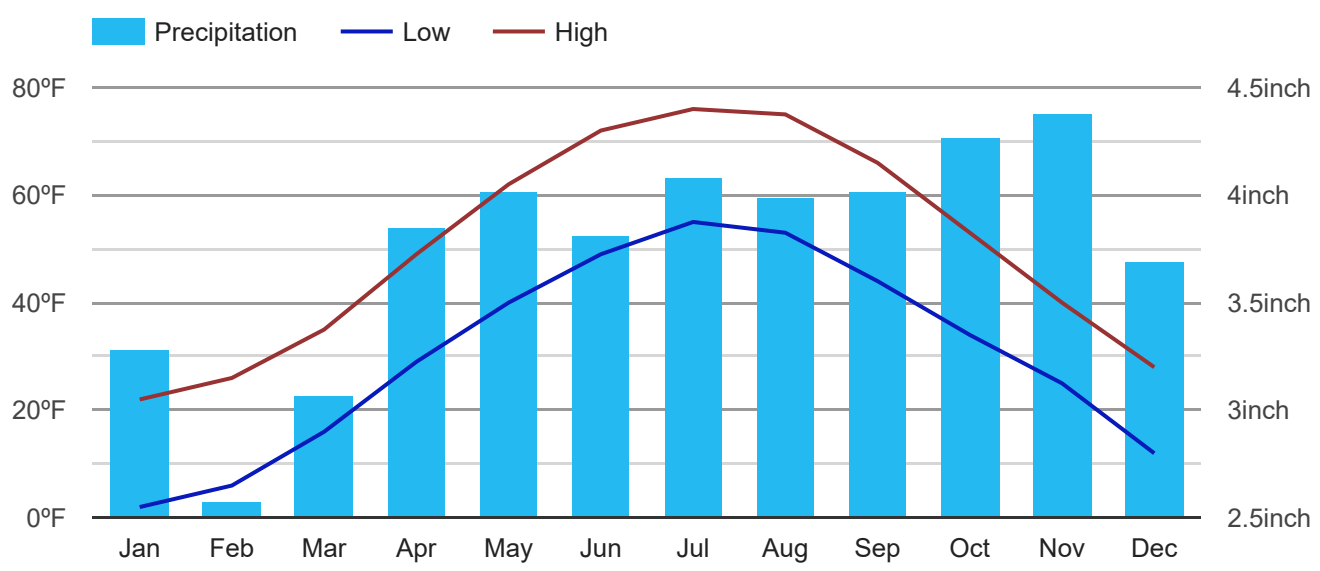
Monthly Daily History Geo & Map

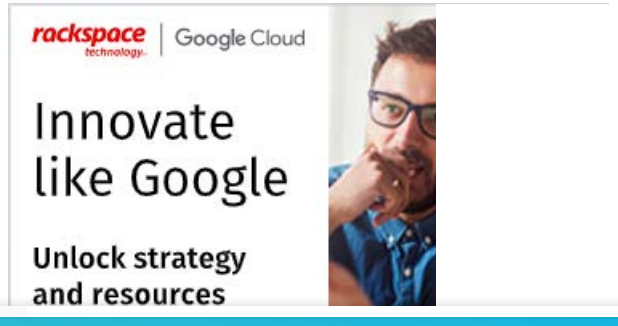
## Climate Patten - Maine

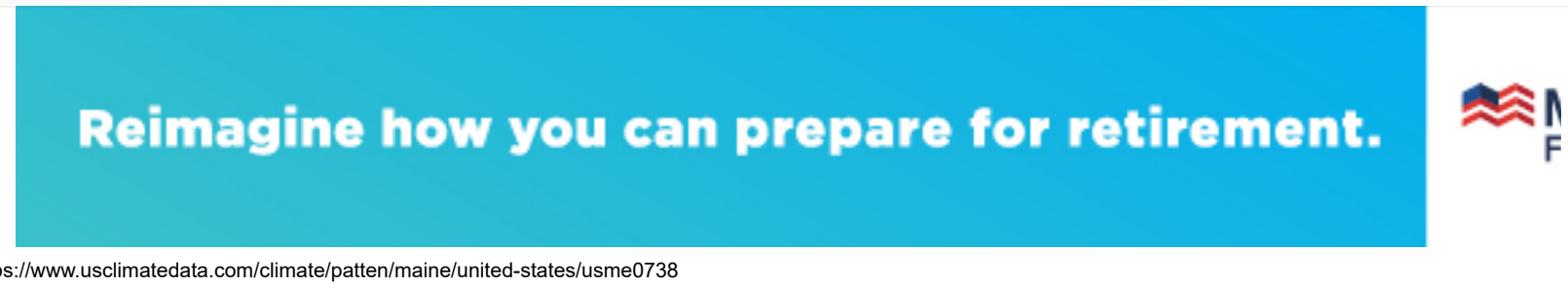
| | Jan (January) | Feb (February) | Mar (March) | Apr (April) | May (May) | Jun (June) |
|---|---|---|---|---|---|---|
| Av. high | 22 | 26 | 35 | 49 | 62 | 72 |
| Av. low | 2 | 6 | 16 | 29 | 40 | 49 |
| Av. precip. | 3.28 | 2.57 | 3.07 | 3.85 | 4.02 | 3.81 |

| | Jul (July) | Aug (August) | Sep (September) | Oct (October) | Nov (November) | Dec (December) |
|---|---|---|---|---|---|---|
| Av. high | 76 | 75 | 66 | 53 | 40 | 28 |
| Av. low | 55 | 53 | 44 | 34 | 25 | 12 |
| Av. precip. | 4.08 | 3.99 | 4.02 | 4.27 | 4.38 | 3.69 |

## Patten Climate Graph - Maine Climate Chart



## Patten weather averages

| | |
|---|---|
| Annual high temperature | 50ºF |
| Annual low temperature | 30ºF |
| Average annual precip. | 45.03 inch |

### Share

### Station Data

Monthly averages Patten
Longitude: -68.4461, Latitude: 45.9964
Average weather Patten, ME - 4765

Monthly: 1981-2010 normals
History: 2008-2016

### Abbreviations

Jan (January): January, Feb (February): February, ...

Learn more

© US Climate Data 2022 | version 3.0 | by US Climate Data |



Reimagine how you can prepare for retirement.

**Attachment 4:**

**Seboeis River Gauge Discharge Data**

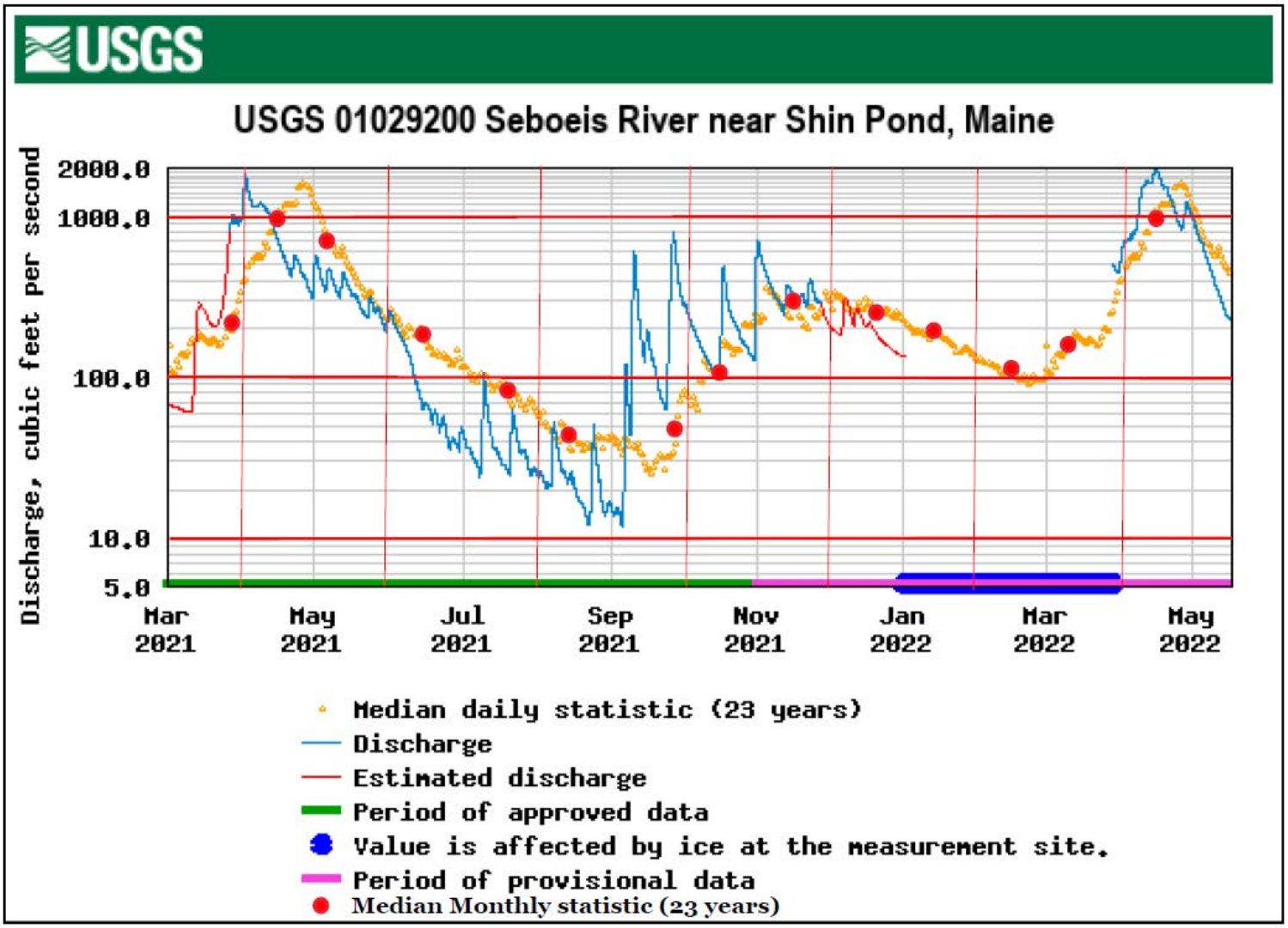
**Seboeis River Near Shin Pond**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Precipitation in Inches** | | | | | | | | | | | |
| 3.28 | 2.57 | 3.07 | 3.85 | 4.02 | 3.81 | 4.08 | 3.99 | 4.02 | 4.27 | 4.38 | 3.69 |
| **Percent Annual Precipitation in Inches** | | | | | | | | | | | |
| 7.3% | 5.7% | 6.8% | 8.5% | 8.9% | 8.5% | 9.1% | 8.9% | 8.9% | 9.5% | 9.7% | 8.2% |
| **Mean Daily Discharge in CFS** | | | | | | | | | | | |
| 190 | 110 | 170 | 990 | 690 | 175 | 85 | 45 | 48 | 105 | 305 | 265 |
| **Percent Annual Flow** | | | | | | | | | | | |
| 6.0% | 3.5% | 5.3% | 31.2% | 21.7% | 5.5% | 2.7% | 1.4% | 1.5% | 3.3% | 9.6% | 8.3% |

Blue: Winter Months - frozen conditions with reduced runoff

Grey/Blue: Late Fall-Early Winter or Late Winter- Early Spring - some reduced runoff

Green: Spring months - increased runoff with snow melt




https://nwis.waterdata.usgs.gov/me/nwis/uv/?ts_id=65499&format=img_stats&site_no=01029200&begin_date=20210301

**Attachment 5:**

**HydroCAD® Model Output - 500-year, 24-hour Storm Event**

**Woldfden_Post PreTreatment Pond Sizing**
Prepared by Wood
HydroCAD® 10.10-5a s/n 00629 © 2020 HydroCAD Software Solutions LLC

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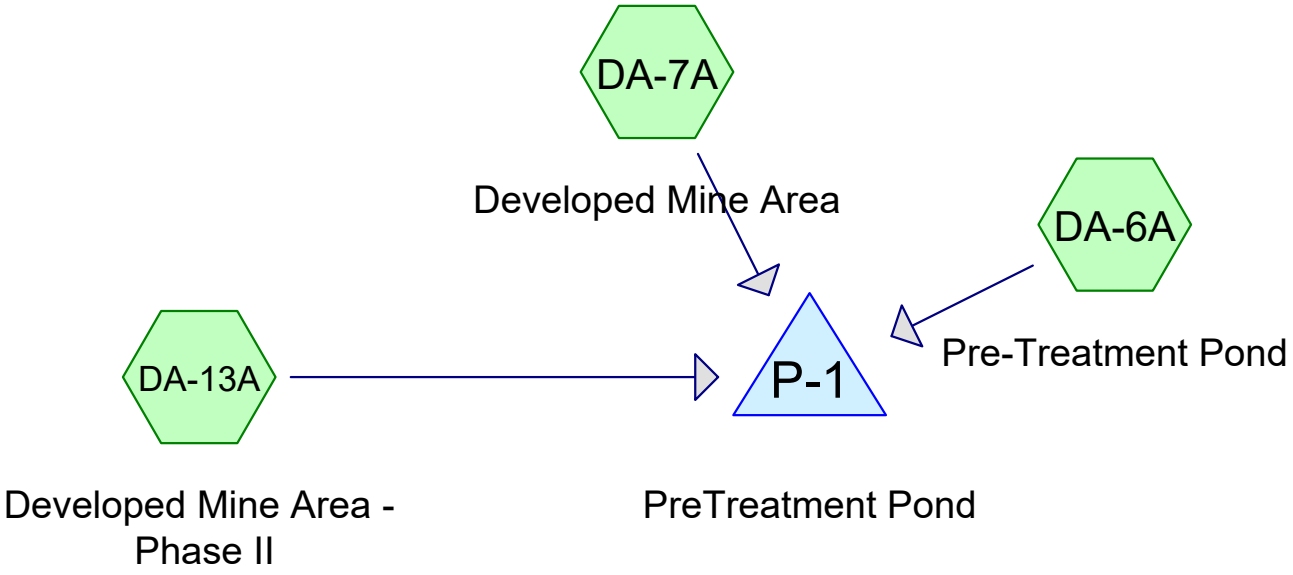
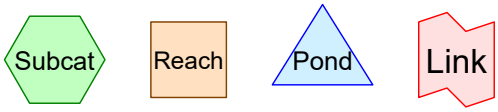
7 Subcat DA-6A: Pre-Treatment Pond
9 Subcat DA-7A: Developed Mine Area
12 Pond P-1: PreTreatment Pond




**Routing Diagram for Woldfden_Post PreTreatment Pond Sizing**
Prepared by Wood, Printed 5/9/2022
HydroCAD® 10.10-5a s/n 00629 © 2020 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 6.761 | 86 | Area Surrounding Mine Facilities, HSG C (DA-13A, DA-7A) |
| 0.334 | 96 | Backfill Plant, HSG C (DA-7A) |
| 0.023 | 98 | Blast Shack, HSG C (DA-7A) |
| 0.099 | 98 | Core Shack & Storage, HSG C (DA-7A) |
| 0.042 | 98 | Equipment Fueling Station, HSG C (DA-7A) |
| 0.071 | 98 | Headframe & Hoist, HSG C (DA-13A) |
| 5.276 | 96 | Low Grade Ore Storage Pad, HSG C (DA-7A) |
| 0.110 | 98 | Maintenance Shop, HSG C (DA-7A) |
| 0.385 | 98 | Mine Access (Portal), HSG C (DA-7A) |
| 0.214 | 98 | Office & Mine Rescue, HSG C (DA-7A) |
| 1.259 | 96 | Ore (Mill Feed) Storage Pad #1, HSG C (DA-7A) |
| 1.016 | 96 | Ore (Mill Feed) Storage Pad #2, HSG C (DA-13A) |
| 2.818 | 98 | Pre-Treatment Water Storage Pond, HSG C (DA-6A) |
| 2.368 | 96 | Site Mine Roads, HSG C (DA-7A) |
| 2.579 | 96 | Snow Storage, HSG C (DA-7A) |
| 0.427 | 86 | Surrounding berm, HSG C (DA-6A) |
| 1.016 | 96 | Waste Rock Pad #2, HSG C (DA-13A) |
| 3.591 | 96 | Waste Rock Storage Pad #1, HSG C (DA-7A) |
| **28.389** | **94** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 28.389 | HSG C | DA-13A, DA-6A, DA-7A |
| 0.000 | HSG D | |
| 0.000 | Other | |
| **28.389** | | **TOTAL AREA** |

## Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Width (inches) | Diam/Height (inches) | Inside-Fill (inches) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DA-7A | 0.00 | 0.00 | 1,320.0 | 0.0100 | 0.013 | 0.0 | 24.0 | 0.0 |

## Summary for Subcatchment DA-13A: Developed Mine Area - Phase II

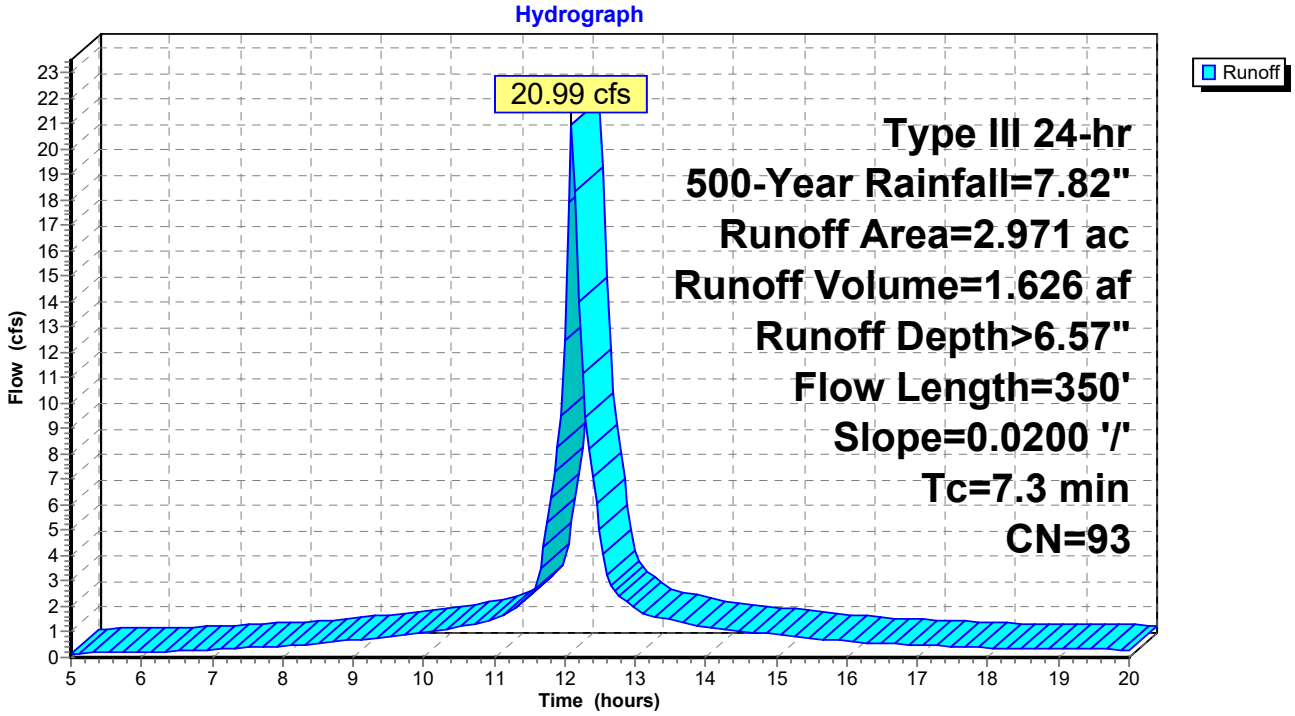
Runoff = 20.99 cfs @ 12.10 hrs, Volume= 1.626 af, Depth> 6.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 500-Year Rainfall=7.82"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 1.016 | 96 | Ore (Mill Feed) Storage Pad #2, HSG C |
| * | 1.016 | 96 | Waste Rock Pad #2, HSG C |
| * | 0.071 | 98 | Headframe & Hoist, HSG C |
| * | 0.868 | 86 | Area Surrounding Mine Facilities, HSG C |
| | 2.971 | 93 | Weighted Average |
| | 2.900 | | 97.61% Pervious Area |
| | 0.071 | | 2.39% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 5.8 | 150 | 0.0200 | 0.43 | | **Sheet Flow,** Fallow n= 0.050 P2= 2.97" |
| 1.5 | 200 | 0.0200 | 2.28 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 7.3 | 350 | Total | | | |

## Subcatchment DA-13A: Developed Mine Area - Phase II



## Hydrograph for Subcatchment DA-13A: Developed Mine Area - Phase II

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) | Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|---|---|---|---|
| 5.00 | 0.44 | 0.08 | 0.16 | 18.00 | 7.26 | 6.43 | 0.38 |
| 5.25 | 0.47 | 0.10 | 0.17 | 18.25 | 7.29 | 6.46 | 0.37 |
| 5.50 | 0.50 | 0.11 | 0.19 | 18.50 | 7.32 | 6.49 | 0.36 |
| 5.75 | 0.53 | 0.13 | 0.20 | 18.75 | 7.35 | 6.52 | 0.35 |
| 6.00 | 0.56 | 0.15 | 0.21 | 19.00 | 7.38 | 6.54 | 0.34 |
| 6.25 | 0.60 | 0.17 | 0.23 | 19.25 | 7.40 | 6.57 | 0.33 |
| 6.50 | 0.63 | 0.19 | 0.26 | 19.50 | 7.43 | 6.60 | 0.32 |
| 6.75 | 0.67 | 0.21 | 0.29 | 19.75 | 7.46 | 6.63 | 0.31 |
| 7.00 | 0.71 | 0.24 | 0.32 | 20.00 | **7.48** | **6.65** | 0.31 |
| 7.25 | 0.75 | 0.27 | 0.35 | | | | |
| 7.50 | 0.79 | 0.30 | 0.38 | | | | |
| 7.75 | 0.84 | 0.33 | 0.41 | | | | |
| 8.00 | 0.89 | 0.37 | 0.44 | | | | |
| 8.25 | 0.95 | 0.41 | 0.49 | | | | |
| 8.50 | 1.00 | 0.45 | 0.55 | | | | |
| 8.75 | 1.07 | 0.50 | 0.62 | | | | |
| 9.00 | 1.14 | 0.56 | 0.68 | | | | |
| 9.25 | 1.22 | 0.62 | 0.75 | | | | |
| 9.50 | 1.30 | 0.69 | 0.82 | | | | |
| 9.75 | 1.38 | 0.77 | 0.89 | | | | |
| 10.00 | 1.48 | 0.85 | 0.97 | | | | |
| 10.25 | 1.58 | 0.94 | 1.07 | | | | |
| 10.50 | 1.69 | 1.04 | 1.21 | | | | |
| 10.75 | 1.82 | 1.15 | 1.35 | | | | |
| 11.00 | 1.96 | 1.27 | 1.50 | | | | |
| 11.25 | 2.12 | 1.43 | 1.84 | | | | |
| 11.50 | 2.33 | 1.62 | 2.37 | | | | |
| 11.75 | 2.78 | 2.04 | 5.31 | | | | |
| 12.00 | 3.91 | 3.13 | **12.49** | | | | |
| 12.25 | 5.04 | 4.24 | **11.15** | | | | |
| 12.50 | 5.49 | 4.68 | 5.03 | | | | |
| 12.75 | 5.70 | 4.89 | 2.48 | | | | |
| 13.00 | 5.86 | 5.05 | 1.93 | | | | |
| 13.25 | 6.00 | 5.18 | 1.61 | | | | |
| 13.50 | 6.13 | 5.31 | 1.47 | | | | |
| 13.75 | 6.24 | 5.42 | 1.34 | | | | |
| 14.00 | 6.34 | 5.52 | 1.20 | | | | |
| 14.25 | 6.44 | 5.61 | 1.10 | | | | |
| 14.50 | 6.52 | 5.70 | 1.03 | | | | |
| 14.75 | 6.60 | 5.78 | 0.97 | | | | |
| 15.00 | 6.68 | 5.85 | 0.90 | | | | |
| 15.25 | 6.75 | 5.92 | 0.83 | | | | |
| 15.50 | 6.82 | 5.99 | 0.77 | | | | |
| 15.75 | 6.87 | 6.05 | 0.70 | | | | |
| 16.00 | 6.93 | 6.10 | 0.63 | | | | |
| 16.25 | 6.98 | 6.15 | 0.59 | | | | |
| 16.50 | 7.03 | 6.20 | 0.56 | | | | |
| 16.75 | 7.07 | 6.24 | 0.53 | | | | |
| 17.00 | 7.11 | 6.28 | 0.50 | | | | |
| 17.25 | 7.15 | 6.32 | 0.47 | | | | |
| 17.50 | 7.19 | 6.36 | 0.44 | | | | |
| 17.75 | 7.22 | 6.39 | 0.41 | | | | |

## Summary for Subcatchment DA-6A: Pre-Treatment Pond

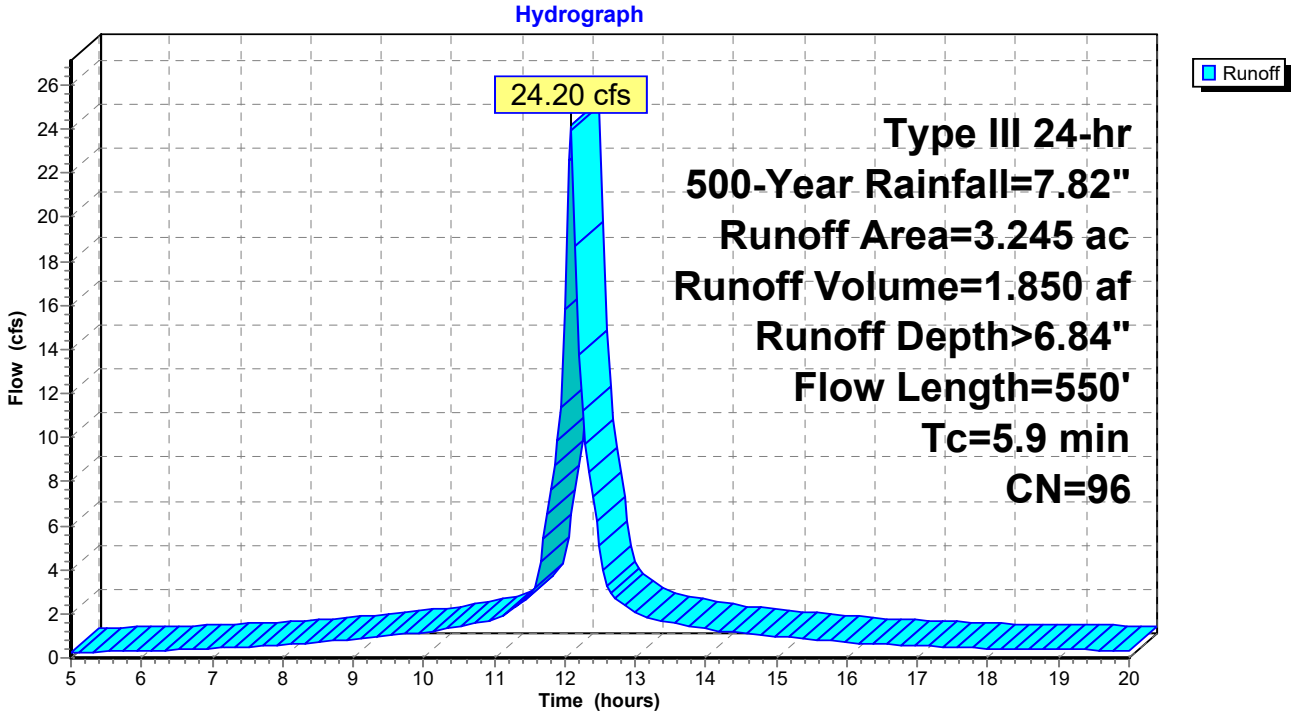
Runoff = 24.20 cfs @ 12.09 hrs, Volume= 1.850 af, Depth> 6.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 500-Year Rainfall=7.82"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 2.818 | 98 | Pre-Treatment Water Storage Pond, HSG C |
| * | 0.427 | 86 | Surrounding berm, HSG C |
| | 3.245 | 96 | Weighted Average |
| | 0.427 | | 13.16% Pervious Area |
| | 2.818 | | 86.84% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 5.0 | | | | | **Direct Entry,** |
| 0.9 | 550 | | 9.83 | | **Lake or Reservoir,** Mean Depth= 3.00' |
| 5.9 | 550 | Total | | | |

### Subcatchment DA-6A: Pre-Treatment Pond



## Hydrograph for Subcatchment DA-6A: Pre-Treatment Pond

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 5.00 | 0.44 | 0.17 | 0.26 |
| 5.25 | 0.47 | 0.19 | 0.27 |
| 5.50 | 0.50 | 0.21 | 0.29 |
| 5.75 | 0.53 | 0.23 | 0.30 |
| 6.00 | 0.56 | 0.26 | 0.32 |
| 6.25 | 0.60 | 0.28 | 0.34 |
| 6.50 | 0.63 | 0.31 | 0.37 |
| 6.75 | 0.67 | 0.34 | 0.41 |
| 7.00 | 0.71 | 0.37 | 0.44 |
| 7.25 | 0.75 | 0.41 | 0.47 |
| 7.50 | 0.79 | 0.45 | 0.51 |
| 7.75 | 0.84 | 0.49 | 0.54 |
| 8.00 | 0.89 | 0.53 | 0.58 |
| 8.25 | 0.95 | 0.58 | 0.63 |
| 8.50 | 1.00 | 0.63 | 0.71 |
| 8.75 | 1.07 | 0.69 | 0.78 |
| 9.00 | 1.14 | 0.76 | 0.86 |
| 9.25 | 1.22 | 0.83 | 0.93 |
| 9.50 | 1.30 | 0.90 | 1.01 |
| 9.75 | 1.38 | 0.99 | 1.08 |
| 10.00 | 1.48 | 1.07 | 1.16 |
| 10.25 | 1.58 | 1.17 | 1.28 |
| 10.50 | 1.69 | 1.28 | 1.44 |
| 10.75 | 1.82 | 1.40 | 1.59 |
| 11.00 | 1.96 | 1.53 | 1.75 |
| 11.25 | 2.12 | 1.69 | 2.17 |
| 11.50 | 2.33 | 1.90 | 2.76 |
| 11.75 | 2.78 | 2.33 | 6.49 |
| 12.00 | 3.91 | 3.45 | **15.84** |
| 12.25 | 5.04 | 4.57 | **11.22** |
| 12.50 | 5.49 | 5.02 | 5.07 |
| 12.75 | 5.70 | 5.23 | 2.66 |
| 13.00 | 5.86 | 5.39 | 2.07 |
| 13.25 | 6.00 | 5.53 | 1.76 |
| 13.50 | 6.13 | 5.65 | 1.61 |
| 13.75 | 6.24 | 5.77 | 1.46 |
| 14.00 | 6.34 | 5.87 | 1.30 |
| 14.25 | 6.44 | 5.96 | 1.20 |
| 14.50 | 6.52 | 6.05 | 1.13 |
| 14.75 | 6.60 | 6.13 | 1.06 |
| 15.00 | 6.68 | 6.20 | 0.98 |
| 15.25 | 6.75 | 6.28 | 0.91 |
| 15.50 | 6.82 | 6.34 | 0.84 |
| 15.75 | 6.87 | 6.40 | 0.76 |
| 16.00 | 6.93 | 6.45 | 0.69 |
| 16.25 | 6.98 | 6.50 | 0.64 |
| 16.50 | 7.03 | 6.55 | 0.61 |
| 16.75 | 7.07 | 6.59 | 0.58 |
| 17.00 | 7.11 | 6.64 | 0.55 |
| 17.25 | 7.15 | 6.68 | 0.52 |
| 17.50 | 7.19 | 6.71 | 0.48 |
| 17.75 | 7.22 | 6.75 | 0.45 |
| 18.00 | 7.26 | 6.78 | 0.42 |
| 18.25 | 7.29 | 6.81 | 0.40 |
| 18.50 | 7.32 | 6.84 | 0.39 |
| 18.75 | 7.35 | 6.87 | 0.38 |
| 19.00 | 7.38 | 6.90 | 0.37 |
| 19.25 | 7.40 | 6.93 | 0.36 |
| 19.50 | 7.43 | 6.95 | 0.35 |
| 19.75 | 7.46 | 6.98 | 0.34 |
| 20.00 | **7.48** | **7.01** | 0.34 |

## Summary for Subcatchment DA-7A: Developed Mine Area

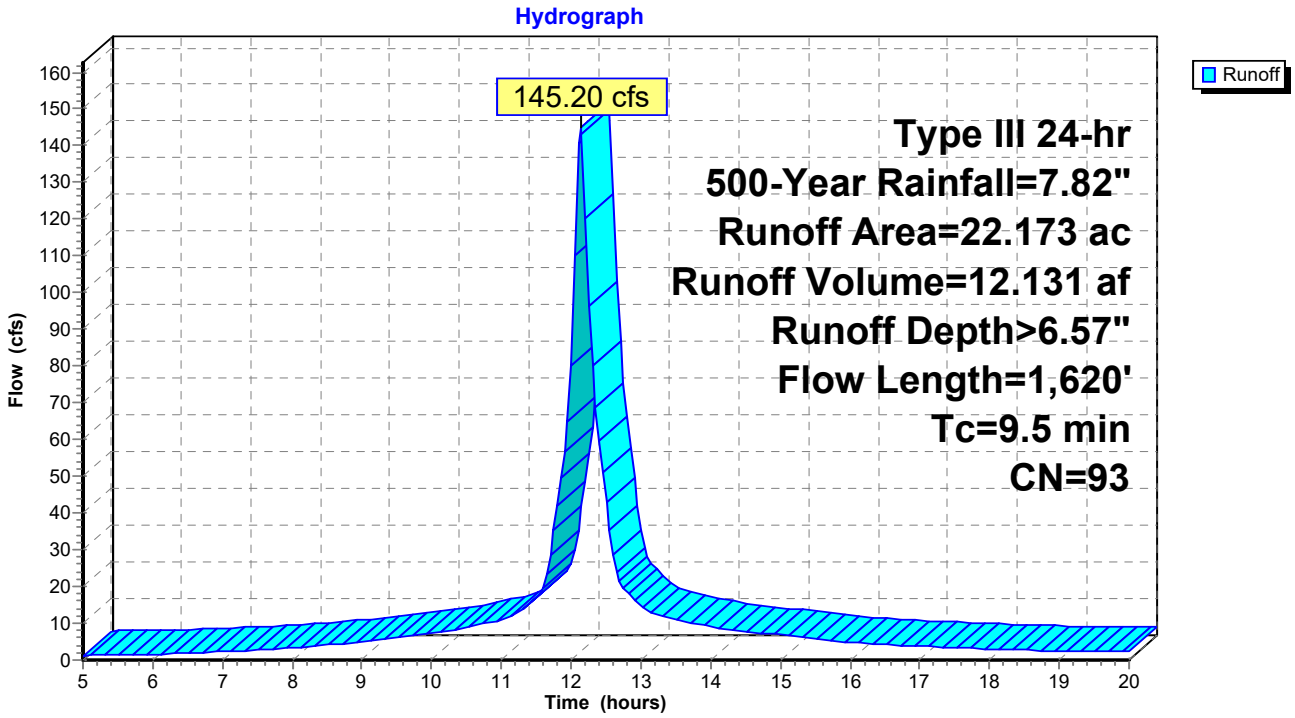
Runoff = 145.20 cfs @ 12.13 hrs, Volume= 12.131 af, Depth> 6.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 500-Year Rainfall=7.82"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 5.276 | 96 | Low Grade Ore Storage Pad, HSG C |
| * | 2.579 | 96 | Snow Storage, HSG C |
| * | 0.214 | 98 | Office & Mine Rescue, HSG C |
| * | 0.099 | 98 | Core Shack & Storage, HSG C |
| * | 0.110 | 98 | Maintenance Shop, HSG C |
| * | 0.042 | 98 | Equipment Fueling Station, HSG C |
| * | 3.591 | 96 | Waste Rock Storage Pad #1, HSG C |
| * | 0.334 | 96 | Backfill Plant, HSG C |
| * | 1.259 | 96 | Ore (Mill Feed) Storage Pad #1, HSG C |
| * | 0.023 | 98 | Blast Shack, HSG C |
| * | 0.385 | 98 | Mine Access (Portal), HSG C |
| * | 2.368 | 96 | Site Mine Roads, HSG C |
| * | 5.893 | 86 | Area Surrounding Mine Facilities, HSG C |
| | 22.173 | 93 | Weighted Average |
| | 21.300 | | 96.06% Pervious Area |
| | 0.873 | | 3.94% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 4.7 | 100 | 0.0150 | 0.35 | | **Sheet Flow,** Fallow n= 0.050 P2= 2.97" |
| 1.7 | 200 | 0.0150 | 1.97 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 3.1 | 1,320 | 0.0100 | 7.20 | 22.62 | **Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 |
| 9.5 | 1,620 | Total | | | |

## Subcatchment DA-7A: Developed Mine Area



## Hydrograph for Subcatchment DA-7A: Developed Mine Area

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 5.00 | 0.44 | 0.08 | 1.16 |
| 5.25 | 0.47 | 0.10 | 1.26 |
| 5.50 | 0.50 | 0.11 | 1.37 |
| 5.75 | 0.53 | 0.13 | 1.47 |
| 6.00 | 0.56 | 0.15 | 1.57 |
| 6.25 | 0.60 | 0.17 | 1.71 |
| 6.50 | 0.63 | 0.19 | 1.91 |
| 6.75 | 0.67 | 0.21 | 2.12 |
| 7.00 | 0.71 | 0.24 | 2.33 |
| 7.25 | 0.75 | 0.27 | 2.55 |
| 7.50 | 0.79 | 0.30 | 2.78 |
| 7.75 | 0.84 | 0.33 | 3.01 |
| 8.00 | 0.89 | 0.37 | 3.25 |
| 8.25 | 0.95 | 0.41 | 3.59 |
| 8.50 | 1.00 | 0.45 | 4.05 |
| 8.75 | 1.07 | 0.50 | 4.54 |
| 9.00 | 1.14 | 0.56 | 5.03 |
| 9.25 | 1.22 | 0.62 | 5.54 |
| 9.50 | 1.30 | 0.69 | 6.06 |
| 9.75 | 1.38 | 0.77 | 6.59 |
| 10.00 | 1.48 | 0.85 | 7.13 |
| 10.25 | 1.58 | 0.94 | 7.88 |
| 10.50 | 1.69 | 1.04 | 8.90 |
| 10.75 | 1.82 | 1.15 | 9.96 |
| 11.00 | 1.96 | 1.27 | 11.02 |
| 11.25 | 2.12 | 1.43 | 13.29 |
| 11.50 | 2.33 | 1.62 | 17.12 |
| 11.75 | 2.78 | 2.04 | 35.20 |
| 12.00 | 3.91 | 3.13 | **80.14** |
| 12.25 | 5.04 | 4.24 | **96.54** |
| 12.50 | 5.49 | 4.68 | 43.00 |
| 12.75 | 5.70 | 4.89 | 19.57 |
| 13.00 | 5.86 | 5.05 | 14.91 |
| 13.25 | 6.00 | 5.18 | 12.23 |
| 13.50 | 6.13 | 5.31 | 11.14 |
| 13.75 | 6.24 | 5.42 | 10.11 |
| 14.00 | 6.34 | 5.52 | 9.07 |
| 14.25 | 6.44 | 5.61 | 8.27 |
| 14.50 | 6.52 | 5.70 | 7.77 |
| 14.75 | 6.60 | 5.78 | 7.27 |
| 15.00 | 6.68 | 5.85 | 6.78 |
| 15.25 | 6.75 | 5.92 | 6.28 |
| 15.50 | 6.82 | 5.99 | 5.79 |
| 15.75 | 6.87 | 6.05 | 5.29 |
| 16.00 | 6.93 | 6.10 | 4.79 |
| 16.25 | 6.98 | 6.15 | 4.42 |
| 16.50 | 7.03 | 6.20 | 4.20 |
| 16.75 | 7.07 | 6.24 | 3.98 |
| 17.00 | 7.11 | 6.28 | 3.76 |
| 17.25 | 7.15 | 6.32 | 3.55 |
| 17.50 | 7.19 | 6.36 | 3.33 |
| 17.75 | 7.22 | 6.39 | 3.12 |
| 18.00 | 7.26 | 6.43 | 2.90 |
| 18.25 | 7.29 | 6.46 | 2.75 |
| 18.50 | 7.32 | 6.49 | 2.68 |
| 18.75 | 7.35 | 6.52 | 2.62 |
| 19.00 | 7.38 | 6.54 | 2.55 |
| 19.25 | 7.40 | 6.57 | 2.49 |
| 19.50 | 7.43 | 6.60 | 2.42 |
| 19.75 | 7.46 | 6.63 | 2.36 |
| 20.00 | **7.48** | **6.65** | 2.29 |

## Summary for Pond P-1: PreTreatment Pond

Base Flow 30 GPM mine dewatering flow

---

Inflow Area = 28.389 ac, 13.25% Impervious, Inflow Depth > 6.63" for 500-Year event
Inflow = 188.44 cfs @ 12.12 hrs, Volume= 15.693 af, Incl. 0.07 cfs Base Flow
Outflow = 0.00 cfs @ 8.85 hrs, Volume= 0.001 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 8.85 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1,184.76' @ 20.00 hrs Surf.Area= 111,887 sf Storage= 683,213 cf ← Peak Storage
Flood Elev= 1,186.50' Surf.Area= 117,672 sf Storage= 882,501 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 72.9 min ( 817.9 - 745.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 1,178.00' | 1,062,806 cf | **Pre-Treatment Water Storage Pond (Prismatic)** Listed below (Recalc) |

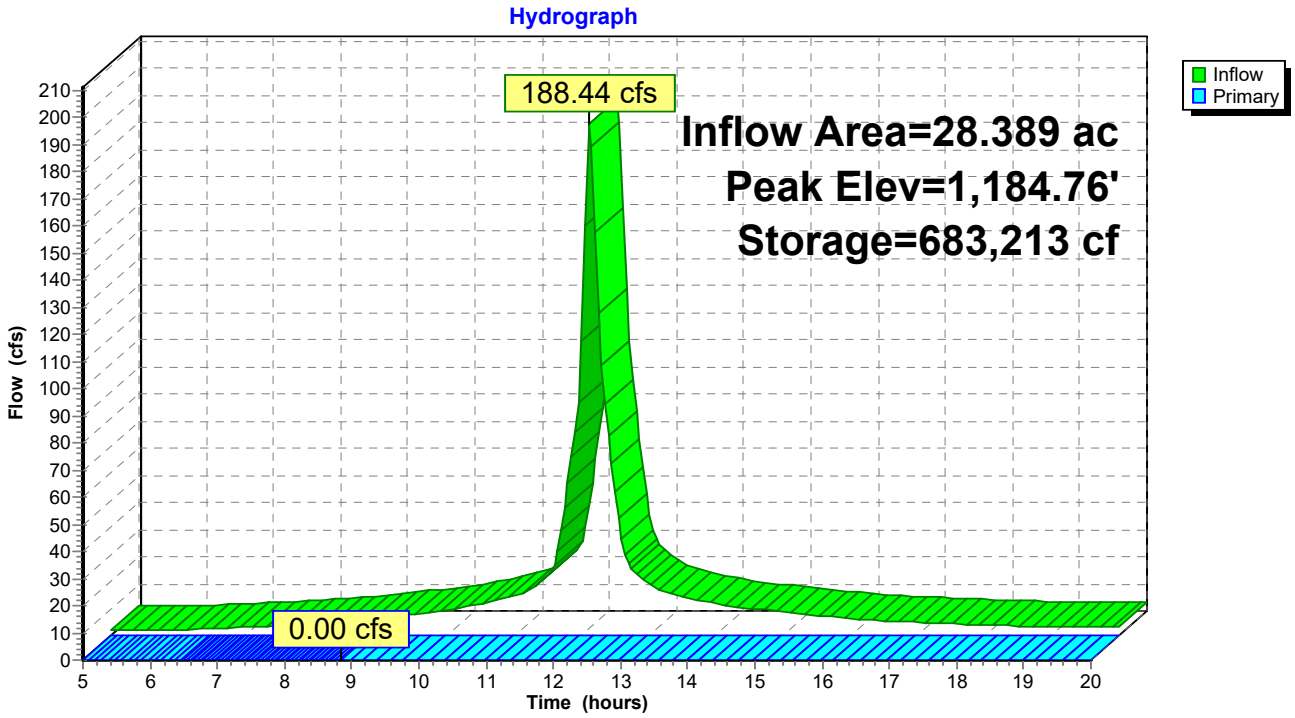
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 1,178.00 | 90,440 | 0 | 0 |
| 1,180.00 | 96,585 | 187,025 | 187,025 |
| 1,182.00 | 102,890 | 199,475 | 386,500 |
| 1,184.00 | 109,356 | 212,246 | 598,746 |
| 1,186.00 | 115,985 | 225,341 | 824,087 |
| 1,188.00 | 122,734 | 238,719 | 1,062,806 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 1,178.00' | **Treatment Rate** |

Head (feet) 0.00 0.50 10.00
Disch. (cfs) 0.000 ~~6.00~~ ← No Pond Discharge Assumed

**Primary OutFlow** Max=0.00 cfs @ 8.85 hrs HW=1,178.50' (Free Discharge)
└**1=Treatment Rate** (Custom Controls 0.00 cfs)

## Pond P-1: PreTreatment Pond



## Hydrograph for Pond P-1: PreTreatment Pond

| Time (hours) | Inflow (cfs) | Storage (cubic-feet) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|
| 5.00 | 1.65 | 74 | 1,178.00 | 0.00 |
| 5.50 | 1.91 | 3,277 | 1,178.04 | 0.00 |
| 6.00 | 2.17 | 6,949 | 1,178.08 | 0.00 |
| 6.50 | 2.61 | 11,207 | 1,178.12 | 0.00 |
| 7.00 | 3.16 | 16,390 | 1,178.18 | 0.00 |
| 7.50 | 3.73 | 22,585 | 1,178.25 | 0.00 |
| 8.00 | 4.34 | 29,842 | 1,178.33 | 0.00 |
| 8.50 | 5.38 | 38,485 | 1,178.42 | **0.00** |
| 9.00 | 6.64 | 49,293 | 1,178.54 | **0.00** |
| 9.50 | 7.96 | 62,431 | 1,178.68 | 0.00 |
| 10.00 | 9.32 | 77,984 | 1,178.85 | 0.00 |
| 10.50 | 11.62 | 96,625 | 1,179.05 | 0.00 |
| 11.00 | 14.34 | 119,979 | 1,179.30 | 0.00 |
| 11.50 | 22.31 | 151,794 | 1,179.63 | 0.00 |
| 12.00 | **108.55** | 244,415 | 1,180.59 | 0.00 |
| 12.50 | **53.17** | 458,076 | 1,182.69 | 0.00 |
| 13.00 | 18.98 | 508,938 | 1,183.17 | 0.00 |
| 13.50 | 14.29 | 537,685 | 1,183.44 | 0.00 |
| 14.00 | 11.64 | 561,027 | 1,183.65 | 0.00 |
| 14.50 | 10.00 | 580,284 | 1,183.83 | 0.00 |
| 15.00 | 8.73 | 597,138 | 1,183.99 | 0.00 |
| 15.50 | 7.46 | 611,706 | 1,184.12 | 0.00 |
| 16.00 | 6.18 | 623,983 | 1,184.23 | 0.00 |
| 16.50 | 5.44 | 634,324 | 1,184.32 | 0.00 |
| 17.00 | 4.88 | 643,606 | 1,184.41 | 0.00 |
| 17.50 | 4.33 | 651,892 | 1,184.48 | 0.00 |
| 18.00 | 3.77 | 659,181 | 1,184.55 | 0.00 |
| 18.50 | 3.50 | 665,663 | 1,184.61 | 0.00 |
| 19.00 | 3.33 | 671,814 | 1,184.66 | 0.00 |
| 19.50 | 3.17 | 677,665 | 1,184.71 | 0.00 |
| 20.00 | 3.00 | **683,217** | **1,184.76** | 0.00 |

Peak water storage and elveation

## Stage-Area-Storage for Pond P-1: PreTreatment Pond

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---|---|---|
| 1,178.00 | 90,440 | 0 |
| 1,178.10 | 90,747 | 9,059 |
| 1,178.20 | 91,055 | 18,149 |
| 1,178.30 | 91,362 | 27,270 |
| 1,178.40 | 91,669 | 36,422 |
| 1,178.50 | 91,976 | 45,604 |
| 1,178.60 | 92,283 | 54,817 |
| 1,178.70 | 92,591 | 64,061 |
| 1,178.80 | 92,898 | 73,335 |
| 1,178.90 | 93,205 | 82,640 |
| 1,179.00 | 93,513 | 91,976 |
| 1,179.10 | 93,820 | 101,343 |
| 1,179.20 | 94,127 | 110,740 |
| 1,179.30 | 94,434 | 120,168 |
| 1,179.40 | 94,742 | 129,627 |
| 1,179.50 | 95,049 | 139,117 |
| 1,179.60 | 95,356 | 148,637 |
| 1,179.70 | 95,663 | 158,188 |
| 1,179.80 | 95,970 | 167,769 |
| 1,179.90 | 96,278 | 177,382 |
| 1,180.00 | 96,585 | 187,025 |
| 1,180.10 | 96,900 | 196,699 |
| 1,180.20 | 97,216 | 206,405 |
| 1,180.30 | 97,531 | 216,142 |
| 1,180.40 | 97,846 | 225,911 |
| 1,180.50 | 98,161 | 235,712 |
| 1,180.60 | 98,476 | 245,543 |
| 1,180.70 | 98,792 | 255,407 |
| 1,180.80 | 99,107 | 265,302 |
| 1,180.90 | 99,422 | 275,228 |
| 1,181.00 | 99,738 | 285,186 |
| 1,181.10 | 100,053 | 295,176 |
| 1,181.20 | 100,368 | 305,197 |
| 1,181.30 | 100,683 | 315,249 |
| 1,181.40 | 100,999 | 325,333 |
| 1,181.50 | 101,314 | 335,449 |
| 1,181.60 | 101,629 | 345,596 |
| 1,181.70 | 101,944 | 355,775 |
| 1,181.80 | 102,259 | 365,985 |
| 1,181.90 | 102,575 | 376,227 |
| 1,182.00 | 102,890 | 386,500 |
| 1,182.10 | 103,213 | 396,805 |
| 1,182.20 | 103,537 | 407,143 |
| 1,182.30 | 103,860 | 417,512 |
| 1,182.40 | 104,183 | 427,915 |
| 1,182.50 | 104,507 | 438,349 |
| 1,182.60 | 104,830 | 448,816 |
| 1,182.70 | 105,153 | 459,315 |
| 1,182.80 | 105,476 | 469,847 |
| 1,182.90 | 105,800 | 480,410 |
| 1,183.00 | 106,123 | 491,007 |
| 1,183.10 | 106,446 | 501,635 |
| 1,183.20 | 106,770 | 512,296 |
| 1,183.30 | 107,093 | 522,989 |
| 1,183.40 | 107,416 | 533,714 |
| 1,183.50 | 107,740 | 544,472 |
| 1,183.60 | 108,063 | 555,262 |
| 1,183.70 | 108,386 | 566,085 |
| 1,183.80 | 108,709 | 576,939 |
| 1,183.90 | 109,033 | 587,827 |
| 1,184.00 | 109,356 | 598,746 |
| 1,184.10 | 109,687 | 609,698 |
| 1,184.20 | 110,019 | 620,683 |
| 1,184.30 | 110,350 | 631,702 |
| 1,184.40 | 110,682 | 642,754 |
| 1,184.50 | 111,013 | 653,838 |
| 1,184.60 | 111,345 | 664,956 |
| 1,184.70 | 111,676 | 676,107 |
| 1,184.80 | 112,008 | 687,291 |
| 1,184.90 | 112,339 | 698,509 |
| 1,185.00 | 112,671 | 709,759 |
| 1,185.10 | 113,002 | 721,043 |
| 1,185.20 | 113,333 | 732,360 |
| 1,185.30 | 113,665 | 743,710 |
| 1,185.40 | 113,996 | 755,093 |
| 1,185.50 | 114,328 | 766,509 |
| 1,185.60 | 114,659 | 777,958 |
| 1,185.70 | 114,991 | 789,441 |
| 1,185.80 | 115,322 | 800,956 |
| 1,185.90 | 115,654 | 812,505 |
| 1,186.00 | 115,985 | 824,087 |
| 1,186.10 | 116,322 | 835,702 |
| 1,186.20 | 116,660 | 847,351 |
| 1,186.30 | 116,997 | 859,034 |
| 1,186.40 | 117,335 | 870,751 |
| 1,186.50 | 117,672 | 882,501 |
| 1,186.60 | 118,010 | 894,285 |
| 1,186.70 | 118,347 | 906,103 |
| 1,186.80 | 118,685 | 917,955 |
| 1,186.90 | 119,022 | 929,840 |
| 1,187.00 | 119,360 | 941,759 |
| 1,187.10 | 119,697 | 953,712 |
| 1,187.20 | 120,034 | 965,699 |
| 1,187.30 | 120,372 | 977,719 |
| 1,187.40 | 120,709 | 989,773 |
| 1,187.50 | 121,047 | 1,001,861 |
| 1,187.60 | 121,384 | 1,013,982 |
| 1,187.70 | 121,722 | 1,026,138 |
| 1,187.80 | 122,059 | 1,038,327 |
| 1,187.90 | 122,397 | 1,050,549 |
| 1,188.00 | **122,734** | **1,062,806** |

Peak water storage and elveation

2-foot freeboard

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 10-D: Water Treatment Scoping Study

Mine Water Service

October 25, 2022

Jeremy Ouellette, P. Eng.
Wolfden Resources, Pickett Mountain Project

Dear Jeremy:

Enclosed please find the completed water treatment study report for Wolfden Resources Pickett Mountain property. Please let me know if you require have any questions or require any clarification.

Sincerely,

Brian Danyliw
Principle, Mine Water Service

Mine Water Service Inc., 83 Digby;s Side Road
Mindemoya, Ontario, Canada P0P 1S0
705-618-6729
brian@minewaterservice.com

Mine Water Service

# Wolfden Resources, Pickett Mountain Project, Mine Water Treatment Scoping Study

## Introduction

Mine Water Service Inc. (MWS) was retained by Wolfden Resources to identify and examine various options to provide a water treatment process to allow treatment on surface contact water and underground mine produced water. This treatment process is required to provide effluent water of a quality that meets or exceeds identified existing water quality at the Pickett Mountain Site.

Mine Water Service is a consultancy operated by Brian Danyliw, a mining industry water treatment professional with over 40 years of experience. In addition to a thorough understanding of all aspects of water treatment relating to mining operations, Brian also has extensive process knowledge of underground mining as well as mineral processing of ore bodies similar to Pickett Mountain. In addition to Brian, the team assembled for this project included Kevin Gotschalk, Princlple with Oracle Water Services, a water treatment expert with over 40 years of water treatment experience and Dr. Paul Thoen, Chief Technology Officer with Shelton Associates, a company with extensive experience in designing, installing and operating membrane treatment facilities at mining operations throughout the world.

The scope of experience of MWS includes site and technical support on water treatment issues at over 80 mining operations around the world.

## Project Report Objectives

The overall objective of this report is to provide a comprehensive and detailed plan for water treatment at the Pickett Mountain site that meets the requirements of the Land Use Planning Commission (LUPC) that treated water will meet existing site water quality. Existing site water quality is based on a set of ten (10) samples collected September 23, 2021 and analyzed by Maine Environmental Laboratory[1]. Detailed analysis reports from these ten samples can be found in Appendix 1 of this report. Water volumes and flow rates are based on the technical memorandum "Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option" dated May 23, 2022 and revised August 25, 2022, prepared by Wood PLC Engineering consultants."[2] discussed in detail within this report.

Included in the report is information and background on the water treatment technologies proposed to demonstrate the ability of these technologies to produce the required quality of treated water. This report details the types of treatment that will be employed, the plant process, basis of plant sizing, mass and water

[1] Maine Environmental Laboratory, One Main Street, Yarmouth, ME 04096
Report Information: Batch ID: ONE 10624, Report ID: 10624-211027-1313, Date of Issue: October 27, 2021

[2] Peters, M. (2022, May 23, Revised August 25). TECHNICAL MEMORANDUM, Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option

balances, treatment efficacy based on computer modeling as well as relevant experience of the authors. The anticipated final treated water quality was developed utilizing input water quality data from a relevant operating mine example (Half Mile Mine- owned by Trevali Mining Corporation located West of Miramichi, New Brunswick, Canada.).

## Design Criteria

| | |
|---|---|
| Daily Identified Water Treatment Requirement: | 152.1 USGPM[3] |
| Flow Contingency: | 30% |
| Design Permeate (final treated effluent) Rate: | 200 USGPM |
| Design Plant Influent Rate: | 205 USGPM |
| Duty: | Continuous, 24 hrs/7/365 |
| Input Water Quality: | Provided by Wolfden – Appendix 1 |
| Background (target) Water Quality: | Provided by Wolfden – Appendix 1 |

## Treatment Approach

The approach to water treatment for the Wolfden Resources, Pickett Mountain Project (Project) is to employ best available technologies to ensure effluent water meets Maine Chapter 200[4] and Title 38, Chapter 3 wastewater discharge requirements[5]. Proposed water treatment technologies for this Project are multistage and scalable. First, membrane filtration utilizing ultrafiltration (UF), which removes particles down to 0.1 micron in size, is a pretreatment stage to remove suspended solids. Second, reverse osmosis (RO) membranes which remove constituents down to atomic radii in size. Through this combination of proven membrane filtration techniques, water quality to meet regulatory requirements can be achieved. RO can effectively remove all contaminants from water, except for some dissolved gases (such as carbon dioxide and oxygen, which are nonhazardous normal constituents of water) and can produce pure water containing only water molecules.

Membrane filtration technologies date back to the late 1950's and were initially developed to allow for the generation of potable water from sea water. Over the years, continued development and refinement of the technology and extensive adoption of the technology across multiple industries and applications has resulted in improved efficacy and reduced costs. In the past decade, membrane filtration water treatment, and in particular some combination of microfiltration (MF), UF, nanofiltration (NF) and RO, has become the industry standard for water and wastewater treatment across multiple industries, including mining and mineral processing. The US Food and Drug Administration (USFDA) guidelines state that "An RO water purification system with several modules connected in series can produce water containing less than 0.1 ppm Total

[3] Permeate flow
[4] 06-096 CMR 200

[5] Title 38, Chapter 3: Protection and improvement of Waters. (n.d.). Retrieved July 21, 2022, from https://www.mainelegislature.org/legis/statutes/38/title38ch3sec0.html

Dissolved Solids (TDS;(resistivity about 1 megohm-cm)."[6] This level of purity is essentially pure water, containing only water molecules, without any elements, metals, or contaminants present.
Many examples of utilization of membrane filtration systems to treat mining and mineral processing influenced waters throughout the world are available. As per the US Environmental Protection Agency (USEPA) Reference Guide for Treatment Technologies for Mine-Influenced Water "[RO] Can remove 90 to 98 percent of TDS. A TDS removal efficiency of 98.5 percent was observed during pilot testing of the membranes tested."[7]

The approach taken for the Pickett Mountain Project is to design a water treatment system which will accomplish the following,

1. Treatment of surface contact water and underground produced water with the ability to produce effluent which meets or exceeds site-specific existing water chemistry (quality).
2. Treatment plant design to accommodate peak flow expectation with additional contingency flow capacity.
3. Minimization of treatment plant concentrate wastewater flow.

## How Membrane Water Treatment Works

### Ultrafiltration

The first step employed in the Pickett Mountain water treatment process is ultrafiltration (UF). It is designed to remove particles down to approximately 0.1 micron in size. Membranes manufactured for UF can be polymeric or ceramic and we will employ ceramic UF membranes because of their robust nature and ability to treat a wide range of influent characteristics. Ceramic UF membranes are essentially hollow tubes constructed of sintered metal (such as aluminum oxide) which results in a porous structure (Figure 1). This porous structure allows the ceramic tubes to act as filters while the sintered metal construction provides abrasion resistance, the ability to withstand a wide range of operating conditions (such as temperature extremes), and long life.

Influent water is forced under pressure through the hollow ceramic tubes. Filtrate (clean water) then passes through the pore structure of the tube walls and exits the membrane system.

[6] https://www.fda.gov/inspections-compliance-enforcement-and-criminal-investigations/inspection-technical-guides/reverse-osmosis
[7] U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, REFERENCE GUIDE to Treatment Technologies for Mining-Influenced Water, March 2014 EPA 542-R-14-001

Figure 1. Ceramic UF Membrane
Image Credit | Wikiwayman [CC BY-SA]

**Reverse Osmosis Overview**

Reverse osmosis (RO) represents state-of-the-art technology in water treatment. RO was developed in the late 1950's as a method of desalinating sea water. Today, RO has earned its name as the most convenient and thorough method to filter water. It is used by most water bottling plants, and by many industries that require ultra-refined water in manufacturing, such as microelectronics and pharmaceuticals, as well as high quality water to meet strict environmental discharge requirements. This advanced technology is also available for hiking enthusiasts and to homes and offices for drinking water filtration.

The RO system is dependent upon, and built around, individual membranes. Each membrane consists of a spiral wound sheet of semi-permeable material. Multiple layers of membrane and supporting material (outer wrap, spacers and permeate collection material) are formed into a tube surrounding a perforated central tube (Figure 2). Multiple layers of membrane allow the system to overcome the relatively low flow per unit area through the semi-permeable RO membranes. Feed water enters one end of the RO tube and as it passes down the length of the tube pure water passes through the RO membranes and reaches the perforated central tube. Water containing contaminants (as contaminants don’t pass through the membranes) continues along the length of the tube and exists as concentrate (wastewater). Pure water that passes through the membranes is collected in the central perforated tube and exists the system as permeate.

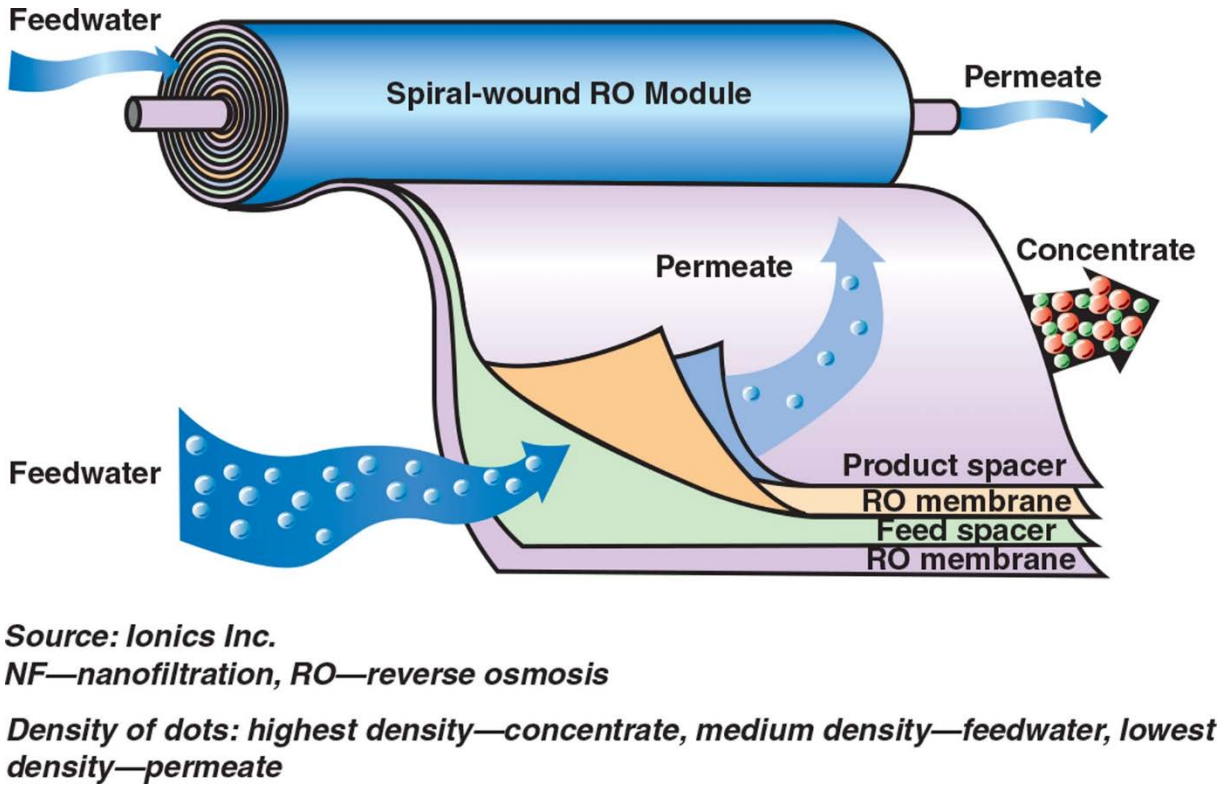



Figure 2. Spiral Wound RO Membrane

**How RO Works**

To understand "reverse osmosis," it is best to start with an understanding of normal osmosis. According to Merriam-Webster's Collegiate Dictionary, osmosis can be explained as the "movement of a water through a semipermeable membrane (as of a living cell) into a solution of higher solute concentration that tends to equalize the concentrations of solute on the two sides of the membrane". A semipermeable membrane is a membrane that will pass some atoms or molecules but not others. Saran™ wrap is a membrane, but it is impermeable to almost everything. An interesting example of a semipermeable membrane is the eggshell. Egg shells have pores large enough to allow oxygen and water vapor through, but small enough to prevent bacteria and dust from entering.

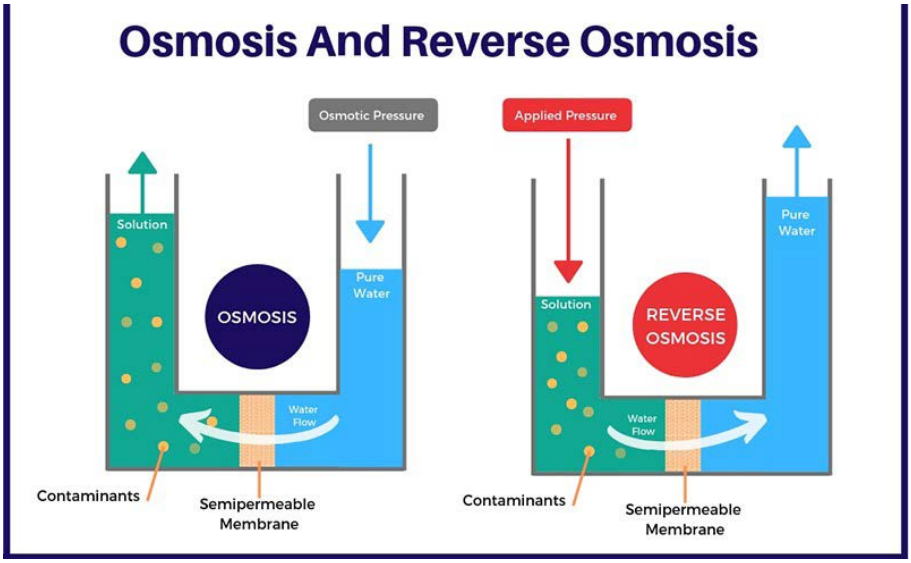



Figure 3, Osmosis and Reverse Osmosis[8]

In Figure 3 above, in the case of osmosis, the membrane allows passage of water molecules but not impurities such as organic molecules, salts or heavy metals. One way to understand osmotic pressure would be to think of the water molecules on both sides of the membrane. They are in constant motion. On the raw water side, some of the pores get plugged with contaminants, but on the pure-water side that does not happen. Therefore, more water passes from the pure-water side to the contaminated water side, as there are more pores on the pure-water side for the water molecules to pass through. The water on the contaminated side rises until one of two things occurs:

- The contaminant concentration becomes the same on both sides of the membrane (which isn't going to happen in this case since there is pure water on one side and contaminated water on the other).
- The water pressure rises as the height of the column of contaminated water rises, until it is equal to the osmotic pressure. At that point, osmosis will stop.

Osmosis is why drinking salty water (like ocean water) will kill you. When you put salty water in your stomach, osmotic pressure begins drawing water <u>out</u> of your body to try to dilute the salt in your stomach. Eventually, you dehydrate and die.

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[8] Membracon. (2019, November 26). *Reverse osmosis systems in industrial processes*. Smart Water Magazine. Retrieved August 16, 2022, from https://smartwatermagazine.com/news/membracon/reverse-osmosis-systems-industrial-processes

In RO, the idea is to use the membrane to act like an extremely fine filter to create pure water from salty or contaminated water. The contaminated water is put on one side of the membrane and pressure is applied to stop, and then reverse, the osmotic process. It is fairly slow, but it works effectively for water purification (Figure 4).

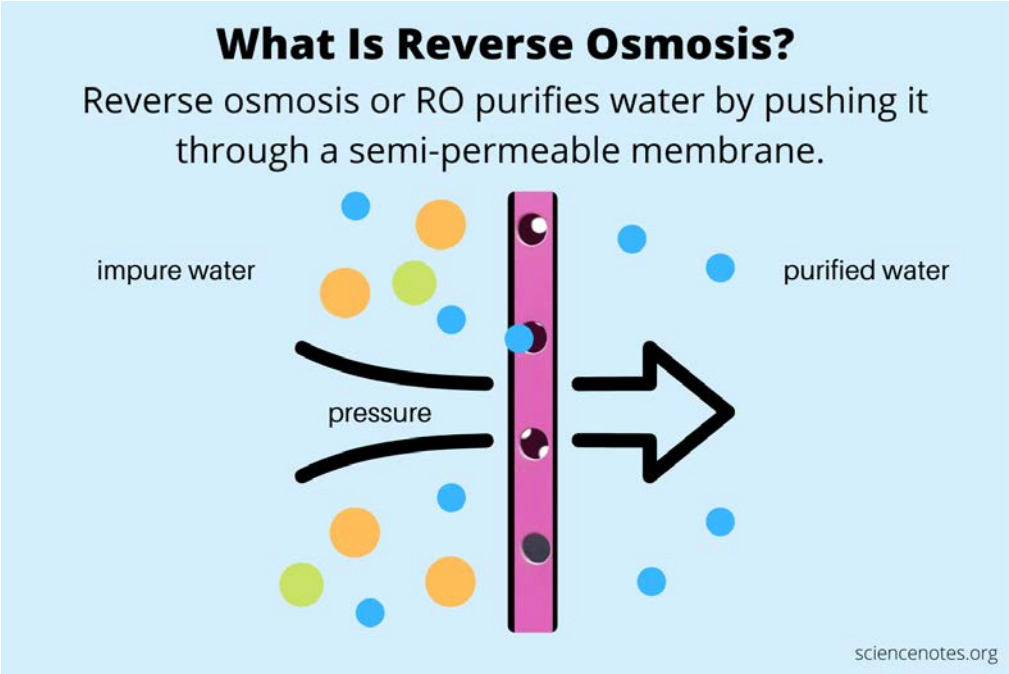


Figure 4. Reverse Osmosis[9]

**Contaminant Removal**

Reverse osmosis is an extremely effective technology in removing contaminants from water. The following chart (Figure 5) outlines some of RO's capabilities regarding specific contaminants compared to other filtration methods.

[9] Helmenstine, A. (2022, February 21). *What is reverse osmosis?* Science Notes and Projects. Retrieved August 16, 2022, from https://sciencenotes.org/what-is-reverse-osmosis/

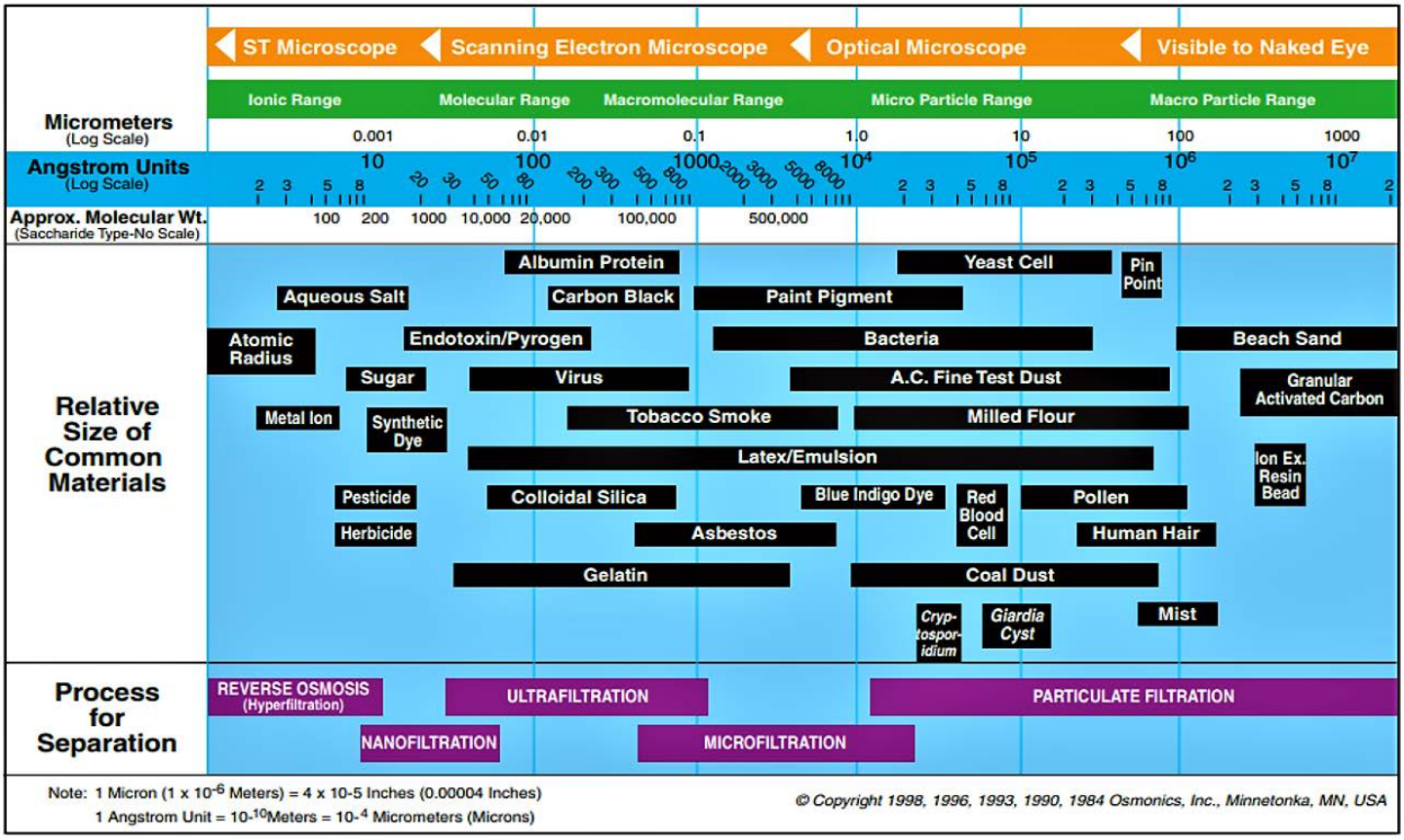


Figure 5, Membrane Filtration Removal Sizes[10]

In the case of heavy metal and other contaminant removal from wastewater, RO can separate all contaminants except for some dissolved gases such as oxygen and carbon dioxide (it should be noted that dissolved gasses are naturally present in all water and are not hazardous). The typical separation efficacy of common ions is listed in the Table 6 below. These rejection efficiencies have been established through a vast number of actual RO system operations and specific documentation for various rejection efficiencies can be found through review of a variety of technical publications. It should be noted that these separation efficiencies are for a single pass through a typical RO membrane of the same type chosen for the Pickett Mountain water treatment plant. Sequential treatment, through a second RO membrane, will result in an additional separation efficacy equal to that listed below. This means, as an example, aluminum separation through two passes would result in 96% - 98% removal in the first pass and an additional 96% - 98% removal of any residual in the second pass for a total removal efficacy of 99.8% - 99.96%. A third pass would therefore result in 99.992% - 99.999% removal.

[10] WP-Content. (2004, August 15). *Home*. WCP Online. Retrieved July 21, 2022, from https://wcponline.com/wp-content/uploads/2004/08/Figure-1-3.png

| Ion | % Rejection* |
|---|---|
| Calcium | 93-99 |
| Sodium | 92-98 |
| Magnesium | 93-98 |
| Potassium | 92-96 |
| Manganese | 96-98 |
| Iron | 96-98 |
| Aluminum | 96-98 |
| Copper | 96-99 |
| Nickel | 96-99 |
| Cadmium | 93-97 |
| Silver | 93-96 |
| Zinc | 96-98 |
| Mercury | 94-97 |
| Hardness Ca&Mg | 93-97 |
| Radioactivity | 93-97 |
| Chloride | 92-98 |
| Ammonium | 80-90 |

| Ion | % Rejection* |
|---|---|
| Bromide | 90-95 |
| Phosphate | 95-98 |
| Cyanide | 90-97 |
| Sulfate | 96-99 |
| Thiosulfate | 96-98 |
| Silicate | 92-95 |
| Silica | 90-98 |
| Nitrate | 90-95 |
| Boron | 50-70 |
| Borate | 30-50 |
| Fluoride | 92-95 |
| Polyphosphate | 96-98 |
| Orthophosphate | 96-98 |
| Chromate | 85-95 |
| Bacteria | 99+ |
| Lead | 95-98 |
| Arsenic | 50-90 |

Figure 6. Typical Rejection Rates for Thin Film Composite RO Membranes

**Nominal rejection characteristics of thin film composite reverse osmosis membranes*. Membrane Rejection Levels. (n.d.). Retrieved July 21, 2022, from https://www.watertreatmentguide.com/Membrane_Rejection.htm#Thin%20Film%20Composite

## Membrane Water Treatment in Mining

Multiple examples of utilization of UF and RO to treat mining influenced waters are available throughout North America and worldwide. These mining operations include examples of treatment of site contact water, underground mine water effluent and tailings facility (TMF) decant water, from both mine only and mine/mill operations, for direct discharge to the environment.

### Input and Target Water Volume and Quality

While no actual produced water from the Pickett Mountain operations is available for analysis, the choice of UF and RO for the water treatment plant will allow successful removal of any metals or other contaminants present once further analysis is conducted as part of the Chapter 200 process and the mine is in operation. For the purposes of this study and to facilitate process design and computer modeling, input water quality is based on water chemistry data supplied by Half Mile Mine. Input water is based on the highest value (worst case) from Half Mile Mine samples which were collected throughout the lifecycle of the mine from construction through operation and maintenance. Sampling at Half Mile was completed by the mine site environmental team and samples were collected using lab provided sampling guidelines and analysis

performed by RPC Science and Engineering (Research and Productivity Council). RPC is a certified laboratory based in Fredericton, New Brunswick. Sampling and analysis took place from 2011 through 2019.

While variations in water quality are expected due to variations in site-specific mineral deposits, based on the MWS's experience with multiple polymetallic massive sulfide mining operations, the Half Mile Mine water quality data is similar to other mine only operations and provides an appropriate comparison to water quality data expected from Pickett Mountain.

Produced contact water volumes are based on peak monthly volumes as described in the technical memorandum "Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option"[11] dated May 23, 2022 and revised August 25, 2022, prepared by Wood PLC Engineering consultants.

Target effluent quality is based on water sampling results from the Pickett Mountain Site collected during groundwater sampling efforts in September 2021 and is the current data set available to evaluate background conditions (Table 1). The average target effluent water quality used in this report is the average of the target analytes from the 10 samples and includes the method detection limit (MDL) value for any samples reported by the lab as non-detect. The highest single value effluent water quality is the highest detected value and does not include the MDL for non-detects. Water analysis data is included in Appendix 1.

[11] Peters, M. (2022, May 23, Revised August 25). TECHNICAL MEMORANDUM, Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option

Mine Water Service

Table 1. Input and Target Effluent Water Quality

| Analyte | Units | Method Detection Limit | Target Effluent Quality Average MG/L | Target Effluent Quality Highest Single Analysis Result MG/L | Influent Water Quality (Highest Half Mile Value) MG/L |
|---|---|---|---|---|---|
| TOTAL ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **6.92** | **9.2** | Not Reported |
| PHENOLPHTHALEIN ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **0.7** | **Not Detectable** | Not Reported |
| BICARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported |
| CARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported |
| TOTAL PHOSPHORUS | MG/L | 0.01 | 0.020 | 0.04 | 0.04 |
| TDS | MG/L | 10 | 38.5 | 51 | Not Reported |
| TSS | MG/L | 2.5 | 4.5 | 9.7 | 12 |
| MERCURY | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Reported |
| ALUMINUM | MG/L | 0.005 | 0.1767 | 0.28 | 0.358 |
| ANTIMONY | MG/L | 0.0002 | 0.00045 | 0.0014 | 0.0009 |
| ARSENIC | MG/L | 0.0002 | 0.00042 | 0.0009 | 0.005 |
| BARIUM | MG/L | 0.003 | 0.0062 | 0.009 | 0.021 |
| BERYLLIUM | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Detectable |
| BORON | MG/L | 0.02 | 0.02 | 0.02 | 0.196 |
| CADMIUM | MG/L | 0.00002 | 0.000132 | 0.00014 | 0.0477 |
| CALCIUM | MG/L | 0.1 | 2.81 | 3.6 | 91.8 |
| CHROMIUM | MG/L | 0.002 | 0.002 | Not Detectable | Not Detectable |
| COBALT | MG/L | 0.0003 | 0.0003 | 0.0003 | 0.151 |
| COPPER | MG/L | 0.0001 | 0.00116 | 0.01 | 0.383 |
| IRON | MG/L | 0.02 | 0.232 | 0.56 | 6.02 |
| LEAD | MG/L | 0.0001 | 0.00018 | 0.0005 | 0.0257 |
| LITHIUM | MG/L | 0.0001 | 0.00029 | 0.0005 | 0.0037 |
| MAGNESIUM | MG/L | 0.1 | 0.67 | 0.9 | 7.17 |
| MANGANESE | MG/L | 0.002 | 0.0334 | 0.075 | 1.27 |
| MOLYBDENUM | MG/L | 0.005 | 0.005 | Not Detectable | Not Detectable |
| NICKEL | MG/L | 0.002 | 0.002 | Not Detectable | 0.013 |
| POTASSIUM | MG/L | 0.1 | 0.28 | 0.4 | 5.92 |
| RUBIDIUM | MG/L | 0.0005 | 0.0005 | Not Reported | 0.0149 |
| SELENIUM | MG/L | 0.00006 | 0.00006 | Not Reported | 0.002 |
| SILICON | MG/L | 0.02 | 1.93 | 3 | 2.6 |
| SILVER | MG/L | 0.0003 | 0.0003 | Not Detectable | Not Detectable |
| SODIUM | MG/L | 0.1 | 0.99 | 1.2 | 25 |
| STRONTIUM | MG/L | 0.0003 | Not Reported | Not Reported | 0.25 |
| SULFUR | MG/L | 1 | 1.05 | 1.4 | 3 |
| THALLIUM | MG/L | 0.0001 | 0.0002 | 0.0008 | Not Detectable |
| ZINC | MG/L | 0.0002 | 0.00768 | 0.045 | 10 |
| CHLORIDE | MG/L | 0.3 | 0.512 | 0.62 | Not Reported |
| FLUORIDE | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported |
| NITRATE AS N | MG/L | 0.1 | 0.1 | Not Detectable | Not Reported |
| NITRITE AS N | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported |
| PH | STU | 0.01 | 6.712 | 6.30 - 7.04 (Range) | 7.5 |
| SPECIFIC CONDUCTANCE | µS/CM | 25 | 26.6 | 28 | 732 |
| SULFATE | MG/L | 0.6 | 1.9 | 2.7 | Not Reported |
| TOC | MG/L | 0.7 | 10.06 | 12 | Not Reported |
| DOC | MG/L | 0.7 | 9.49 | 12 | Not Reported |
| TOTAL CYANIDE | MG/L | 0.005 | 0.0136 | 0.015 | Not Reported |
| TURBIDITY | NTU | 0.1 | 3.91 | 9.7 | 21.2 |
| TRUE COLOR | | 5 | 48 | 70 | Not Reported |

Note: Units are milligram per liter (MG/L)
Target effluent quality average utilizes the MDL for all values that were reported by the laboratory as zero.

It should also be noted that oil, grease and other potential organic materials which might enter the wastewater stream through mining operations are considered in the treatment plant design. Modern underground mine design and operations carefully monitors and controls any discharge of oil and grease from underground mobile equipment. In addition to oil and grease separation systems used to separate and recover oil and grease from wash water, mobile equipment contain multiple failsafe devices designed to minimize the risk of any spills occurring due to equipment failures. Even with these safeguards in place, there remains potential for trace amounts of oil and grease to be in the mine effluent water sent to the water treatment plant. The inclusion of ceramic UF as a first treatment stage in the treatment plant design provides proven technology for rejection of oil and grease to the waste stream. This means that any trace amounts of oil and grease that may enter the water treatment plant will ultimately be retained within the mine wastewater system for disposal via cement preparation for backfill. As an example, one study conducted using ceramic UF membranes on oily wastewater documented a 97.6% rejection rate.[12]

## Modeling Studies

Modeling of UF RO systems was completed utilizing four different commercially available software packages. The accuracy of computer simulations versus laboratory and pilot studies was examined by the Texas Water Development Board and presented in their "Report 1148321310 Part II. Performance Evaluation of Reverse Osmosis Membrane Computer Models" which was published in 2014. In part their conclusions state, "In summary, the overall accuracy and precision demonstrated by the computer models evaluated as part of this study were within a reasonable level of expectation considering the limited amount of the start-up data available. The level of accuracy for first stage feed pressures was sufficient to facilitate a conservative selection of a first stage feed pump. The level of accuracy for rejection of most ion constituents and total dissolved solids was within the expected range considering the limited amount of start-up feed and permeate water quality data. Computer model accuracy was comparable to the accuracy provided by the results of a pilot study for the one full-scale facility for which pilot test data was available. Another pilot study evaluation demonstrated the similarity of performance provided by pilot testing and computer models in predicting the performance of a full-scale reverse osmosis membrane system. Computer models created to predict the performance of two different membranes used during single-element pilot tests demonstrated a sufficient degree of accuracy to validate the use of computer models in predicting the performance of a full-scale membrane system. The precision demonstrated by the computer models was, in most cases, sufficient to facilitate the design of a membrane system to accommodate similar membranes from multiple membrane manufacturers."[13]

A number of commercial modeling programs are available, and each program utilize membranes that are commercially available from a single membrane manufacturer. The following programs were utilized to develop this water treatment plan.

[12] Chen, J.; Lv, Q.; Meng, Q.; Liu, X.; Xiao, X.; Li, X.; Liu, Y.; Zhang, X.; Gao, P. Study on Treatment of Low Concentration Oily Wastewater Using Alumina Ceramic Membranes. Crystals 2022, 12, 127. https:// doi.org/10.3390/cryst12020127

[13] https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/1148321310_Part%20II_Performance%20Evaluation.pdf

1. Hyr-RO-Dose from French Creek Software Inc., which is a specialized water treatment modeling program. The hyd-RO-Dose program is primarily designed to predict antiscalant requirements for membrane systems; however, to accomplish this, a detailed model of the membrane system input and output water chemistry is developed by the software. The primary benefit of the hyd-RO-Dose program is modeling of water chemistry parameters to five decimal places making it especially effective for ultra-pure water.
2. Wave software from Dupont. Wave is a modeling program developed by Dupont to support system designers utilizing various Dupont technologies, including UF and RO membranes from Dupont.
3. Winflows from Suez Water Technologies and Solutions. Winflows is a modeling program developed by Suez to support system designers utilizing various Suez technologies, including UF and RO membranes from Suez.
4. IMSDesign from Nitto Hydranautics. IMS Design is a modeling program developed by Nitto/Hydranautics to support system designers utilizing various Nitto/Hydranautics UF and RO membranes.

In all modeling cases, a single UF stage was utilized followed by a two-stage RO system to provide optimal metal and mineral removal. All programs were utilized as a check against each other and because some programs model certain chemical species that others do not. Reduction of reject (waste) water was accomplished through the utilization of a calcite reactor and filter press followed by an additional UF RO stage on the first pass reject water. Final wastewater treatment design utilized IMSDesign software due to its expanded capabilities to model a wider range of metals (as shown on Table 2 “Permeate Water Quality Summary from Multiple Models” on the following page).

The four models generated the following data for permeate water quality (see Table 2 below). It should be noted that slight variations in final effluent quality from one program to another are the result of slight differences in the efficiency of the particular membranes chosen for the model. As per the scope of the Project these various modeling programs were utilized to determine the final permeate quality achievable. Final membrane selection will be based on Mine Water Service’s field experience with similar water quality and include, for example, Hydronautics CPA7-LD low fouling spiral wound membranes for final modeling and plant design.

Table 2. Permeate Water Quality Summary from Multiple Models

| | | | | | | Modeling Program | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | hyd-RO-Dose | Wave | Winflows | IMSDesign |
| **Analyte** | **Units** | **Method Detection Limit** | **Target Effluent Quality Average MG/L** | **Target Effluent Quality Highest Single Analysis Result MG/L** | **Influent Water Quality (Highest Half Mile Value) MG/L** | **Final Effluent Quality** | **Final Effluent Quality** | **Final Effluent Quality** | **Final Effluent Quality** |
| TOTAL ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **6.92** | **9.2** | Not Reported | 0 | | | |
| PHENOLPHTHALEIN ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **0.7** | **Not Detectable** | Not Reported | 0 | | | |
| BICARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported | 0.000 | 1.39 | 2.170 | 0.677 |
| CARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported | 0.000 | 0.000 | 0.000 | 0.000 |
| TOTAL PHOSPHORUS | MG/L | 0.01 | 0.020 | 0.04 | 0.04 | 0.000 | 0.000 | 0.010 | 0.000 |
| TDS | MG/L | 10 | 38.5 | 51 | Not Reported | 0.28 | 1.420 | 5.090 | 0.970 |
| TSS | MG/L | 2.5 | 4.5 | 9.7 | 12 | 0.000 | 0.000 | 0.000 | 0.000 |
| MERCURY | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Reported | | | | |
| ALUMINUM | MG/L | 0.005 | 0.1767 | 0.28 | 0.358 | 0.000 | | | 0.000 |
| ANTIMONY | MG/L | 0.0002 | 0.00045 | 0.0014 | 0.0009 | 0.000 | | | |
| ARSENIC | MG/L | 0.0002 | 0.00042 | 0.0009 | 0.005 | | | | 0.000 |
| BARIUM | MG/L | 0.003 | 0.0062 | 0.009 | 0.021 | 0.000 | 0.000 | 0.000 | 0.000 |
| BERYLLIUM | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Detectable | | | | |
| BORON | MG/L | 0.02 | 0.02 | 0.02 | 0.196 | 0.000 | 0.000 | | 0.014 |
| CADMIUM | MG/L | 0.00002 | 0.000132 | 0.00014 | 0.0477 | | | | 0.000 |
| CALCIUM | MG/L | 0.1 | 2.81 | 3.6 | 91.8 | 0.05 | 0.000 | 0.170 | 0.000 |
| CHROMIUM | MG/L | 0.002 | 0.002 | Not Detectable | Not Detectable | | | | |
| COBALT | MG/L | 0.0003 | 0.0003 | 0.0003 | 0.151 | | | | 0.0000 |
| COPPER | MG/L | 0.0001 | 0.00116 | 0.01 | 0.383 | 0.000958 | | | 0.000 |
| IRON | MG/L | 0.02 | 0.232 | 0.56 | 6.02 | 0.000 | | 0.000 | 0.000 |
| LEAD | MG/L | 0.0001 | 0.00018 | 0.0005 | 0.0257 | | | | 0.000 |
| LITHIUM | MG/L | 0.0001 | 0.00029 | 0.0005 | 0.0037 | | | | 0.000 |
| MAGNESIUM | MG/L | 0.1 | 0.67 | 0.9 | 7.17 | 0.000 | | 0.050 | 0.000 |
| MANGANESE | MG/L | 0.002 | 0.0334 | 0.075 | 1.27 | | | | 0.000 |
| MOLYBDENUM | MG/L | 0.005 | 0.005 | Not Detectable | Not Detectable | | | | 0.000 |
| NICKEL | MG/L | 0.002 | 0.002 | Not Detectable | 0.013 | | | | 0.000 |
| POTASSIUM | MG/L | 0.1 | 0.28 | 0.4 | 5.92 | 0.000 | 0.000 | 0.120 | 0.004 |
| RUBIDIUM | MG/L | 0.0005 | 0.0005 | Not Reported | 0.0149 | | | | |
| SELENIUM | MG/L | 0.00006 | 0.00006 | Not Reported | 0.002 | | | | |
| SILICON | MG/L | 0.02 | 1.93 | 3 | 2.6 | 0.000 | 0.000 | 0.040 | 0.000 |
| SILVER | MG/L | 0.0003 | 0.0003 | Not Detectable | Not Detectable | | | | |
| SODIUM | MG/L | 0.1 | 0.99 | 1.2 | 25 | 0.010 | 0.000 | 1.060 | 0.261 |
| STRONTIUM | MG/L | 0.0003 | Not Reported | Not Reported | 0.25 | | | | 0.000 |
| SULFUR | MG/L | 1 | 1.05 | 1.4 | 3 | 0.06 | | 0.003 | 0.000 |
| THALLIUM | MG/L | 0.0001 | 0.0002 | 0.0008 | Not Detectable | | | | |
| ZINC | MG/L | 0.0002 | 0.00768 | 0.045 | 10 | | | | 0.004 |
| CHLORIDE | MG/L | 0.3 | 0.512 | 0.62 | Not Reported | 0.13 | 0.000 | 1.280 | 0.000 |
| FLUORIDE | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported | | | | |
| NITRATE AS N | MG/L | 0.1 | 0.1 | Not Detectable | Not Reported | | | 0.016 | 0.009 |
| NITRITE AS N | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported | | | | |
| PH | STU | 0.01 | 6.712 | 6.30 - 7.04 (Range) | 7.5 | 5.76 | 4.600 | 5.230 | 8.140 |
| SPECIFIC CONDUCTANCE | µS/CM | 25 | 26.6 | 28 | 732 | 1.12 | 9.000 | 10.000 | <10 |
| SULFATE | MG/L | 0.6 | 1.9 | 2.7 | Not Reported | 0.000 | 0.000 | 0.000 | 0.000 |
| TOC | MG/L | 0.7 | 10.06 | 12 | Not Reported | | | | |
| DOC | MG/L | 0.7 | 9.49 | 12 | Not Reported | | | | |
| TOTAL CYANIDE | MG/L | 0.005 | 0.0136 | 0.015 | Not Reported | | | | |
| TURBIDITY | NTU | 0.1 | 3.91 | 9.7 | 21.2 | 0 | 0.000 | 0.000 | 0.000 |
| TRUE COLOR | | 5 | 48 | 70 | Not Reported | 0 | 0.000 | 0.000 | 0.000 |

1. Empty cells indicate that that specific program does not model that analyte.
2. Minor variations in final water quality from one program to another is due to performance variations in the particular suppliers' membranes.

It should be noted that certain species are not modelled by any of the programs and that certain species were not included in the baseline or Half Mile analytical analysis. A brief description of these species follows.

- Modeling programs automatically adjust chloride, sodium or sulfate to modify input water chemistry to produce a water that is balanced in total anion and cation molar concentration. For this reason, in some instances, chloride, sodium or sulfate concentrations in permeate or concentrate water may not

be exactly equal to the theoretical values based on input water analysis chemistry. An example of this can be found in the Winflows chloride value in Table 2.

- Various alkalinities were not tested for certain samples, and in the case of Half Mile only total alkalinity was reported. Alkalinity in water takes into account natural bicarbonate, carbonate and hydroxide ions and is an equilibrium reached based on carbon dioxide adsorption and buffering capacity of the water. Alkalinity can vary dramatically in water based on rainfall, temperature, and seasonal variability especially associated with ice cover of surface waters. Alkalinity variability will not have any impact on the proposed treatment process or results achievable for all other metals and species present.
- TDS (Total Dissolved Solids) represents the sum of dissolved metals and other species in water and is not required or relevant in modeling UF RO system removal efficiency.
- Mercury was not reported in the Half Mile report and was therefore not modeled. It should be noted however that the IMSDesign program does model mercury removal and imputing mercury concentration at 0.1 mg/l resulted in a permeate mercury residual of not detectable when modeled.
- Rubidium is not currently modeled by any modeling programs due to the infrequent occurrence of rubidium in waters. Removal efficiency of rubidium is expected to be similar to that of strontium based on their similar atomic weights (rubidium = 85.5, strontium = 87.6). Available literature[14] indicates strontium removal utilizing RO ranges from 99.7% to 100% for a single pass. Anticipated removal efficiency for the Pickett Mountain two pass system would therefore be essentially 100%.
- Selenium is not currently modeled by any modeling programs however published literature[15] indicates that rejection rates for selenium are expected to be 90% to 95% for a single pass RO. This indicates a rejection rate in the two-pass Pickett Mountain plant of 99% to 99.75%.
- Sulfate was not reported however low-level sulfate was added to the models representing background sulfate levels.
- TOC (Total Organic Carbon) and DOC (Dissolved Organic Carbon) were not reported for the Half Mile samples and were therefore not modeled.
- Cyanide was not reported for Half Mile samples and was therefore not modeled.
- True color was not reported for Half Mile and was not modeled.

[14]Cai, Y.-H.; Yang, X.J.; Schäfer, A.I. Removal of Naturally Occurring Strontium by Nanofiltration/Reverse Osmosis from Groundwater. *Membranes* **2020**, *10*, 321. https://doi.org/10.3390/membranes10110321

[15] Abejón, R. A Bibliometric Analysis of Research on Selenium in Drinking Water during the 1990–2021 Period: Treatment Options for Selenium Removal. Int. J. Environ. Res. Public Health 2022, 19, 5834. https://doi.org/10.3390/ijerph19105834

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## Table 3. Anticipated Final Treated Water Quality (IMSDesign)

| | | | | | | Modeling Program | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | hyd-RO-Dose | Wave | Winflows | IMSDesign | |
| **Analyte** | **Units** | **Method Detection Limit** | **Target Effluent Quality Average MG/L** | **Target Effluent Quality Highest Single Analysis Result MG/L** | **Influent Water Quality (Highest Half Mile Value) MG/L** | **Final Effluent Quality** | **Final Effluent Quality** | **Final Effluent Quality** | **Final Effluent Quality** | **Final Expected Water Treatment Plant Effluent Quality MG/L** |
| TOTAL ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **6.92** | **9.2** | Not Reported | 0 | | | | |
| PHENOLPHTHALEIN ALKALINITY | MG/L as $CaCO_3$ | 0.7 | **0.7** | **Not Detectable** | Not Reported | 0 | | | | |
| BICARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported | 0.000 | 1.39 | 2.170 | 0.677 | 0.677 |
| CARBONATE ALKALINITY | MG/L | 1.3 | Not Reported | Not Reported | Not Reported | 0.000 | 0.000 | 0.000 | 0.000 | Not Detectable |
| TOTAL PHOSPHORUS | MG/L | 0.01 | 0.020 | 0.04 | 0.04 | 0.000 | 0.000 | 0.010 | 0.000 | Not Detectable |
| TDS | MG/L | 10 | 38.5 | 51 | Not Reported | 0.28 | 1.420 | 5.090 | 0.970 | 0.970 |
| TSS | MG/L | 2.5 | 4.5 | 9.7 | 12 | 0.000 | 0.000 | 0.000 | 0.000 | Not Detectable |
| MERCURY | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Reported | | | | | |
| ALUMINUM | MG/L | 0.005 | 0.1767 | 0.28 | 0.358 | 0.000 | | | 0.000 | Not Detectable |
| ANTIMONY | MG/L | 0.0002 | 0.00045 | 0.0014 | 0.0009 | 0.000 | | | | Not Detectable |
| ARSENIC | MG/L | 0.0002 | 0.00042 | 0.0009 | 0.005 | | | | 0.000 | Not Detectable |
| BARIUM | MG/L | 0.003 | 0.0062 | 0.009 | 0.021 | 0.000 | 0.000 | 0.000 | 0.000 | Not Detectable |
| BERYLLIUM | MG/L | 0.0002 | 0.0002 | Not Detectable | Not Detectable | | | | | Not Detectable |
| BORON | MG/L | 0.02 | 0.02 | 0.02 | 0.196 | 0.000 | 0.000 | | 0.014 | Not Detectable |
| CADMIUM | MG/L | 0.00002 | 0.000132 | 0.00014 | 0.0477 | | | | 0.000 | Not Detectable |
| CALCIUM | MG/L | 0.1 | 2.81 | 3.6 | 91.8 | 0.05 | 0.000 | 0.170 | 0.000 | Not Detectable |
| CHROMIUM | MG/L | 0.002 | 0.002 | Not Detectable | Not Detectable | | | | | Not Detectable |
| COBALT | MG/L | 0.0003 | 0.0003 | 0.0003 | 0.151 | | | | 0.0000 | Not Detectable |
| COPPER | MG/L | 0.0001 | 0.00116 | 0.01 | 0.383 | 0.000958 | | | 0.000 | Not Detectable |
| IRON | MG/L | 0.02 | 0.232 | 0.56 | 6.02 | 0.000 | | 0.000 | 0.000 | Not Detectable |
| LEAD | MG/L | 0.0001 | 0.00018 | 0.0005 | 0.0257 | | | | 0.000 | Not Detectable |
| LITHIUM | MG/L | 0.0001 | 0.00029 | 0.0005 | 0.0037 | | | | 0.000 | Not Detectable |
| MAGNESIUM | MG/L | 0.1 | 0.67 | 0.9 | 7.17 | 0.000 | | 0.050 | 0.000 | Not Detectable |
| MANGANESE | MG/L | 0.002 | 0.0334 | 0.075 | 1.27 | | | | 0.000 | Not Detectable |
| MOLYBDENUM | MG/L | 0.005 | 0.005 | Not Detectable | Not Detectable | | | | 0.000 | Not Detectable |
| NICKEL | MG/L | 0.002 | 0.002 | Not Detectable | 0.013 | | | | 0.000 | Not Detectable |
| POTASSIUM | MG/L | 0.1 | 0.28 | 0.4 | 5.92 | 0.000 | 0.000 | 0.120 | 0.004 | Not Detectable |
| RUBIDIUM | MG/L | 0.0005 | 0.0005 | Not Reported | 0.0149 | | | | | Not Detectable |
| SELENIUM | MG/L | 0.00006 | 0.00006 | Not Reported | 0.002 | | | | | Not Detectable |
| SILICON | MG/L | 0.02 | 1.93 | 3 | 2.6 | 0.000 | 0.000 | 0.040 | 0.000 | Not Detectable |
| SILVER | MG/L | 0.0003 | 0.0003 | Not Detectable | Not Detectable | | | | | Not Detectable |
| SODIUM | MG/L | 0.1 | 0.99 | 1.2 | 25 | 0.010 | 0.000 | 1.060 | 0.261 | 0.261 |
| STRONTIUM | MG/L | 0.0003 | Not Reported | Not Reported | 0.25 | | | | 0.000 | Not Detectable |
| SULFUR | MG/L | 1 | 1.05 | 1.4 | 3 | 0.06 | | 0.003 | 0.000 | Not Detectable |
| THALLIUM | MG/L | 0.0001 | 0.0002 | 0.0008 | Not Detectable | | | | | Not Detectable |
| ZINC | MG/L | 0.0002 | 0.00768 | 0.045 | 10 | | | | 0.004 | 0.004 |
| CHLORIDE | MG/L | 0.3 | 0.512 | 0.62 | Not Reported | 0.13 | 0.000 | 1.280 | 0.000 | Not Detectable |
| FLUORIDE | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported | | | | | Not Detectable |
| NITRATE AS N | MG/L | 0.1 | 0.1 | Not Detectable | Not Reported | | | 0.016 | 0.009 | Not Detectable |
| NITRITE AS N | MG/L | 0.03 | 0.03 | Not Detectable | Not Reported | | | | | Not Detectable |
| PH | STU | 0.01 | 6.712 | 6.30 - 7.04 (Range) | 7.5 | 5.76 | 4.600 | 5.230 | 8.140 | 8.180 |
| SPECIFIC CONDUCTANCE | µS/CM | 25 | 26.6 | 28 | 732 | 1.12 | 9.000 | 10.000 | <10 | <10 |
| SULFATE | MG/L | 0.6 | 1.9 | 2.7 | Not Reported | 0.000 | 0.000 | 0.000 | 0.000 | Not Detectable |
| TOC | MG/L | 0.7 | 10.06 | 12 | Not Reported | | | | | |
| DOC | MG/L | 0.7 | 9.49 | 12 | Not Reported | | | | | |
| TOTAL CYANIDE | MG/L | 0.005 | 0.0136 | 0.015 | Not Reported | | | | | |
| TURBIDITY | NTU | 0.1 | 3.91 | 9.7 | 21.2 | 0 | 0.000 | 0.000 | 0.000 | Not Detectable |
| TRUE COLOR | | 5 | 48 | 70 | Not Reported | 0 | 0.000 | 0.000 | 0.000 | Not Detectable |

The above modeling results (Table 3) indicate that the proposed treatment plant design will be able to meet existing water quality at the Pickett Mountain site.

## Water Treatment Facility Design

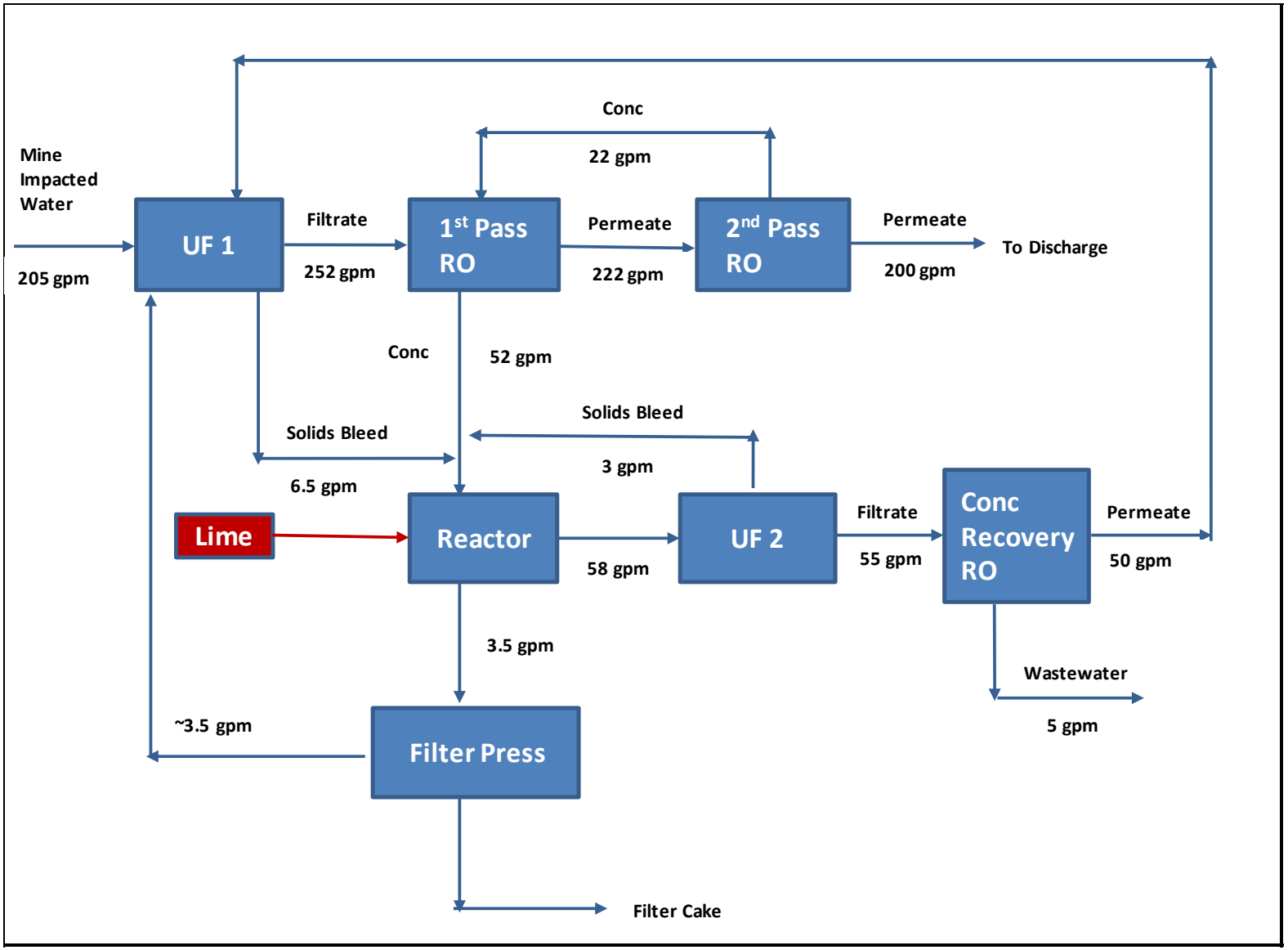
The conceptual facility design for the Project is as follows and presented on Figure 7,

1. Surface contact water from the collection/storage pond is fed to the water treatment plant at a rate of 205 USGPM.
2. Feed water passes through a ceramic UF unit for removal of suspended solids.
3. Filtrated is then fed to the first of two stages of RO.
4. Permeate from the first stage RO is fed to the second stage RO.
5. Second stage RO permeate is final effluent (treated water) and is produced at a rate of 200 USGPM.
6. Second stage wastewater (concentrate) is recycled to the first stage RO feed at a rate of 22 USGPM.
7. First stage RO wastewater (concentrate) reports to a reactor where lime (CaO) is added to precipitate excess calcium and alkalinity as calcite (calcium carbonate – $CaCO_3$) which is removed via filtration and becomes a solid waste material (filter cake). Filter cake volume is anticipated to be 2.6 cubic feet per day (2.9 cubic yards per month) The media filter cake is defined as a special waste under Maine's Solid Waste Management Rules, Chapter 400, and will be transported and disposed of in conformance with those rules.
8. Reactor overflow water reports to a second UF RO system (concentrate recovery system) at a rate of 58 USGPM.
9. Permeate from the concentrate recovery UF RO system is recycled to the primary UF feed at a rate of 50 USGPM along with calcite filter filtrate at a rate of 3.5 USGPM.
10. Final wastewater (concentrate) exits the plant at a flow rate of 5 USGPM.

Based on the proposed plant design the full capacity water balance is as follows,

| | |
|---|---|
| Mine Impacted Water Treatment Plant Feed | = 205 USGPM |
| Final Permeate (Treated) Water to Discharge | = 200 USGPM |
| Wastewater | = 5 USGPM |

Figure 7. Proposed Plant Process Flow Diagram



The proposed treatment plant will result in an overall mass balance (Table 4).

Table 4. Mass Balance

| Analyte | Units | Target Effluent Quality MG/L | Final Plant Clean Water @ 200 USGPM | Final Plant Waste Stream @ 5 USGPM |
|---|---|---|---|---|
| TOTAL ALKALINITY | MGCACO3/L | **6.92** | | |
| PHENOLPHTHALEIN ALKALINITY | MGCACO3/L | **0.7** | | |
| BICARBONATE ALKALINITY | MG/L | | 0.677 | 27.757 |
| CARBONATE ALKALINITY | MG/L | | 0.004 | 0.164 |
| TOTAL PHOSPHORUS | MG/L | **0.02** | Not Detectable | 1.64 |
| TDS | MG/L | **42.7** | 1.660 | |
| TSS | MG/L | **4.5** | Not Detectable | 492 |
| MERCURY | MG/L | **0.0002** | | |
| ALUMINUM | MG/L | **0.1767** | Not Detectable | 14.678 |
| ANTIMONY | MG/L | **0.00045** | Not Detectable | 0.0369 |
| ARSENIC | MG/L | **0.0004** | Not Detectable | 0.205 |
| BARIUM | MG/L | **0.0062** | Not Detectable | 0.861 |
| BERYLLIUM | MG/L | **0.0002** | Not Detectable | Not Detectable |
| BORON | MG/L | **0.02** | Not Detectable | 8.036 |
| CADMIUM | MG/L | **0.000132** | Not Detectable | 1.9557 |
| CALCIUM | MG/L | **2.81** | Not Detectable | 3763.8 |
| CHROMIUM | MG/L | **0.002** | Not Detectable | Not Detectable |
| COBALT | MG/L | **0.0003** | Not Detectable | 6.191 |
| COPPER | MG/L | **0.00116** | Not Detectable | 15.703 |
| IRON | MG/L | **0.232** | Not Detectable | 246.82 |
| LEAD | MG/L | **0.00018** | Not Detectable | 1.0537 |
| LITHIUM | MG/L | **0.00029** | Not Detectable | 0.1517 |
| MAGNESIUM | MG/L | **0.67** | Not Detectable | 293.97 |
| MANGANESE | MG/L | **0.0334** | Not Detectable | 52.07 |
| MOLYBDENUM | MG/L | **0.005** | Not Detectable | 0.0943 |
| NICKEL | MG/L | **0.002** | Not Detectable | 0.533 |
| POTASSIUM | MG/L | **0.28** | Not Detectable | 242.72 |
| RUBIDIUM | MG/L | **0.0005** | Not Detectable | 0.6109 |
| SELENIUM | MG/L | **0.005** | Not Detectable | 0.082 |
| SILICON | MG/L | **1.93** | Not Detectable | 106.6 |
| SILVER | MG/L | **0.0003** | Not Detectable | Not Detectable |
| SODIUM | MG/L | **0.99** | 0.281 | 1025 |
| STRONTIUM | MG/L | **0.0003** | Not Detectable | |
| SULFUR | MG/L | **1.05** | Not Detectable | 123 |
| THALLIUM | MG/L | **0.0002** | Not Detectable | Not Detectable |
| ZINC | MG/L | **0.00768** | 0.004 | 410 |
| CHLORIDE | MG/L | **0.512** | Not Detectable | 41 |
| FLUORIDE | MG/L | **0.03** | Not Detectable | |
| NITRATE AS N | MG/L | **0.1** | Not Detectable | 203.2 |
| NITRITE AS N | MG/L | **0.03** | Not Detectable | |
| PH | STU | **6.3 - 7.04 (Range)** | 8.140 | 8.18 |
| SPECIFIC CONDUCTANCE | µS/CM | **26.6** | <10 | 30012 |
| SULFATE | MG/L | **1.9** | Not Detectable | 110.7 |
| TOC | MG/L | **10.06** | | 492 |
| DOC | MG/L | **9.49** | | 492 |
| TOTAL CYANIDE | MG/L | **0.0136** | | 0.615 |
| TURBIDITY | NTU | **3.91** | Not Detectable | 869.2 |
| TRUE COLOR | | **48** | Not Detectable | 2870 |

## Plant Sizing

The water treatment plant size proposed is based on peak monthly treatment volumes as described in the technical memorandum "Proposed Pickett Mountain Mine Project Precipitation Runoff Collection Areas - Mine Only Option" dated May 23, 2022 and revised August 25, 2022, prepared by Wood PLC Engineering consultants and prepared by Wood PLC Engineering consultants. Table 5 below provides a summary of the anticipated runoff flows summarized in this technical memorandum, with the peak or highest flow months highlighted in red (Table 5). Treatment plant sizing is based on the highest monthly estimated flow of 6.57 million gallons which equates to 152.08 USGPM. Normal contingency factors added to water treatment plant designs range from 20% to 30% and a 30% excess flow contingency was used for design of the Pickett Mountain plant. The proposed treatment plant is therefore sized to discharge treated water at the anticipated peak monthly flow with a 30% additional contingency capacity which equates to 197.71 USGPM which was rounded up to 200 USGPM.

Total annual estimated runoff volume is 43.73 million gallons which equates to a nominal treatment rate of 119,808.2 gallons per day or 83.2 USGPM. Based on an optimized waste stream flow of 5 USGPM at full plant capacity the annual wastewater volume is expected to be 1,075,200 gallons per year (2.13 USGPM at 83.2 USGPM permeate production rate). It should also be noted that the proposed UF RO design for the Pickett Mountain plant is modular in nature. While the proposed plant is currently sized to accommodate peak flows as per the table below should further study result in changes to anticipated flows the proposed plant design can easily be modified to accommodate any anticipated flow.

Table 5. Peak Monthly Runoff Flows

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average Precipitation in Inches** | | | | | | | | | | | |
| 3.28 | 2.57 | 3.07 | 3.85 | 4.02 | 3.81 | 4.08 | 3.99 | 4.02 | 4.27 | 4.38 | 3.69 |
| **Runoff Volume in Million Gallons** | | | | | | | | | | | |
| 2.22 | 1.72 | 2.07 | 2.29 | 2.41 | 2.26 | 2.45 | 2.39 | 2.41 | 2.59 | 2.67 | 2.51 |
| **Assumed Runoff Factor Due to Temperature** | | | | | | | | | | | |
| 0.15 | 0.10 | 0.70 | 2.30 | 1.60 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.90 |
| **Estimated Runoff Volume Adjusted for Temperature in Million Gallons** | | | | | | | | | | | |
| 0.33 | 0.17 | 1.45 | 5.28 | 3.87 | 2.26 | 2.45 | 2.39 | 2.41 | 2.59 | 2.54 | 2.26 |
| **30 GPM Mine Dewatering Monthly Volume in Million Gallons** | | | | | | | | | | | |
| 1.34 | 1.21 | 1.34 | 1.30 | 1.34 | 1.30 | 1.34 | 1.34 | 1.30 | 1.30 | 1.30 | 1.34 |
| **Total Monthly Treatment Volume in Million Gallons** | | | | | | | | | | | |
| 1.67 | 1.38 | 2.79 | 6.57 | 5.20 | 3.56 | 3.79 | 3.73 | 3.71 | 3.89 | 3.84 | 3.60 |

Blue: Winter Months - frozen conditions with reduced runoff.
Grey/Blue: Late Fall-Early Winter or Late Winter- Early Spring - some reduced runoff.
Green: Spring months - increased runoff with snow melt.

## Pre and Post Production Water Management

Water management during the construction phase of the Project will entail water collection, storage, treatment and discharge but with reduced volumes due to a reduced site footprint resulting in reduced collection and water treatment requirements. Water will be collected from the waste rock storage pad and the storage ponds. Water from these pads and ponds will be collected and treated as if it was contaminated. After treatment through the water treatment plant, effluent will be discharged into the Post -Treatment Water Storage Pond, tested, then discharged into the surrounding groundwater via infiltration galleries. Reject water from the water treatment plant will be pumped back into the large Pre-Treatment Water Storage Pond where it will mix with additional impacted water collected from the site.

Approximately 32% of the site assets will not be established until near production. The headframe and associated pads will not be developed until 3 years post startup of the project. This means that prior to start up and well into production the actual water requiring collection for treatment will be less than the projected maximum volume. Prior to start up, with development of site assets representing only 68% of the total site footprint, the precipitation requiring collection and treatment represents 29,750,000 gallons of water over a 12-month construction/preproduction period (68% of the total projected annual volume of 43.73 million gallons). This represents a nominal treatment plant clean water production rate of 56.58 USGPM which will result in a nominal reject water rate of 1.414 USGPM.

The total volume of stored water capacity in the pre water treatment storage pond is projected to be 6,870,000 Gallons. Over the duration of 1 full year pre-production (at 68% asset development), the maximum reject water produced is 743,410 gallons or 10.82% of the total volume of the pond. The total volume of water requiring treatment in the first year of operation can be treated with the proposed water treatment plant in 104 days at peak design flow.

Chemical and mineral loading in the 743,410 gallons of stored reject water will be minimal due to continued dilution from precipitation. After the first construction year and when production and backfilling commence, this stored water will be treated again, and contaminants further concentrated. Final concentrates can then be used in the mining process as backfill cement mix water as described in the next section of this report.

Postproduction impacted water will continue to be collected in the pre water treatment storage pond, processed through the water treatment plant and stored in the Post-Treatment Water Storage Pond, tested and once verified to meet existing water quality will be discharged into the surrounding groundwater via infiltration galleries. It is anticipated that once production ceases eventual dilution from natural precipitation will result in the site impacted water reaching background quality without the requirement for treatment. In the case that this is incorrect, water treatment will take place until a small volume of wastewater remains in storage. This water can then be collected and removed from site to be stored at a certified water management facility or evaporated until only solids remain, which would then be removed and disposed of in an approved landfill.

## Water Treatment Plant Waste Water Management

The proposed treatment plant will produce, at peak flow, 5 USGPM of wastewater which will be directed to the Pre-Treatment Water Storage Pond within the Pickett Mountain Site. Wastewater will be stored until backfill production commences and will then be used to prepare cement to be utilized for backfill placement underground as a means of ground stabilization. Annual water treatment requirements for the Pickett Mountain Site are projected to be 43.73 million gallons which equates to an average water treatment plant permeate production rate of 83.2 USGPM (utilizing 365 days per year plant operation) during production. Wastewater production from the plant at this treatment rate will be 2.13 USGPM or 3,072 US gallons per day based on the Wood PLC Engineering study cited above.

Backfill production is based on the use of cemented rock fill with an anticipated fill placement rate of 6.6 tons per day of rock placement and 5% cement binder content. Daily water requirements for cement preparation are estimated to be 6,340 US gallons. Daily wastewater production from the UF RO plant is projected to be 3,072 US gallons. This means that all wastewater generated from the RO plant can be used for cement production during production.

## Reagent Use and Final Disposition

Various chemical reagents are employed to treat the various membrane systems for scale and deposit control as well as required periodic cleaning. While cleaning frequency can't be determined until the plant is in actual operation MWS's experience with UF RO plants treating similar quality water indicates that cleaning frequency will likely be less than monthly and more likely quarterly for first stage UF and first and second stage RO. Cleaning frequency for the brine recover UF (UF 2) and RO will be slightly more frequent due to the nature of the water being treated at this stage of the process however anticipated frequency would still be not more than monthly. All chemicals are applied to the influent side of the UF and RO system and therefore report to the wastewater side of the process. In all cases, the reagents do not represent a hazard for downstream use of wastewater in the Pickett Mountain operations. The anticipated maximum consumption of reagents that will be utilized in operation of the plant are outlined below in Table 6.

Table 6. Water Treatment Plant Anticipated Reagent Use

| Reagent | Composition | Purpose | Addition Point | Dosage (mg/l) | Anticipated Monthly Consumption at Peak Flow | Anticipated Monthly Consumption at Nominal Flow |
|---|---|---|---|---|---|---|
| Sodium Hydroxide | Sodium hydroxide 50% | RO stage 2 feed pH adjustment | RO stage 2 feed | 110 | 6,820 lb. | 3,290 lb. |
| Lime | CaO 100% | Calcite reactor | Calcite reactor | TBD | TBD | TBD |
| Osmonix WL3000 or BWA Flocon 885 Antiscalant or similar | Proprietary (Biodegradable) | Scale control for RO membranes | RO stage 1 feed | 5 | 351.5 lb. | 150 lb. |
| Disinfectant | Sodium hypochlorite (bleach) | Biofouling cleaning of UF | UF chemically enhanced backwash | Periodic - weekly | 125 lb. | 125 lb. |
| Low pH Cleaner | Hydrochloric or Citric acid 10% | RO membrane cleaning | RO clean In place | Periodic - monthly | 20 lb. | 20 lb. |
| Alkaline Cleaner | Sodium hydroxide 10% | RO membrane cleaning | RO clean In place | Periodic - monthly | 20 lb. | 20 lb. |

Note: Monthly consumption based on peak plant flow.

All chemical reagents utilized in the operation of the plant ultimately report to the waste stream and will not pass through the RO membranes to end up in the final permeate discharge water. While all wastewater generated from the water treatment plant will be utilized for cement preparation it should be noted that even prior to this the reagents will be eliminated through natural reactions in the wastewater holding pond. The sodium hydroxide, low pH cleaner and alkaline cleaner will naturally decompose to form sodium chloride (table salt) and water. Sodium hypochlorite will degrade naturally to form, once again, sodium chloride and water. The proprietary antiscalant is biodegradable[16] and contains no components that would be harmful to people or the environment.

In addition to periodic cleaning both UF and RO membranes are periodically replaced due to wear and in some cases fouling due to inorganic scale formation which results in reduced flow rates and excessive operating pressure. The proposed plant design will include a high degree of instrumentation allowing the operators to monitor membrane performance and schedule membrane replacements prior to any operational impact on the plant. Membranes which are replaced can be safely disposed of in landfill.

## Re-Mineralization

In many instances, treated water from RO plants is re-mineralized prior to discharge to the environment to add back constituents in to enhance the discharge water quality. In the case of the Pickett Mountain Project, this remineralization could be undertaken to add calcium and alkalinity to provide levels equal to the background water quality targets. Remineralization is accomplished by adding calcium, normally in the form of calcium chloride, and alkalinity normally in the form of sodium carbonate.

Remineralization is easily included in the overall water treatment plant design and control systems. Instrumentation included in the plant design will automatically calculate and adjust addition rates of calcium chloride and sodium carbonate based on plant operating rate to achieve calcium and alkalinity targets. The

[16] http://www.dormeco.co.il/wp-content/uploads/2012/12/Flocon-885.pdf

need for and amount of remineralization will be determined in conjunction with the Chapter 200 permitting for the Project.

Anticipated remineralization reagent usage is as follows (Table 7).

Table 7. Anticipate Re-Mineralization Reagent Requirements

| Reagent | Composition | Purpose | Addition Point | Dosage (mg/l) | Anticipated Monthly Consumption at Peak Flow | Anticipated Monthly Consumption at Nominal Flow |
|---|---|---|---|---|---|---|
| Calcium Chloride | $CaCl_2$ 32% | Addition of calcium to final effluent | Final effluent | 50 | 3,515 lb. | 1,496 lb. |
| Sodium Carbonate | $Na_2CO_3$ 100% | Addition of alkalinity to final effluent | Final effluent | 50 | 3,515 lb. | 1,496 lb. |

# Appendix 1. Wolfden Supplied Input and Existing Water Quality

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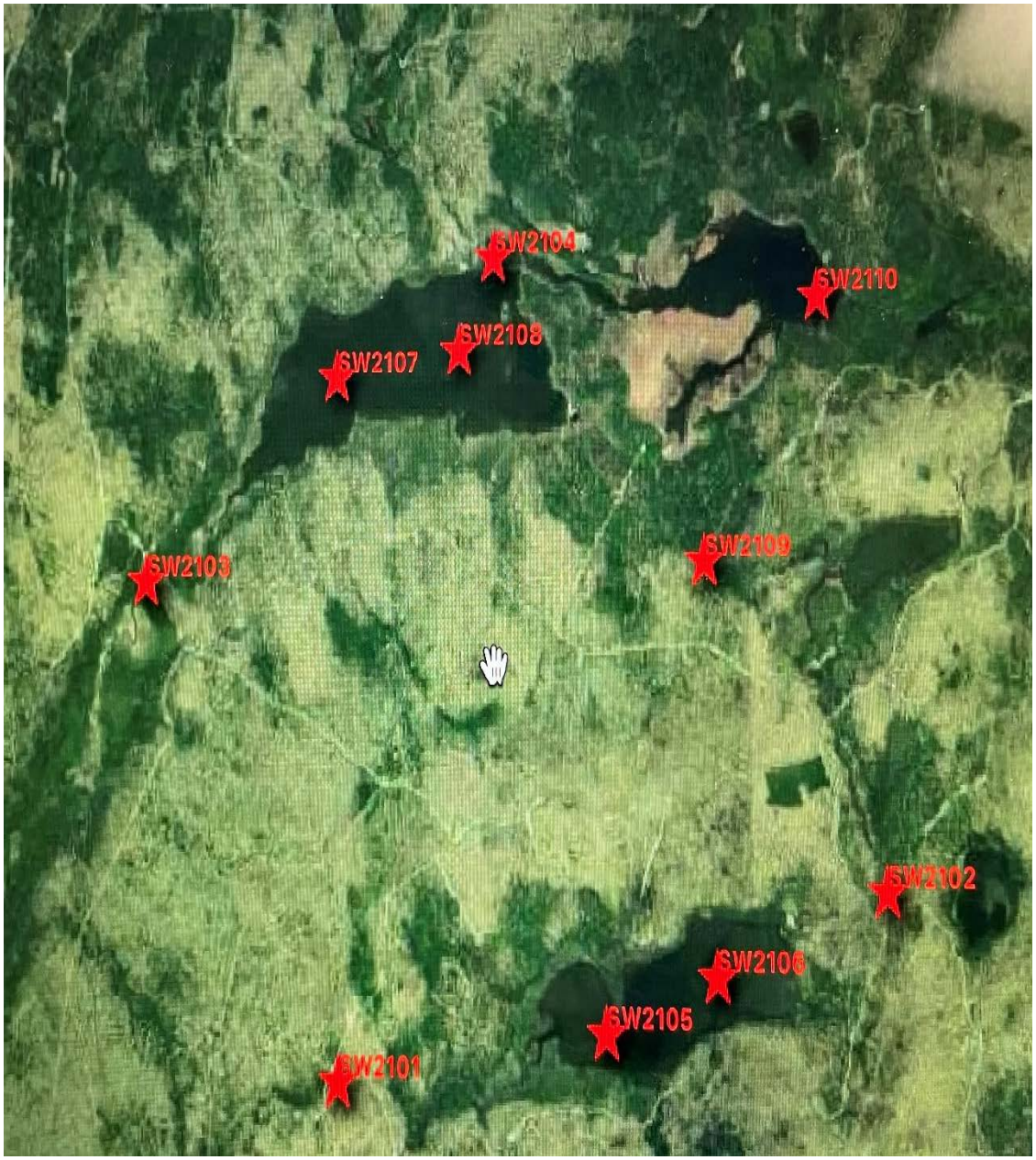
# Input Water Quality (Half Mile Mine)

| Analyte | Units | Influent Water Quality (Highest Half Mile Value) MG/L |
|---|---|---|
| TOTAL ALKALINITY | MG/L as $CaCO_3$ | Not Reported |
| PHENOLPHTHALEIN ALKALINITY | MG/L as $CaCO_3$ | Not Reported |
| BICARBONATE ALKALINITY | MG/L | Not Reported |
| CARBONATE ALKALINITY | MG/L | Not Reported |
| TOTAL PHOSPHORUS | MG/L | 0.04 |
| TDS | MG/L | Not Reported |
| TSS | MG/L | 12 |
| MERCURY | MG/L | Not Reported |
| ALUMINUM | MG/L | 0.358 |
| ANTIMONY | MG/L | 0.0009 |
| ARSENIC | MG/L | 0.005 |
| BARIUM | MG/L | 0.021 |
| BERYLLIUM | MG/L | Not Detectable |
| BORON | MG/L | 0.196 |
| CADMIUM | MG/L | 0.0477 |
| CALCIUM | MG/L | 91.8 |
| CHROMIUM | MG/L | Not Detectable |
| COBALT | MG/L | 0.151 |
| COPPER | MG/L | 0.383 |
| IRON | MG/L | 6.02 |
| LEAD | MG/L | 0.0257 |
| LITHIUM | MG/L | 0.0037 |
| MAGNESIUM | MG/L | 7.17 |
| MANGANESE | MG/L | 1.27 |
| MOLYBDENUM | MG/L | Not Detectable |
| NICKEL | MG/L | 0.013 |
| POTASSIUM | MG/L | 5.92 |
| RUBIDIUM | MG/L | 0.0149 |
| SELENIUM | MG/L | 0.002 |
| SILICON | MG/L | 2.6 |
| SILVER | MG/L | Not Detectable |
| SODIUM | MG/L | 25 |
| STRONTIUM | MG/L | 0.25 |
| SULFUR | MG/L | 3 |
| THALLIUM | MG/L | Not Detectable |
| ZINC | MG/L | 10 |
| CHLORIDE | MG/L | Not Reported |
| FLUORIDE | MG/L | Not Reported |
| NITRATE AS N | MG/L | Not Reported |
| NITRITE AS N | MG/L | Not Reported |
| PH | STU | 7.5 |
| SPECIFIC CONDUCTANCE | µS/CM | 732 |
| SULFATE | MG/L | Not Reported |
| TOC | MG/L | Not Reported |
| DOC | MG/L | Not Reported |
| TOTAL CYANIDE | MG/L | Not Reported |
| TURBIDITY | NTU | 21.2 |
| TRUE COLOR | | Not Reported |

Water Sampling Locations and Existing Water Quality – Pickett Mountin Site



Mine Water Service

# Appendix 2. Individual Modeling Program Data – Two Pass Primary Treatment

Mine Water Service

Hyd-RO-dose

# hyd-RO-dose®

**WATER CHEMISTRY SUMMARY**
**AT 75.0 % RECOVERY**

Report Date: 06-06-2022 Sampled: 06-06-2022
Sample ID: 0 at 1658

| CATIONS (mg/L) | Raw | Feed | Product | Brine |
|---|---|---|---|---|
| Calcium(as Ca) | 2.04 | 2.04 | 0.05 | 8.00 |
| Magnesium(as Mg) | 0.16 | 0.16 | 0.00 | 0.63 |
| Barium(as Ba) | 0.00 | 0.00 | 0.00 | 0.00 |
| Strontium(as Sr) | 0.00 | 0.00 | 0.00 | 0.00 |
| Sodium(as Na) | 0.56 | 0.56 | 0.01 | 2.20 |
| Potassium(as K) | 0.13 | 0.13 | 0.00 | 0.51 |
| Lithium(as Li) | 0.00 | 0.00 | 0.00 | 0.00 |
| Iron(as Fe) | 0.13 | 0.13 | 0.00 | 0.51 |
| Ammonia(as $NH_3$) | 0.00 | 0.00 | 0.00 | 0.00 |
| Aluminum(as Al) | 0.01 | 0.01 | 0.00 | 0.04 |
| **ANIONS (mg/L)** | | | | |
| Chloride(as Cl) | 5.03 | 5.03 | 0.13 | 19.72 |
| Sulfate(as $SO_4$) | 0.06 | 0.06 | 0.00 | 0.24 |
| Dissolved $CO_2$ | 0.0 | 0.0 | 0.0 | 0.0 |
| Bicarbonate | 0.2 | 0.2 | 0.0 | 0.7 |
| Carbonate | 0.0 | 0.0 | 0.0 | 0.0 |
| Silica(as $SiO_2$) | 0.14 | 0.14 | 0.00 | 0.55 |
| Phosphate(as $PO_4$) | 0.00 | 0.00 | 0.00 | 0.00 |
| $H_2S$ (as $H_2S$) | 0.00 | 0.00 | 0.00 | 0.00 |
| Fluoride(as F) | 0.00 | 0.00 | 0.00 | 0.00 |
| Nitrate(as $NO_3$) | 0.01 | 0.01 | 0.00 | 0.04 |
| Boron(as B) | 0.00 | 0.00 | 0.00 | 0.00 |
| **PARAMETERS** | | | | |
| pH | 7.00 | 7.00 | 5.76 | 7.84 |
| Temperature (°C) | 25.00 | 25.00 | 25.00 | 25.00 |
| Calculated T.D.S. | 8.59 | 8.59 | 0.28 | 33.70 |
| Calculated Cond. | 19.22 | 19.22 | 1.12 | 73.79 |

**French Creek Software, Inc.**
**1220 Valley Forge Road, Suite 21, Valley Forge, PA 19460**

Mine Water Service

Wave

DUPONT

| Concentrations (mg/L as ion) | | | | | | |
|---|---|---|---|---|---|---|
| | | Concentrate | | Permeate | | |
| | Feed | Stage1 | Stage2 | Stage1 | Stage2 | Total |
| $NH_4^+$ | 0.07 | 0.14 | 0.55 | 0.00 | 0.00 | 0.00 |
| $K^+$ | 0.01 | 0.02 | 0.09 | 0.00 | 0.00 | 0.00 |
| $Na^+$ | 0.04 | 0.08 | 0.33 | 0.00 | 0.00 | 0.00 |
| $Mg^{+2}$ | 0.00 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 |
| $Ca^{+2}$ | 0.06 | 0.11 | 0.44 | 0.00 | 0.00 | 0.00 |
| $Sr^{+2}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Ba^{+2}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $CO_3^{-2}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $HCO_3^-$ | 1.72 | 2.07 | 4.81 | 1.38 | 1.39 | 1.39 |
| $NO_3^-$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $F^-$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Cl^-$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Br^{-1}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $SO_4^{-2}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $PO_4^{-3}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $SiO_2$ | 0.01 | 0.02 | 0.06 | 0.00 | 0.00 | 0.00 |
| Boron | 0.01 | 0.03 | 0.09 | 0.00 | 0.00 | 0.00 |
| $CO_2$ | 57.61 | 58.28 | 59.42 | 56.90 | 57.63 | 57.24 |
| TDS* | 1.96 | 2.50 | 6.42 | 1.41 | 1.42 | 1.41 |
| Cond. µS/cm | 8 | 8 | 10 | 9 | 9 | 9 |
| pH | 4.7 | 4.8 | 5.2 | 4.6 | 4.6 | 4.6 |

Footnotes:

*Total Dissolved Solids includes ions, $SiO_2$ and B. It does not include $NH_3$ and $CO_2$

Mine Water Service

Winflows

**SUEZ Water Technologies & Solutions**

**Winflows Version 4.04** DataBase Version 4.04

**Streams Analytical Data**

| Ions, mg/l | | Raw Feed | RO1 Element Feed | DownStream Perm RO1 | RO1 Concentrate |
|---|---|---|---|---|---|
| Calcium (Ca) | | 83.00 | 83.00 | 0.17 | 276.36 |
| Magnesium (Mg) | | 25.00 | 25.00 | 0.05 | 83.24 |
| Sodium (Na) | | 106.00 | 106.00 | 1.06 | 350.97 |
| Potassium (K) | | 8.00 | 8.00 | 0.12 | 26.39 |
| Ammonia - N (NH4) | | 2.00 | 2.00 | 0.11 | 6.42 |
| Barium (Ba) | | 0.05 | 0.05 | 0.00 | 0.17 |
| Strontium (Sr) | | 0.10 | 0.10 | 0.00 | 0.33 |
| Iron (Fe) | | 1.00 | 1.00 | 0.00 | 3.33 |
| Manganese (Mn) | | 0.10 | 0.10 | 0.00 | 0.33 |
| Sulfate (SO4) | | 3.00 | 3.00 | 0.00 | 9.99 |
| Chloride (Cl) | | 303.61 | 303.61 | 1.28 | 1009.33 |
| Fluoride (F) | | 1.00 | 1.00 | 0.01 | 3.30 |
| Nitrate (NO3) | | 5.00 | 5.00 | 0.07 | 16.51 |
| Bromide (Br) | | 0.00 | 0.00 | 0.00 | 0.00 |
| Phosphate (PO4) | | 1.00 | 1.00 | 0.01 | 3.32 |
| Boron (B) | | 0.00 | 0.00 | 0.00 | 0.00 |
| Silica (SiO2) | | 5.00 | 5.00 | 0.04 | 16.57 |
| Hydrogen Sulfide (H2S) | | 0.00 | 0.00 | 0.00 | 0.00 |
| Bicarbonate (HCO3) | | 145.78 | 145.78 | 2.17 | 479.45 |
| Carbon Dioxide (CO2) | | 20.53 | 20.53 | 20.43 | 21.34 |
| Carbonate (CO3) | | 0.10 | 0.10 | 0.00 | 1.11 |
| TDS, mg/l | | 689.73 | 689.73 | 5.09 | 2287.12 |
| Flow | gpm | 351.09 | 351.09 | 245.80 | 105.30 |
| Temperature | °C | 25.00 | 25.00 | 25.00 | 25.00 |
| Pressure | psi | 0.00 | 148.40 | 0.00 | 91.55 |
| Hardness | ppm as CaCO3 | 310.23 | 310.23 | 0.62 | 1032.95 |
| Density | kg/m3 | 997.49 | 997.49 | 997.00 | 998.63 |
| Ionic Strength | | 0.01 | 0.01 | 0.00 | 0.05 |
| Osm. Pressure | psi | 6.72 | 6.72 | 0.22 | 21.27 |
| pH | | 7.00 | 7.00 | 5.23 | 7.45 |
| Conductivity at 25°C | µS/cm | 1268.00 | 1268.00 | 10.00 | 3939.00 |
| **Saturation Data** | | | | | |
| BaSO4 | % | 6.34 | 6.34 | 0.00 | 25.02 |
| CaF2 | % | 10.09 | 10.09 | 0.00 | **223.43** |
| CaSO4 | % | 0.10 | 0.10 | 0.00 | 0.43 |
| SiO2 | % | 3.99 | 3.99 | 0.02 | 13.20 |
| SrSO4 | % | 0.01 | 0.01 | 0.00 | 0.03 |
| Struvite | % | 0.00 | 0.00 | 0.00 | 0.03 |
| LSI | | -0.37 | -0.37 | -6.47 | 0.80 |
| S&DI | | -0.71 | -0.71 | -6.98 | 0.72 |

Mine Water Service

IMSDesign

| Ion (mg/l) | Raw Water | Feed Water | Permeate Water | Concentrate |
|---|---|---|---|---|
| Hardness, as CaCO3 | 256.89 | 236.43 | 0.000 | 471.7 |
| Ca | 91.00 | 83.76 | 0.000 | 419.6 |
| Mg | 7.17 | 6.60 | 0.000 | 33.1 |
| Na | 25.53 | 34.21 | 0.261 | 168.0 |
| K | 5.96 | 5.62 | 0.004 | 27.5 |
| NH4 | 0.01 | 0.01 | 0.000 | 0.0 |
| Ba | 0.021 | 0.019 | 0.000 | 0.1 |
| Sr | 0.250 | 0.230 | 0.000 | 1.2 |
| Zn+2 | 10.000 | 9.200 | 0 | 46.103 |
| CO3 | 0.68 | 13.53 | 0.004 | 23.0 |
| HCO3 | 392.00 | 384.74 | 0.677 | 1898.8 |
| SO4 | 3.00 | 2.76 | 0.000 | 13.8 |
| Cl | 1.00 | 0.92 | 0.000 | 4.6 |
| NO3 | 10.00 | 9.32 | 0.009 | 46.1 |
| PO4 | 0.04 | 0.04 | 0.000 | 0.2 |
| OH | 0.00 | 0.16 | 0.011 | 0.0 |
| SiO2 | 2.60 | 2.40 | 0.000 | 12.0 |
| B | 0.20 | 0.24 | 0.014 | 0.9 |
| CO2 | 21.12 | 19.43 | 0.01 | 19.43 |
| NH3 | 0.00 | 0.00 | 0.00 | 0.00 |
| **TDS** | **549.46** | **553.60** | **0.97** | **2694.98** |
| **pH** | **7.50** | **7.53** | **8.14** | **8.18** |

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 10-E: Water Management at the Pickett Mountain Mine Site Technical Memorandum

SME
SEVEE & MAHER
ENGINEERS

4 Blanchard Road, P.O. Box 85A
Cumberland, ME 04021
Tel: 207.829.5016 • Fax: 207.829.5692
info@sme-engineers.com
sme-engineers.com

**TECHNICAL MEMORANDUM**

TO: Doug Stewart, Stantec

FROM: Peter Maher, P.E.
Erik Clapp, L.G.
Lisa Turner, P.E., L.S.S.

DATE: December 19, 2022

SUBJECT: **WATER MANAGEMENT AT THE PICKETT MOUNTAIN MINE SITE**

## 1.0 PURPOSE AND BACKGROUND

Wolfden Mt. Chase LLC (Wolfden) is proposing to mine zinc, lead, copper, silver, and gold from a metallic mineral deposit located in T6R6 in Penobscot County, Maine, named the Pickett Project. The land where the mine will be located is in the General Management (M-GN) Subdistrict and needs to be rezoned to the D-PD Subdistrict, to allow for a well-planned mining development. Mining is regulated under LUPC Chapters 10, 12, and 13 Rules. If rezoning is approved, mining operations must also satisfy Maine Department of Environmental Protection (MEDEP) Chapter 200 Metallic Mineral Exploration, Advanced Exploration and Mining Rules, and receive a mining permit. The information contained herein is being prepared in support of the LUPC rezoning from M-GN to D-PD Subdistrict.

The Project is proposed as a "mine only" operation which will limit the volume of water from precipitation events that will require treatment. Any surface water that may contact mine materials will be collected and, along with water from mine dewatering, will be treated to appropriate water quality standards and returned to the on-site environment. Sevee & Maher Engineers, Inc. (SME) was tasked by Stantec to review available information and develop conceptual methods for returning treated water back to the on-site environment.

## 2.0 BACKGROUND DOCUMENTS REVIEWED

Several documents were made available to SME to assist in our evaluation of water treatment alternatives for the Pickett Mountain site. These documents include:

- Conceptual Site Plan (prepared by WSP, dated October 17, 2022)
- Soil Suitability Map 2 (prepared by Wood dated September 28, 2022)
- Mine Water Treatment Scoping Study (prepared by Mine Water Service dated September 11, 2022)
- Technical Memorandum re: Precipitation Runoff Collection Areas (prepared by Wood, dated August 25, 2022)

- Soil Suitability Evaluation (prepared by WSP and Watershed Resource Consultants, dated September 2022)

## 3.0 WATER MANAGEMENT ALTERNATIVES ANALYSIS

Wolfden is proposing to rezone 374 acres (WSP, September 2022) to accommodate the mining project. Within the 374-acre area, there will be approximately 28.39 acres where materials will be stored and contact water will be generated from precipitation events. Approximately 28 million gallons per year (MGY) of water will be collected from within these 28.39 acres. Additionally, the mine will be dewatered to facilitate operations. The mine dewatering will generate an additional 15.8 MGY (about 30 gallons per minute [gpm]) of water, for a total of 43.8 MGY to be collected, treated, and re-introduced to the watershed (Wood, August 25, 2022). An on-site collected water treatment facility, which will use ultrafiltration and reverse osmosis technologies, will treat the 43.8 MGY of collected runoff and groundwater to applicable water quality standards (Mine Water Services, September 11, 2022). The objective of SME's efforts is to identify viable alternatives for the on-site disposition of this treated water.

Four water disposition methods were identified and evaluated by SME:

- Drip irrigation;
- Infiltration galleries;
- Spray irrigation; and
- Snowmaking.

Major considerations used to evaluate each of the treatment alternatives included the on-site soil and geologic characteristics (including soil permeability, depth to bedrock, depth to water table, and slopes), available suitable land within the 374 acres proposed for rezoning, maintaining the existing hydroperiod for on-site wetlands, and climate considerations (summer and winter disposition).

### 3.1 Drip Irrigation

While drip irrigation would be "out of the way" once installed, it had several disadvantages identified during our study, making it the least attractive of the alternatives identified for this site for the following reasons:

- Requires large acreage;
- Not commonly used in New England (not a proven technology in our area);
- Requires substantial cover material build-up and continuous flows to avoid freeze-ups in the winter due to a lack of biological activity in the disposition water;
- Requires burial and therefore substantial soil disturbance for installation; and
- Installation is intended for flat fields and not a wooded environment.

## 3.2 Infiltration Galleries

Infiltration galleries are similar to a subsurface wastewater disposal system. They are used extensively throughout New England to dispose of municipal, industrial, and residential wastewater. There are several large systems (11 to 26 MGY) located in the state of Maine which have been operating successfully for as long as 30 years and is a proven wastewater disposal technology. The advantages of infiltration galleries are that they have the potential to be a year-round disposition option if constructed with adequate cover, use less land area than the other alternatives evaluated, and are "out of the way" once constructed. Disadvantages of infiltration galleries include:

- Expensive to construct;
- Require suitable soils, and soils at this site may be too fine-grained to accept the infiltration rates expected for this project without constructing a very large system;
- Installation will require soil disturbance (i.e., potential compaction and smearing) of existing soils and organic layers, potentially reducing the infiltration capacity;
- A substantial amount of cover material build-up would be required to avoid freeze-ups in the winter due to a lack of biological activity in the disposition water; and
- Galleries will need to be removed at the end of the project.

## 3.3 Spray Irrigation

Spray irrigation is a proven technology for wastewater disposal in New England. It allows for evaporation, transpiration, and infiltration. It is easily installed without significant soil disturbance or clearing of trees and provides flexible distribution of the treated water. Spray irrigation will facilitate the evaporation of some of the disposition water, which will allow for the best match of pre- and post-development water infiltration at the site. A number of spray irrigation systems are permitted and successfully operated in northern New England with flows ranging from 74 to over 230 MGY sprayed on 36 to 113 acres. The disadvantages of spray irrigation are that it:

- Can only be used in the late spring, summer, and early fall;
- Requires active management; and
- Requires sufficient acreage.

## 3.4 Snowmaking

Snowmaking is also a proven technology for wastewater disposal in New England. It is often combined with spray irrigation to minimize the storage requirement for treated water during the winter months. Similar to spray irrigation, snowmaking is a flexible technology for the disposition of treated water. Also, similar to spray irrigation, a number of systems are permitted in New England, successfully disposing of 29 to 104 MGY applied to 26 to 113 acres. Snowmaking is a proven technology for wastewater disposition, is easily installed without significant soil disturbance or clearing of trees, and dovetails well

with spray irrigation, thereby reducing storage requirements for treated water. Disadvantages of snowmaking include:

- Only an option during late fall, winter, and early spring;
- Requires active management;
- Potential for freeze-ups during winter operations; and
- Has an acreage requirement that is separate from the acreage for spray irrigation.

### 3.5 Spray Irrigation/Snowmaking Combination

There are numerous combination Spray Irrigation/Snowmaking systems in operation in New England. These systems are typically in locations where there is no opportunity to discharge treated wastewater to a surface water. Examples of these systems operating in Maine include:

Moosehead System. This facility has been in operation for over 40 years and treats 206 MGY. The spray irrigation portion of the system uses an application rate of 2.5 inches/week and the snowmaking system uses an application rate of 4.1 inches/week. Approximately 89 acres of glacial till soils are used for this system.

Carrabassett Valley System. The Carrabassett Valley System treats a total of 183 MGY. The spray irrigation portion applies 3.7 inches/week over 129 acres and the snowmaking portion applies 2.9 inches/week over 54 acres. This site is located on approximately 75 acres of glacial till soils.

Rangeley System. This facility treats 103 MGY. The spray irrigation portion applies 2.5 inches/week over 36 acres and the snowmaking portion applies 1.6 inches/week over 28 acres. Similar to the Moosehead and Carrabassett Systems, it is located on glacial till soils not unlike those found at Pickett Mountain.

Wolfeboro, NH. This system treats 97 MGY of treated wastewater on 46 acres. The application rate is 3 inches/week. They do not use snowmaking, which requires them to have larger storage lagoons.

Pineland Farms Potatoes. This system is designed to treat 337 MGY of wastewater from a potato processing facility in Aroostook County. The spray irrigation portion applies 2 inches/week, and the snowmaking portion applies less than one inch/week over a total of 113 acres.

## 4.0 SELECTED ALTERNATIVE

Based on our analyses of the four alternatives, a combination of spray irrigation and snowmaking, combined with water storage is the preferred alternative for the Project. Both are proven technologies for the disposition of treated wastewater in New England. It is expected that this combination of technologies will readily manage the disposition of the 43.8 MGY of treated water.

The spray irrigation/snowmaking alternative allows for the flexible disposition of treated water to maintain the hydroperiod of the nearby wetland. Furthermore, application rates can be tailored to mimic natural, long-term precipitation patterns.

The use of infiltration galleries is another alternative that could possibly be utilized; however, additional soils investigations will need to be conducted to determine if appropriate soils are present to handle the water generated. It may be possible to utilize this technology in combination with spray irrigation and snowmaking if areas with suitable soils are identified. If this alternative were to be utilized, it would require additional supporting information from a detailed soil investigation.

Figure 1 (attached) presents a site plan which shows potential Water Recharge Areas where treated water can be disposed. A total of 60 acres is available for use for water recharge. Based on application rates of 2 to 4 inches of water per week (typical of the systems described in Section 3.5), approximately 15 to 29 acres would be required for the Spray Irrigation/Snowmaking alternative. A 46-acre solar farm is proposed at the site and some of this land could also be utilized for treated water disposition.

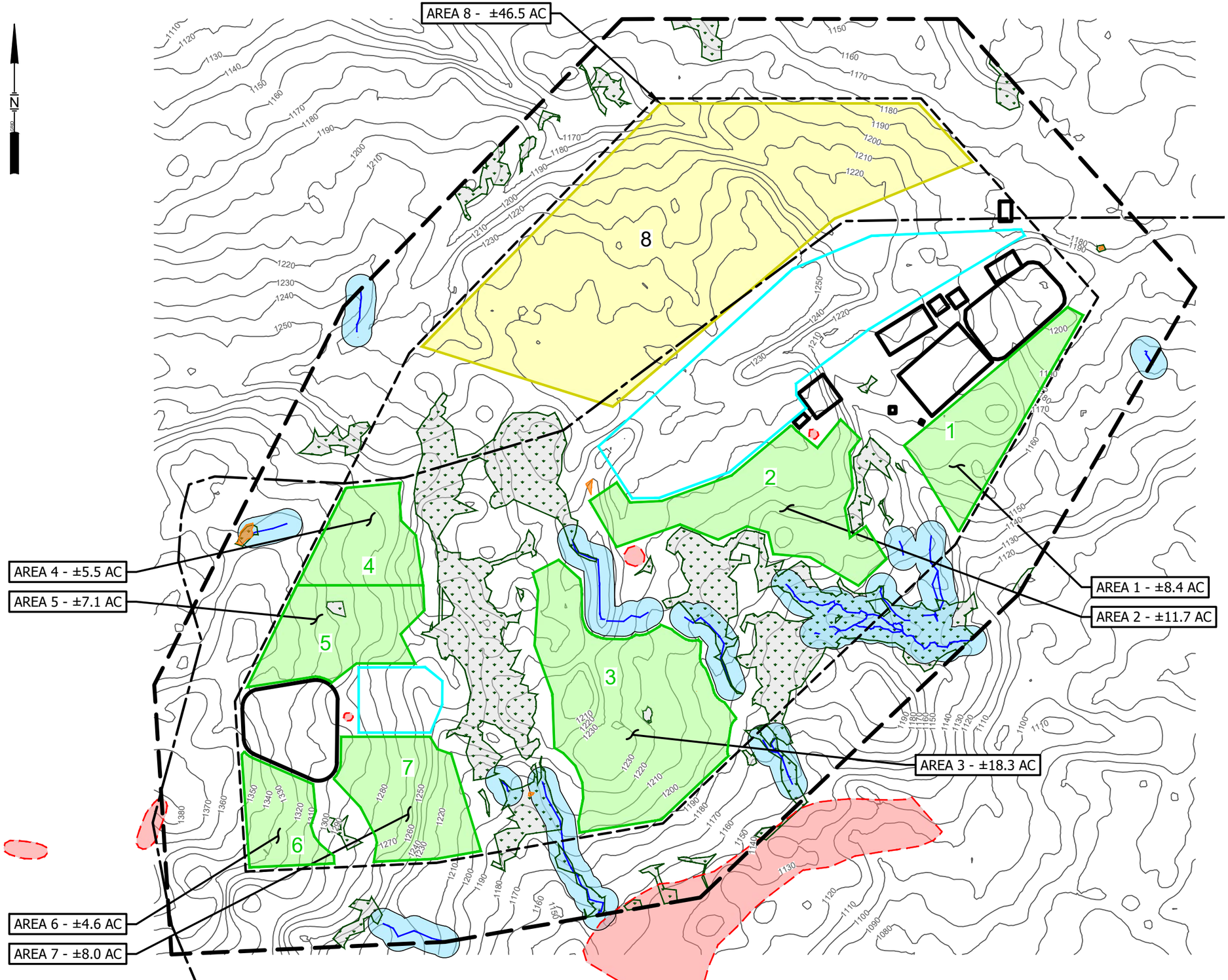
## 5.0 SUMMARY AND RECOMMENDATIONS

The combination of pre-treatment and post-treatment water storage, coupled with spray irrigation and snowmaking, will adequately handle the disposition of treated water at the Project site. Using these technologies, and application rates typical of similar projects at similar sites, will require between 15 and 29 acres of land required for disposal. There are at least 60 acres of available land which could be utilized for treated water disposition within the 374 acres proposed for rezoning.

The selection and positioning of land areas selected for treated water disposition can be determined once detailed soil studies and site topography have been completed. It will be critical to understand the hydrology of the on-site wetlands so that the pre-development water balance of these features can be maintained.

Attachment

- Figure 1 – Potential Collected Water Recharge Areas




LEGEND

- POTENTIAL SOLAR AREA
- DRAINAGE BOUNDARY
- 400' ZONING SETBACK
- PROPOSED RE-ZONING
- STREAM WITH 75' BUFFER
- WETLAND
- VERNAL POOL
- ARCHEOLOGICAL SITE
- WATER COLLECTION AREA
- WATER RECHARGE AREAS
- POTENTIAL SOLAR AREA/ WATER RECHARGE AREA
- PROPOSED STRUCTURE

250 0 500 FEET

FIGURE 1
POTENTIAL COLLECTED WATER RECHARGE AREAS
STANTEC
PICKETT MOUNTAIN MINE SITE
T6 R6, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: V-SP05 PM LMN: WDA CTB: SME-STD REV: 12/19/2022

\\NSERVER\cfs\Stantec\Pickett Mt\ACAD\Plans\V-SP05 PM Drawing 2022R10.dwg, WDA FIG 1, 12/19/2022 3:23:05 PM, jrl

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 10-F: Recreational Use of Pleasant Lake Letters from Residents

**From:** Zach Lingley <zacharylingley@gmail.com>
**Sent:** June 24, 2021 2:26 PM
**To:** Jeremy Ouellette <JOuellette@wolfdenresources.com>
**Cc:** Jonathan Seavey <jseavey22@yahoo.com>
**Subject:** Re: Lake Traffic

I just spent two consecutive weekends at Rockbema and saw a total of 4 fishing boats on the water, all for less than 5 hours. This is the next closest body of water to those you referenced. I don't know anyone that fishes Pickett Mountain Pond, but it might be good to speak to the game warden.

On Thu, Jun 24, 2021 at 1:22 PM Jeremy Ouellette <JOuellette@wolfdenresources.com> wrote:

> Hi Gents,
>
> I'm trying to sort out how much traffic is on the lakes currently in the Pickett Region. Focus on Pleasant Lake and Pickett Mountain Pond.
>
> Looking for statements from locals that use the lakes to produce the facts even if anecdotal. I'm discussed so far with Stanley Grass. Can you give me any names and emails of folks you've spoken to that could comment on the amount of traffic per month? Like number of fishermen/women that use the lake on a monthly basis (roughly).
>
> Thanks,
>
> Jeremy

--
Zach Lingley
207-902-0179 (Cell)
www.PatriotConsultingMaine.com
Zachary.Lingley@gmail.com

**From:** stanley grass <ffemt2031@yahoo.com>
**Sent:** July 13, 2021 8:51 AM
**To:** Jeremy Ouellette <JOuellette@wolfdenresources.com>
**Subject:** RE: Lease 20130425 145438.pdf

So very sorry that I'm just now responding to your emails. Just found this in my junk mail. The lake is fairly busy with fishermen in the spring and slows a little over the summer. People use the sand beach to camp throughout the summer. The launch by my camp and the launch by the Gallagher camp are the only two on the lake and there was a gate on their side last I knew. I would think on average you are close at 10 launches a month. Some months more and some less. I wish there was another launch somewhere because we have firewood stolen and usually get broken into a couple times a year but it is what it is and we have learned not to leave anything of high value. Again. Sorry it has taken so long to respond. I think I have it fixed now. Any more questions  feel free to reach out anytime.

Stan Grass

207-659-5755

80 Beech Grove road
Corinth Me. 04427

Sent from Yahoo Mail on Android

On Thu, May 20, 2021 at 11:00 PM, Jeremy Ouellette <JOuellette@wolfdenresources.com> wrote:

> Hi Stan,
>
> Apologies, its been a while since reaching out.  I have a bit of a favour to ask of you.  I'm trying to confirm and understand the boat launches around Pleasant lake.  Is the gravel launch near your camp the only boat launch or are there others?  Also, do you have an estimate of how often they are used on a per month basis?  My guess is around 10 launches but wanted to get your feel for it.
>
> Thanks,
>
> Jeremy

**From:** KATAHDIN LODGE <lodge@katahdinlodge.com>
**Sent:** June 29, 2020 12:00 PM
**To:** Jeremy Ouellette <JOuellette@wolfdenresources.com>
**Subject:** Re[6]: Gemma Hudgell

Hi Jereny -

Not sure about hikers or any of the boat launches but probably about 500 ATV riders per month per trail and 700 snowmobile riders. The snowmopbile riders is more because there are less trails for them.

Hope this helps,

Chuck

------ Original Message ------
From: "Jeremy Ouellette" <JOuellette@wolfdenresources.com>
To: "KATAHDIN LODGE" <lodge@katahdinlodge.com>
Sent: 06/28/20 10:07:21 PM
Subject: RE: Re[4]: Gemma Hudgell

> Hi Chuck,
>
> Would you have any input on the estimated amount of use these trails get as well as boat launches etc? The LUPC is looking for these numbers and our estimates aren't good enough. Something from you would be very helpful. Lets say rough number of riders/hikers/boat launches etc per month on average.
>
> Thanks again!
>
> Jeremy

# EXHIBIT 11.0 REZONING TO/FROM PROTECTION SUBDISTRICT

This exhibit is not applicable to this application.

# EXHIBIT 12.0 CORPORATE GOOD STANDING

# State of Maine

## Department of the Secretary of State

**I, the Secretary of State of Maine, certify** that according to the provisions of the Constitution and Laws of the State of Maine, the Department of the Secretary of State is the legal custodian of the Great Seal of the State of Maine which is hereunto affixed and that the paper to which this is attached is a true copy from the records of this Department.

***In testimony whereof,*** I have caused the Great Seal of the State of Maine to be hereunto affixed. Given under my hand at Augusta, Maine, this twelfth day of January 2023.

Shenna Bellows

**Shenna Bellows**
***Secretary of State***

### Additional Addresses

| Legal Name | Title | Name | Charter # | Status |
|---|---|---|---|---|
| WOLFDEN MT. CHASE LLC | Registered Agent | JOSEPH C. SIVISKI, ESQ. | 20180806FC | GOOD STANDING |

| Home Office Address (of foreign entity ) | Other Mailing Address |
|---|---|
| 2234 OLD LILAC LANE<br>OTTAWA, ON K1H 6H7 | ONE CANAL PLAZA, 9TH FLOOR<br>PORTLAND, ME 04101 |

Authentication: 8125-960 - 1 - Thu Jan 12 2023 14:18:39

# EXHIBIT 13.0 NOTICE OF FILING

Notice of Filing forms were sent to the parties identified below via Certified Mail on January 11, 2023 (**Attachment 13-A)**. Twenty-five-day public notices were also published in the Houlton Pioneer Times and Bangor Daily News on December 21, 2022, and December 22, 2022, respectively. Seven-day public notices were published in the Houlton Pioneer Times and Bangor Daily News on January 11, 2023. Proofs are provided in **Attachment 13-A.**

## 13.1 PROPERTIES WITHIN 1,000 FEET

No properties are located within 1,000 feet of the area proposed for rezoning (**Figure 13-1**).

## 13.2 GOVERNMENT AGENCIES

Notice was sent to the Penobscot County and Aroostook County commissioners.

## 13.3 REPRESENTATIVES

Notice was sent to State Representative Donald Ardell representing House -District 6, Kathy Javner representing House District 29, and State Senator Harold “Trey” Stewart representing District 2.

## 13.4 NEARBY LANDOWNERS

**Table 13-1** lists the nearby landowners whose properties are more than 1,000 feet from the Project Area but were provided notice as a courtesy.

### Table 13-1: Notice Mailing List, Pickett Mountain Metallic Mine

| Name | Street/P.O. Box | Town | State | Zip |
|---|---|---|---|---|
| Ryan R. Allen | 8 Knotta Way | Naples | ME | 04055 |
| Aroostook Timberlands, LLC | P.O. Box 5777 | Saint John, New Brunswick, E2L 4M3, Canada | | |
| Cassidy Timberlands, LLC<br>c/o Benjamin Carlisle | P.O. Box 637 | Bangor | ME | 04402 |
| Raymond & Jeanette Gallagher | P.O. Box 478 | Patten | ME | 04765 |
| Gardner Land Company, Inc,<br>Nickolas Ireland | P.O. Box 189 | Lincoln | ME | 04457 |
| Herbert C. Haynes, Inc.<br>c/o Ginger Maxwell | P.O. Box 96 | Winn | ME | 04495 |
| Lakeville Shores, Inc<br>c/o Ginger Maxwell | P.O. Box 96 | Winn | ME | 04495 |
| Bert S. Lord | 131 Wiley Road | Littleton | ME | 04730 |
| David Porter | 131 E. Newport Road | Stetson | ME | 04488 |

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

| Name | Street/P.O. Box | Town | State | Zip |
|---|---|---|---|---|
| Raye & Kathy Porter | 131 E. Newport Road | Stetson | ME | 04488 |
| Kyle & Jon Wescott | 191 Location Road | Belgrade | ME | 04917 |
| Stanley Grass Jr. | 80 Beech Grove Road | Corinth | ME | 04427 |

# EXHIBIT 13 FIGURES

Figure 13-1: Proposed Rezoning Boundary with 1,000-foot Buffer.

# EXHIBIT 13 ATTACHMENTS

Attachment 13-A: Notice of Filing Forms and Certified Mail Receipts

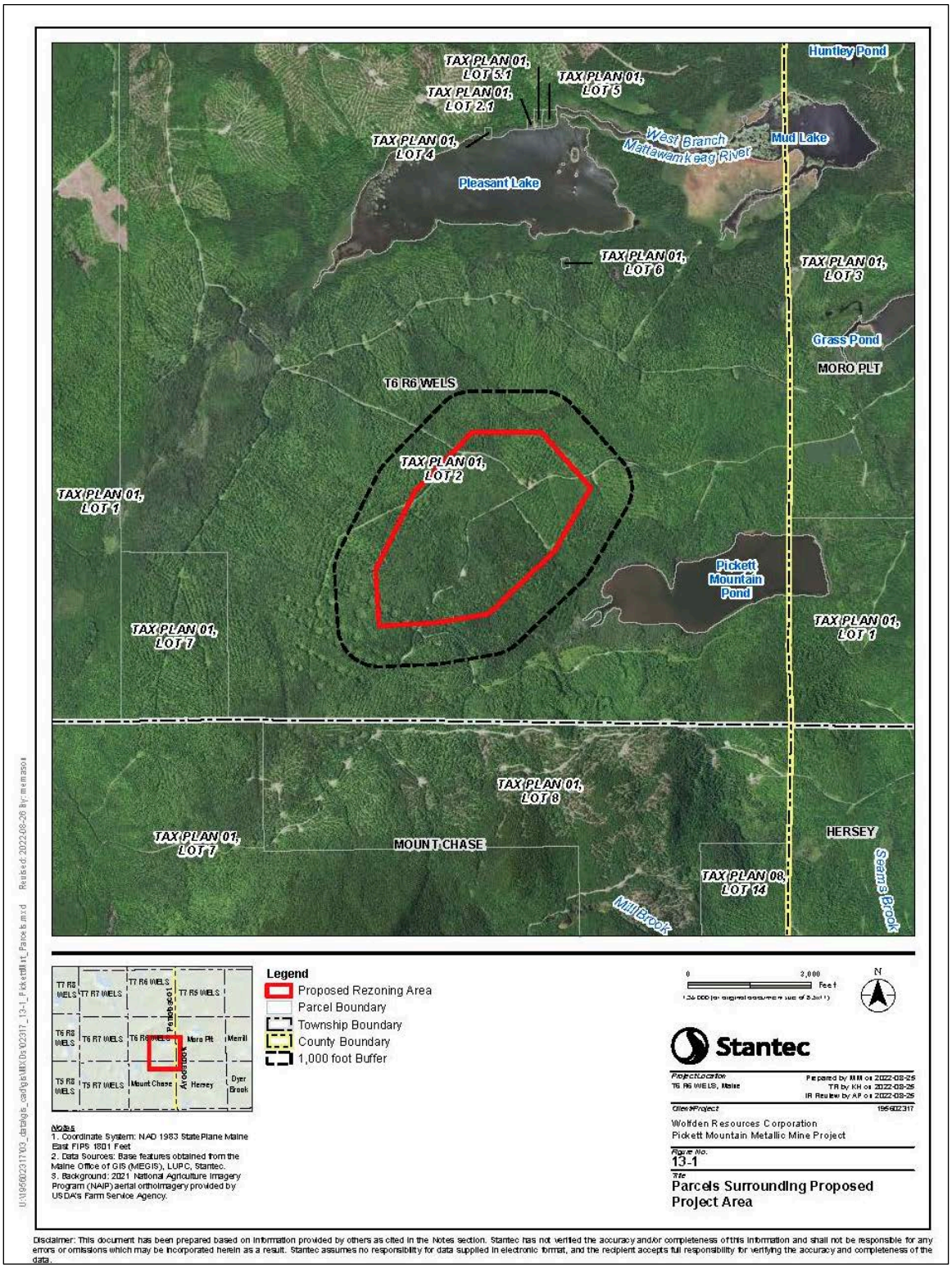



**Figure 13-1: Proposed Rezoning Boundary with 1,000-foot Buffer.**

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 13-A: Notice of Filing Forms and Certified Mail Receipts

# Mi'kmaq

(Continued from Page 1B)

eration more environmentally sustainable.

With fish consumption advisories on the wild brook trout population due to mercury contamination, the trout hatchery makes it possible for people to consume brook trout safely, O'Donnell said.

Fish is a culturally relevant product to the Mi'kmaq Nation, while also supporting a food movement where the farm can sell their fish to meet market demand and support local pantries.

"Tribal leadership believe that food sovereignty is critically important for the tribe, but also the local community and so the EDA grant was awarded to us to provide community resilience," O'Donnell said.

# What's Happening

*To submit items, please call or fax 207-532-2281, fax, mail to PO Box 456, Houlton, ME 04730, or email pioneertimes@nepublish.com by 4 p.m. Friday.*

**Wednesday, Dec. 21**

HOULTON: Putnam House Senior Center, open noon to 5 p.m.

HOULTON: Narcotics Anonymous meeting, 7 p.m. at Aroostook Recovery Center of Hope, 59 Main St.

ONLINE: Gathering Place, sponsored by Aroostook Agency on Aging, 10-11 a.m. Safe virtual space for those with chronic memory loss or health conditions to engage in fun activities. FMI: 764-3396 or 1-800-439-1789 or email info@aroostookaging.org.

**Thursday, Dec. 22**

HOULTON: The Maine Educational Opportunity Center presents the Essentials of College Planning at 9, 10 and 11 a.m. and 1 and 2 p.m. at the Houlton Higher Education Center, 18 Military St. FMI call 1-800-281-3703 or go to http://meoc,maine.edu.

HOULTON: AA meeting, 7:30 p.m., Watson Hall, upstairs, Church of the Good Shepherd, 116 Main St.

**Friday, Dec. 23**

HOULTON: TOPS (Take Off Pounds Sensibly) # 0233 meets weekly at the Family Center, 18 Kelleran St., with weigh-in from 7:45-8:45 a.m. and meeting from 9-10 a.m. FMI: Call Diane at 207-521-1717.

HOULTON: Putnam House Senior Center, open 10 a.m.-3 p.m.

**Saturday, Dec. 24**

HOULTON: AA meeting, 9 a.m., upstairs side room, Church of the Good Shepherd, 116 Main St.

**Monday, Dec. 26**

HOULTON: Putnam House Senior Center, open 10 a.m.-3 p.m.

HOULTON: Al-Anon Family Group Meeting for families and friends of alcoholics, 7 p.m. Upstairs side room, Watson Hall/Church of the Good Shepherd, 116 Main St. Houlton

ONLINE: A Family for Me live Q&A sessions online at noon and 6 p.m. Go to https://afamilyformemaine.org/.

**Tuesday, Dec. 27**

ONLINE: Caregiver Support Group, 6-7 p.m., hosted by Aroostook Agency on Aging. Share feelings, make friends and learn from others traveling a similar path. FMI: Call 764-3396, 1-800-439-1789 or email info@aroostookaging.org.

HOULTON: AA meeting, 7:30-9 p.m. Tuesdays at First Baptist Church, 46 Court St. FMI: Mike, 889-0910.

**Wednesday, Dec. 28**

HOULTON: Putnam House Senior Center, open noon to 5 p.m.

HOULTON: Narcotics Anonymous meeting, 7 p.m. at Aroostook Recovery Center of Hope, 59 Main St.

ONLINE: Gathering Place, sponsored by Aroostook Agency on Aging, 10-11 a.m. Safe virtual space for those with chronic memory loss or health conditions to engage in fun activities. FMI: 764-3396 or 1-800-439-1789 or email info@aroostookaging.org.

**Thursday, Dec. 29**

HOULTON: The Maine Educational Opportunity Center presents the Essentials of College Planning at 9, 10 and 11 a.m. and 1 and 2 p.m. at the Houlton Higher Education Center, 18 Military St. FMI call 1-800-281-3703 or go to http://meoc,maine.edu.

HOULTON: AA meeting, 7:30 p.m., Watson Hall, upstairs, Church of the Good Shepherd, 116 Main St.

**Friday, Dec. 30**

HOULTON: TOPS (Take Off Pounds Sensibly) # 0233 meets weekly at the Family Center, 18 Kelleran St., with weigh-in from 7:45-8:45 a.m. and meeting from 9-10 a.m. FMI: Call Diane at 207-521-1717.

HOULTON: Putnam House Senior Center, open 10 a.m.-3 p.m.

**Saturday, Dec. 31**

HOULTON: AA meeting, 9 a.m., upstairs side room, Church of the Good Shepherd, 116 Main St.

**Sunday, Jan. 1**

HOULTON: AA meeting, 6 p.m. at Aroostook Recovery Center of Hope and via Zoom. FMI: 207-254-2213, cputnam@amhc.org, sholton@amhc.org.

HOULTON: Al-Anon Family Group Meeting for families and friends of alcoholics, 7 p.m. Upstairs side room, Watson Hall/Church of the Good Shepherd, 116 Main St. Houlton

**Monday, Jan. 2**

HOULTON: Putnam House Senior Center, open 10 a.m.-3 p.m.

ONLINE: A Family for Me live Q&A sessions online at noon and 6 p.m. Go to https://afamilyformemaine.org/.

HOULTON: Al-Anon Family Group Meeting for families and friends of alcoholics, 7 p.m. Upstairs side room, Watson Hall/Church of the Good Shepherd, 116 Main St. Houlton

*Please submit your nonprofit event information to pbrewer@bangordailynews.com or to story@thecounty.me.*

Legal Notices

## **NOTICE**
## TOWN OF HOULTON TAXPAYERS

**The Town Books for the 2022 fiscal year will close on December 31, 2022. Tax payments must be received by 12:00 PM at the Houlton Town Office on December 30, 2022, or U.S. postmarked on or before December 31, 2022, to be accepted for the 2022 fiscal year. Outstanding taxes as of January 1, 2023 will be printed in the annual Town Report.**

**Dec. 21, 28, 2022**

Legal Notices

## PUBLIC HEARING
## TOWN OF HOULTON
## FY23 BUDGET

The Houlton Town Council will hold a public hearing and vote at 6:00p.m., TUESDAY, JANUARY 3, 2023 on the following: (Note: The FY23 Budget in its entirety is available for public review at the Houlton Town Office during normal business hours.)

**PROPOSED EXPENDITURES**

| | | |
|---|---|---|
| Administration | | 588,421 |
| Assessing | | 101,135 |
| Tax Abatements | | 20,000 |
| Protection | | 469,192 |
| Police | | 1,413,768 |
| Fire | | 639,755 |
| Ambulance | | 948,637 |
| Health & Social Services | | 35,865 |
| Code Enforcement | | 62,891 |
| Community Development | | 63,767 |
| Cemeteries | | 99,973 |
| Public Buildings-Town Office | | 36,076 |
| Public Buildings-White Building | | 7,200 |
| Public Works | | 1,209,134 |
| Recreation | | 264,960 |
| Park Maintenance | | 191,158 |
| Civic Center(Arena) | | 217,818 |
| Airport | | 85,575 |
| Planning Board | | 2,850 |
| Employee Benefits | | 1,954,248 |
| Debt Service | | 534,620 |
| Outside Agencies | | 209,001 |
| Chamber of Commerce | 24,000 | |
| Library | 167,522 | |
| Life Flight | 1,531 | |
| Northern Maine Dev. Comm. | 10,648 | |
| Aroostook Area on Aging | 3,500 | |
| Snowmobile Club | 1,800 | |
| Projects | | 4,000 |
| Roads 2000 | | 200,000 |
| Grant Match | | 5,000 |
| Tax Increment Finance | | 497,703 |
| Capital Reserve | | 261,350 |
| **TOTAL MUNICIPAL BUDGET** | | **$10,124,097** |
| **MANDATES** | | |
| Aroostook County Tax | | 506,468 |
| RSU#29 | | 2,163,772 |
| **TOTAL MANDATES** | | **$2,670,240** |
| **GRAND TOTAL FY23 BUDGET** | | **$12,794,337** |

Dec.. 21, 2022

Legal Notices

## NOTICE OF FILING OF ZONING PETITION WITH THE MAINE LAND USE PLANNING COMMISSION

This is to notify you that Wolfden Mt. Chase LLC., a wholly owned subsidiary of Wolfden Resources Corporation, with the address of 1100 Russell Street, Suite 5, Thunder Bay, Ontario, Canada P7B 5N2 will be filing a zoning petition with the Maine Land Use Planning Commission, pursuant to provisions of 12 M.R.S.A Section 685-A (8-A), to rezone approximately 375 acres of land located in T6R6 WELS Penobscot County, Maine from its present General Management and resources Subdistrict designations to a Planned Development (D-PD) Subdistrict, referred to as its Pickett Mountain Project, for purposes of initial development, operation and closure of an underground metallic mineral mine pursuant to Chapters 10 and 12 of the Land Use Planning Commission regulations. The petition will be filed for public inspection at the Maine Land Use Planning Commission offices below on or about January 17th of 2023.

**AUGUSTA OFFICE**
18 Elkins Lane – Harlow Bldg.
22 State House Station, Augusta, ME 04333-0022
Tel. (207) 287-2631/TTY (888) 577-6690, FAX (207) 287-7439

**EAST MILLINOCKET OFFICE**
191 Main Street, East Millinocket, ME 04430
Tel. (207) 485-8354/Tel. (207) 399-2176, FAX (207) 746-2243

In accordance with the Commission's Chapter 12 rule, a **public hearing must be held** for this zoning petition. Details on the public hearing, including how to participate in the hearing, request intervenor status, receive future notifications, and the date of the record closes, will be posted in a separate Notice of Public Hearing as soon as that information is available. Public comments are welcome up until the close of the record. The LUPC encourages interested persons to submit written comments on this petition electronically to the e-mail address wolfdenrezoning.LUPC@maine.gov. Written comments submitted in hard copy should be sent to the Maine Land Use Planning Commission's Augusta Office address, attention: **Tim Carr**, and must be received by the Commission in a timely manner. For additional information, contact Stacie Beyer at the Augusta Office, or through the project e-mail address listed above.

Dec. 21, 2022

Legal Notices

## ADVERTISEMENT FOR BIDS
### *Stardust Motel Renovations – Phase 2*

The **Houlton Band of Maliseet Indians** cordially invites bids for the Stardust Motel Renovations – Phase II Project. Sealed bids will be received at the Stardust Motel located at 672 North Street until **2:00pm** prevailing local time, **Tuesday, January 17, 2023**, at which time they will be opened and read aloud. Bids received after this time will not be accepted.

Sealed envelopes shall be addressed:

**"HBMI Stardust Motel Renovations- Phase II"**
**Attn: Rosa McNally Houlton Band of Maliseet Indians**
**88 Bell Road Littleton, ME 04730**
CONSTRUCTION BID - DO NOT OPEN

***Due to Covid-19 restrictions, bids will not be accepted at the HBMI Main Office. All bids shall be hand delivered to the Stardust Motel at the date and time of bid opening***

The work generally consists of the following, which is not an all-inclusive list: The renovation of a 4,400SF hotel building including the installation of a sprinkler and fire alarm system, new windows, doors, siding, flooring, interior finishes, plumbing fixtures, heating system, and electrical system.

A Pre-Bid Conference is scheduled to be held on **Thursday, January 5, 2023 @ 10:00am** at the project site located at 672 North Street (US Route 1), Houlton, ME. Attendance at the Pre-Bid Conference is **mandatory**. After the Pre-Bid Conference, the project area will be open to attendees of the Conference for inspection of existing conditions.

Bids must be accompanied by a satisfactory Bid Bond in the amount of 5% of the Bid. The selected Contractor will be required to furnish a 100% Contract Performance and Payment Bonds and Lien Waivers to cover the execution of the work, which shall be in conformity with the Bonds and Lien Waivers contained in the Specifications and for the Contract Amount. The Owner reserves the right to waive any and all technical and legal deficiencies, to reject any and all Bids, or to accept any Bid that the Owner may deem to be in their best interest.

Indian preference will be applied when considering all bids.

Contract Documents may be examined at:
B.R. Smith Associates, Inc. 11 Hall Street, Presque Isle, Maine

Bidders may obtain electronic PDF copies of plans and specifications by emailing a request to mpooler@brsainc.com indicating Company Name, Contact Name, Mailing Address, Telephone Number, and Email Address to send copies. These requests will be the basis for a plan holders list for updates and information. Requests lacking information will not receive documents.

Bidders may obtain plans and specifications for a **$100.00** pre-paid, non-refundable fee, **$110.00** if mailed (United States Postal Service first class) or $120.00 (Federal Express-Overnight) from: B.R. Smith Associates, Inc., 11 Hall St., Presque Isle, Maine, Tel 207.764.3661.

No formal interpretation of the Contract Documents will be made after **9:00 am, Friday, January 13, 2023.**

by: Houlton Band of Maliseet Indians

Dec. 21, 2022

IRVING

## Grow Your Career Right Here at Home

**Irving Forest Products, Inc. and Irving Woodlands, LLC** are growing companies on the leading edge of technology in the Sawmills and Woodlands industries.

**Irving Woodlands, LLC** has the following positions available:

- Garage Planner – Rate depending on experience
- Heavy Equipment Mechanic – Rate depending on experience
- Truck Drivers – Starting at $23.50 per hour
- Field Forester – Salary depending on experience
- Heavy Equipment Operator – Rate depending on experience
- Silviculture Operator Superintendent – Salary depending on experience
- Site Prep Forwarder Operator – Rate depending on experience

**Irving Forest Products, Inc** has the following positions available:

- Quality Control Specialist – Salary depending on Experience
- Industrial Electrician – Starting at $24.55 per hour
- Boiler Operator – Starting at $22.15 per hour
- Machine Operators/Laborers – Starting at $19.10 per hour
- Millwrights – Starting at $22.25 per hour
- Lube Technician – Rate depending on experience

**Part time positions also available.**

Full time positions include competitive wages and an excellent benefits package including:

- Night Shift Differential
- Incentive Bonus Program
- Company Uniforms
- Medical, Dental and Vision Insurance
- Life and Disability Insurance
- Medical Reimbursement Account
- 401k Company Match
- Vacation, Earned Leave and Holiday Pay

★ **$2,000 Sign-On Bonus**

If you are a self-starter, have a strong work ethic and are interested in joining our team and for more details, please apply online at https://careers.jdirving.com/ Browse Region and Select: **Maine**
Or you can call us at (207) 834-5767 and speak with an Human Resource representative.

Irving Woodlands, LLC and Irving Forest Products, Inc. are Equal Employment Opportunity employers

**jdirving.com/careers**

IRVING

## Weekend Loader Operator - $26.50
## Friday, Saturday, and Sunday

Irving Forest Products – Ashland Sawmill

We are looking for motivated individuals to contribute to the Forest Products industry as a **Loader Operator**

**Qualifications:**

- Experience Required: experience with mobile equipment in industrial settings such as industrial forklifts, payloaders, log cranes, etc.
- Sawmill industry experience is preferred.
- Individuals need to be hard working, safety-oriented and self-motivated.
- Desire to work with the best machinery and technology in the industry
- Applicants need to be able to work in a team environment that is committed to safety, quality, and production.

**Key Responsibilities:**

- Commit to working weekend shifts
- Responsible for loading and unloading kilns with lumber
- Load railcars as needed
- Other duties as assigned
- Maintaining strict company environmental rules and best management practices.
- Maintain safety compliance, follow all safety rules and wear appropriate PPE for task at hand.

**What We Offer:**

Fulltime position offers a competitive wage and an excellent benefits package. The package consists of the following:

- o Starting at $21.52 per hour
- o Weekend Bonus $5.00 per hour*
- o Shift differential $2.00 per hour
- o Production Bonus
- o Attendance Bonus
- o $2,000 Sign-On Bonus
- o 401K Retirement with Company Match
- o Medical, vision and dental coverage
- o Disability Insurance
- o Annual Uniform Program
- o Vacation and Holiday Pay
- o Earned Employee Leave

***Part-time Single Shifts to be considered**

If you are a self-starter, have a strong work ethic and are interested in joining our team and for more details, please apply online at https://careers.jdirving.com/ Browse Region and Select: **Maine**

Or you can call us at (207) 418 - 4056 and speak with a Talent Acquisition Specialist.

Irving Woodlands, LLC and Irving Forest Products, Inc. are Equal Employment Opportunity employers

**careers.jdirving.com**

IRVING

## Grow Your Career Right Here at Home

**Irving Woodlands, LLC**, a leader in the East Coast Forest products industry known for its commitment to quality products, service and sound environmental management, is seeking experienced Log Truck drivers that are seeking work or interested in starting their own business.

## Trucking Contractors

The successful applicant will be an experienced log truck diver that holds a valid Class A CDL license. Contractors and Drivers must be able to go to Canada.

Previous experience hauling in the woods would be an asset. For individuals that do not have their own truck and wish to become a contractor, we can help you with getting started. We offer assistance in Equipment Financing and Business Start-up.

If you are a self-starter, have a strong work ethic, and are interested in joining our team, please contact:

**1-207-834-5767**
or
**meforestjobs@jdirving.com**

**jdirving.com/careers**

## Boats/Marine 360

**1986 18' REGAL BOAT AND TRAILER** V-8 needs fuel pump. Bangor, $2500 207-745-9351

**CHRIS CRAFT CONTINENTAL 1956 23 FT** Family owned over 20 years and just finished much restoration but must sell due to owner death from Covid. This is a gorgeous boat that needs wiring and chrome reinstalled and some additional varnishing. On trailer, in boathouse outside of Millinocket. Make offer. 239-250-0066

**SAILBOAT '76 BRISTOL 24'** Masthead Sloop w/jib furling, Rebuilt Yanmar 8HP diesel, 6' headroom cabin sleeps 4, galley/icebox. $3,500 299-8729

## Cars 365

**CHEVROLET 1931 INDEPENDENCE** Burgundy/Beige, 7,760 Mi, Chevrolet 5 passenger coupe. Solid body with doors that line up and close, some wear on clean interior with curtains. Everything is stock, no modifications. A 6-cyliner with 3-speed transmission. Clean underneath. Excellent tires. Used little, paint is very good. $28,500 207-299-4351

**FORD 1996 MUSTANG CONVERTIBLE** V6, AT, green with tan top, only 6,040 miles, never seen snow. Perfect. $24,999. Call 207-843-6205

**MERCEDES-BENZ 1981 380SL** Blue/Blue, 94,000 Mi, Private Party, Convertible, w/ both hard top and soft top. Very good condition. Clean title. Garaged all year. Used only in summer. $18,000 207-631-2631

**MERCEDES-BENZ SL 500 2004** Hard top convertible. Immaculate. 51,000 original miles. Loaded. Two New batteries, 4 new tires. Garaged every winter. $20,000 207-949-1723

**PONTIAC 1984 FIREBIRD TRANS AM** Blue/Gray, 85,000 Mi, Private Party, Runs and drives well, turn key and go. 350 V8 Chev, 5 speed transmission, new; motor, tires, brakes, paint, exhaust, after market air conditioning. $6,000 207-843-5773

## Motorcycles/Mopeds 375

**SUZUKI 2007** Black, Bergman 650 CC Scooter. Mint condition. 16,775 miles. $2,000 Leave a message at 207-723-8049

2010 Honda Accord EXL 144k $10,500

2017 Dodge Grand Caravan SXT 90k $15,500

2017 Toyota Tundra SR5 4x4 79k $29,999

2015 Chevy 1500 Crew Z71 132k $20,500

2016 Jeep Grand Cherokee Laredo 77k $21,250

Sell Us Your Car!

Not happy with your trade in allowance at a Big Box Dealer? Having trouble selling your car privately?

Come see us!

We will make you a CASH OFFER on the spot!

LAV'S Auto

88 River Road, Route 15, Orrington, ME 207-922-2934

**SUZUKI 2013 BOULEVARD M-90 1500** Mint cond, gray. 7900mi. many extras: cust. grips, pegs, roll & sissy bars w/ bag, radiator cowling, tank bib, nose fairing, mag rims. $5500 207-825-4103

## Sport Utility 380

**GMC 2005 ENVOY XL 4WD** Black w/ leather interior. Many new parts. 183k miles. Runs great. $3,999 Brewer. 207-478-0402

## Pickups/4 Wheel Drives 385

**CHEVY 2014 SILVERADO LT** Exc. body, interior & mechanical, NO rust, Rhino lining, Bose sys., new tires. Only 33k mi. $35,000 207-234-4403

**FORD 2019 F-250 SUPER DUTY** Red 11,000 Mi, fiberglass cap, rug bedliner, 7 1/2 ft Boss plow, plow light, new set grabber tires, and remote control starter. $48,500 207-989-4105

**GMC 2013 SIERRA 1500 SLT** w/Fisher plow. 160k miles. Leather, sunroof, runs great, serviced regularly, good tires. $21,000 OBRO. 207-404-4888

## Tractors/Trailers/Trucks 390

**FORD 2019 F-250** 54,500 Mi, 4x4 Crew Cab Lariat Super Duty, 6.2L V8 Eng, color Magma Red appears black, black leather int. $54,000 207-852-7589

WOW!

**GMC 2010 CANYON SLE** Ext. Cab 4X4 V8, Maroon. 39,600 Mi. In excellent condition with many extras! $26,500 Firm. Call for more info 564-8555

**UTILITY TRAILER** 6x10, all pressure treated, excellent rubber, tilts. Good to go. $700 obo. 207.299.5678

## Transportation General 351

**5TH WHEEL HITCH** for pickup bed camper. $800 OBO. Bangor, 207-745-9351

REDUCED

**TOYOTA FJ-40 PROJECT** 2 1977 frames with 1 good tub, and a pickup load of spare parts. Eddington. $3700 207-249-3763

## Sports/Recreation 450

**2001 BIG SKY MONTANA KEYSTONE 5TH WHEEL** 35 ft. extremely nice, you will love this home. $13,800. Call 207-356-4178

**2014 FOREST RIVER WILDCAT 5TH WHEEL** 38 foot, 3 slide-outs. Very good Condition. $23,500. 207-659-1036

**FLA. 5TH WHEEL** '13 Infinity 38" 4 slides, hard piped in, 2 TVs, 2 a/cs, storage area. Lot rent pd til Oct. '23. Loc. Morningside Estates, Dade City, Fl. $5k bonus take over mthly financing. Trade for house/land. 949-6491.

**HEARTLAND 2010 BIG HORN 5TH WHEEL CAMPER** 36 foot, 3 slide outs. New tires 2019, very good condition. $20,000, 207-989-6828

## Agriculture General 505

**JOHN DEERE 2 FAMILY TRACTOR 2720 WITH 200CX FRONT END LOADER AND 46 BACKHOE, WITH CHIPPER ATTACHMENT. LOW HRS 200-0916** .

## Merchandise General 605

**ARIENS ZERO TURN MOWER** 2018, Commercial 60" deck, Exc. Cond. $3850. Bangor, 207-745-9351

**ELECTRIC WHEELCHAIRS** (2) 1 year old, seasonal use only, good condition. $1000 each obo. 207-924-2057

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**SEGA ARCADE VIDEO GAME CABINET** Zaxxon, good shape, made in 1982. $2500, 207-949-3562

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### Legal Notices

**TOWN OF HAMPDEN**
**PUBLIC HEARING NOTICE**

Notice is hereby given that the Hampden Town Council will conduct a public hearing at 6:00 pm on Tuesday, January 3, 2023, in the Municipal Building Council Chambers, located at 106 Western Avenue, Hampden, to hear the following:

1. BACTS - Bus Stop Design and Management Guidelines and Bus Stop Designation Plan
2. Proposed amendments to the Hampden Marijuana Ordinance, Article 3 - Medical Marijuana Registered Caregiver; and Article 4 section 4.3.

Copies of the proposed ordinance with amendment is available at the Town Office or online at www.hampdenmaine.gov.

Gayle Decker, Town Clerk

Dec. 22, 2022

### Legal Notices

**NOTICE OF PUBLIC SALE**

Notice is hereby given that in accordance with the Judgment of Reformation of Mortgage and for Foreclosure and Sale entered August 26, 2022 in the action entitled **Federal Home Loan Mortgage Corporation, as Trustee for the benefit of the Freddie Mac Seasoned Credit Risk Transfer Trust, Series 2019-4 v. Linda A. Gerrier**, by the Dover-Foxcroft District Court, Docket No. RE-21-11, wherein the Court adjudged the foreclosure of a mortgage granted by Linda A. Gerrier to Mortgage Electronic Registration Systems, Inc., as nominee for GMAC Mortgage Corporation dba ditech.com dated January 26, 2005 and recorded in the Piscataquis County Registry of Deeds in Book 1637, Page 236, the period of redemption having expired, a public sale of the property described in the mortgage will be conducted on **Tuesday, January 10, 2023, commencing at 10:30 AM, 707 Sable Oaks Dr., Suite 250, South Portland, ME 04106 on the front steps of the building in front of the flag pole**.

The property is located at 37 Greenville Road, Shirley, Maine.

The sale will be by public auction. All bidders for the property will be required to make a deposit of $5,000.00 by certified or bank check at the time of the public sale made payable to Korde & Associates, P.C., which deposit is non-refundable as to the highest bidder. The balance of the purchase price shall be paid within forty-five (45) days of the public sale. In the event a representative of the mortgagee is not present at the time and place stated in this notice, no sale shall be deemed to have occurred and all rights to reschedule a subsequent sale are reserved. Additional terms will be announced at the public sale.

Korde & Associates, P.C., 707 Sable Oaks Dr., Suite 250, South Portland, Maine 04106, (207) 775-6223. Updates may be found at: http://www.logs.com/me-sales-report.html.

20-000546

Dec. 8, 15, 22, 2022

### Legal Notices

**NOTICE OF FILING OF ZONING PETITION WITH THE MAINE LAND USE PLANNING COMMISSION**

This is to notify you that Wolfden Mt. Chase LLC., a wholly owned subsidiary of Wolfden Resources Corporation, with the address of 1100 Russell Street, Suite 5, Thunder Bay, Ontario, Canada P7B 5N2 will be filing a zoning petition with the Maine Land Use Planning Commission, pursuant to provisions of 12 M.R.S.A Section 685-A (8-A), to rezone approximately 375 acres of land located in T6R6 WELS Penobscot County, Maine from its present General Management and resources Subdistrict designations to a Planned Development (D-PD) Subdistrict, referred to as its Pickett Mountain Project, for purposes of initial development, operation and closure of an underground metallic mineral mine pursuant to Chapters 10 and 12 of the Land Use Planning Commission regulations. The petition will be filed for public inspection at the Maine Land Use Planning Commission offices below on or about January 17th of 2023.

**AUGUSTA OFFICE**
18 Elkins Lane - Harlow Bldg.
22 State House Station, Augusta, ME 04333-0022
Tel. (207) 287-2631/TTY (888) 577-6690, FAX (207) 287-7439

**EAST MILLINOCKET OFFICE**
191 Main Street, East Millinocket, ME 04430
Tel. (207) 485-8354/Tel. (207) 399-2176, FAX (207) 746-2243

In accordance with the Commission's Chapter 12 rule, a **public hearing must be held** for this zoning petition. Details on the public hearing, including how to participate in the hearing, request intervenor status, receive future notifications, and the date of the record closes, will be posted in a separate Notice of Public Hearing as soon as that information is available. Public comments are welcome up until the close of the record. The LUPC encourages interested persons to submit written comments on this petition electronically to the e-mail address wolfdenrezoning.LUPC@maine.gov. Written comments submitted in hard copy should be sent to the Maine Land Use Planning Commission's Augusta Office address, attention: **Tim Carr**, and must be received by the Commission in a timely manner. For additional information, contact Stacie Beyer at the Augusta Office, or through the project e-mail address listed above.

Dec. 22, 2022

### Legal Notices

**NOTICE AND ORDER:**

Petition for Appointment of Guardian of a minor.
Docket No SU22P2254GD
In the interest of Star Marie Garman.
Gloria T. Richards, you are being notified of the following intentions of James DiGregorio and Veronica Richards - DiGregorio is seeking full appointment of Guardianship.
Court - Suffolk Probate and Family Court
24 New Chardon Street
Boston, MA 02114
Hearing Date January 18,2023
Time 9AM
4th floor, Courtroom 4

Dec. 22, 2022

### 12-21 CRYPTOQUIP

EBZ VDBZIA DGYR TRVCRHJRA JDR SBMX SZHD SBTR ARRCIE. XRRC JDGJ WM SWMA NBT NZJZTR TRYRTRMHR.

**Yesterday's Cryptoquip:** IF THEY CONSTRUCT AN INTERSTELLAR DAY SPA WAY IN THE FUTURE, WOULD IT OFFER A SPATIAL FACIAL?

Today's Cryptoquip Clue: E equals Y

### 12-22 CRYPTOQUIP

JDX'J PXJNAIXP NR YXP JROXRIX YAND NDX JZOX IZOX ZJ ZENRQ KXQQXGG. AN'J Z YAGG-KZNXP QROZIEX.

**Yesterday's Cryptoquip:** YOU SHOULD HAVE RESPECTED THE MONK MUCH MORE DEEPLY. KEEP THAT IN MIND FOR FUTURE REVERENCE.

Today's Cryptoquip Clue: J equals S

## Chargers

(Continued from Page 7)

late 2023 or early 2024.

"The state has plans to award funding for five to six new DC fast charging sites in Aroostook County: Presque Isle, Fort Kent, Ashland, Houlton, Van Buren or Madawaska, and another potential location somewhere on I-95 between Bangor and Houlton," said Amalia Siegel, program manager for electric vehicle initiatives at Efficiency Maine.

Cameron Clark of Houlton, owner and president of Cam's Lawn Care and Landscaping, solved his own power issues for his Tesla. He had built a solar array for his business and installed a charging plug, which he makes available free to other Tesla owners.

"The cost is minimal and I did not see any spike in cost like those that charge on the grid," he said.

Clark has had his electric vehicle for two years, and when traveling uses the brand's supercharger network, which is more cost-effective than regular chargers, he said. One or two people a week stop by and use his charger.

More electric vehicles are traveling to Aroostook, and that will hopefully inspire residents to drive them, too, Clark said. Having more level 2 and 3 chargers available will make owning them more practical.

"Once the charging stations are here, I'm confident more EVs will be driven," he said.

## Nominations

(Continued from Page 7)

together to tackle new assignments each week focused on these skills areas.

Previous sponsors of YPI participants include Acadia Health Education Coalition, ACE Rent-A-Car, Aroostook Agency on Aging, Aroostook County Action Program/Healthy Aroostook, Aroostook Mental Health Services, Inc., Barresi Financial, Carroll's Auto Sales, Cary Medical Center, Central Aroostook Association, City of Caribou, City of Presque Isle, The County Federal Credit Union, Dead River Company, DFAS-Limestone, Dunleavy Law Offices, F.A. Peabody Co., Farm Credit of Maine, Hardscrabble Solutions, Huber Engineered Woods, Katahdin Trust Company, K-Pel Industrial Services, Inc., Loring Job Corps Center, Machias Savings Bank, Maine Centers for Women, Work and Community, MSAD 20, McCain Foods, MMG Insurance, NorState Federal Credit Union, Northern Light A.R. Gould Hospital, Northern Maine Community College, Northern Prosthetics, Pines Health Services, Rathbun Lumber Company, Ryan's Heart, Sitel, S.W. Collins, TD Bank, Thompson Financial Group, Town of Fort Fairfield, United Insurance, U.S. Postal Service, University of Maine at Presque Isle, University of Maine Cooperative Extension, Versant Power, and WAGM-TV.

There is no age restriction for the Young Professionals Institute. YPI is for participants who are "young" in their careers, new to management, on track for promotion, or looking to enhance their professional skills, regardless of age.

There are 20 seats available for YPI 2023. Professionals interested in taking the course must submit their names for nomination or have their business employer nominate them. The nomination deadline is Monday, Jan. 30. Selections will be announced Wednesday, Feb. 1. A $250 registration fee, paid by course participants or their business sponsors, is due by Friday, Feb. 17.

For more information about the short course, which is not being offered for academic credit, please visit www.umpi.edu/ypi or contact Rockwell at 207-521-3100 (ext. 2102) or tracy.rockwell@maine.edu.

## Gala

(Continued from Page 7)

$100 a couple. Tables of eight are also available for purchase for $700. Tickets are available through our online portal at www.memberplanet.com/s/unitedwayofaroostook/blacktiegala, our Facebook page or by emailing Duncan at sarah@unitedwayaroostook.org.

## Snowmobile

(Continued from Page 6)

awaska's former snowmobile festival in 2011.

Northeast SnoCross is a snowmobile race series that opened a practice track in Naples in late 2022, and has since lined up its first series of races in southern Maine and New York. Racers from New England and as far south as New York will join local riders for events at Spud Speedway in Caribou on March 4 and 5.

"This is a high-action sport that will bring in professional racers and locals," said Troy Haney, owner of Spud Speedway.

The races in Madawaska were part of the United States Cross Country racing circuit based in Minnesota.

Haney has partnered with Jim Gamage, owner of 180 Sealcoating & Stripping in Caribou, to launch what they hope will become an annual gathering of snowmobile fans.

A longtime rider himself, Gamage had been snowmobiling in Aroostook for more than a decade before he and his wife Michelle purchased a home in Caribou.

During the pandemic, the couple decided to permanently move from Rockport to Caribou because of the region's friendly atmosphere and plentiful winter recreational opportunities for their 12-year-old son Noah.

After attending snowmobile and ATV events across Maine and New England, Gamage realized that Caribou deserved its own chance to help others discover Aroostook's prime snowmobile trails.

"The people are so welcoming and the trail system is the best in Maine," Gamage said. "You've got fields, lakes, woods, any type of riding you could want."

Through four days of events, Gamage and Haney want to showcase Aroostook's trails and the hard work that local volunteer clubs put into maintaining them.

On Friday, March 3, riders will embark on a historic trail tour from Caribou Park & Ride to destinations along the former Loring Air Force Base. The group will travel along the U.S.-Canada border trail to Van Buren before returning to Caribou.

The following night will feature a show from the Portland-based RaveX snowmobile stunt team along Bennett Drive. The street will remain closed for a snowmobile parade, bonfire, a beer garden, food vendors and live music.

Anyone who missed the historic trail tour will be able to join the Snowmobile Clubs Poker Run on March 5. From 8 a.m. to 2 p.m., people can purchase game cards at Spud Speedway and then travel to clubs in Washburn, Presque Isle, Fort Fairfield and Limestone for cards, food and drinks. The Poker Run grand prize will be $2,500 while second and third places will receive $1,000 and $500, respectively.

"If you haven't booked your hotel room [for the festival], you might want to make that a priority," Gamage said. "I've called all the area hotels and they've said the number of rooms available is shrinking."

Whether some people are looking to relocate or visit their favorite trails, Gamage and Haney hope that their SnowBowl becomes a sought-after event and a showcase of what the Caribou region has to offer.

"Caribou is becoming a destination town of Aroostook because of [our summer festivals] Thursdays on Sweden Street and Caribou Cares About Kids and our fall craft fair," Haney said. "It's time we add a winter event that will bring people to Caribou."

For a full schedule of SnowBowl events, visit the Spud Speedway Facebook page.

Get the edge over your competition!
Advertise here for as low as $16/wk. Call (207) 532-2281.

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REMODELING SERVICES

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Sustainable Agriculture/ Horticulture Professional

The Sustainable Agriculture and Horticulture Professional position in Aroostook County is responsible for planning, implementing, and evaluating educational programs in support of farm businesses in the county. This work will often be done in partnership with county-based colleagues and statewide commodity (potato, dairy, livestock, fruit, and vegetable) or subject specialists (water quality, pest management, food safety) within Cooperative Extension. In particular, the professional will be expected to respond to the needs of livestock producers as well as to the needs of home gardeners. The professional will have overall responsibility for a county-wide Master Gardener Volunteer program.

**Position will be based in an Aroostook County Cooperative Extension office in Houlton, Presque Isle, or Fort Kent, Maine.**

**Typical hiring range for this position is $42,000 to $47,000 commensurate with experience and qualifications.**

**https://umaine.hiretouch.com/job-details?jobid=80131**


**Legal Notices**

**NOTICE OF FILING OF ZONING PETITION WITH THE MAINE LAND USE PLANNING COMMISSION**

This is to notify you that Wolfden Mt. Chase LLC., a wholly owned subsidiary of Wolfden Resources Corporation, with the address of 1100 Russell Street, Suite 5, Thunder Bay, Ontario, Canada P7B 5N2 will be filing a zoning petition with the Maine Land Use Planning Commission, pursuant to provisions of 12 M.R.S.A Section 685-A (8-A), to rezone 375 acres of land located in T6R6 WELS Penobscot County, Maine from its present General Management and Protection Subdistrict designations to a Planned Development (D-PD) Subdistrict, referred to as its Pickett Mountain Project, for purposes of development, operation and closure of an underground metallic mineral mine pursuant to Chapters 10 and 12 of the Land Use Planning Commission regulations. The petition will be filed for public inspection at the Maine Land Use Planning Commission offices below on or about January 17th of 2023.

**AUGUSTA OFFICE**
18 Elkins Lane – Harlow Bldg.
22 State House Station
Augusta, ME 04333-0022
Tel. (207) 287-2631/TTY. Maine Relay 711
FAX (207) 287-7439

**EAST MILLINOCKET OFFICE**
191 Main Street
East Millinocket, ME 04430
Tel. (207) 485-8354
FAX (207) 746-2243

**ASHLAND OFFICE**
45 Radar Road
Ashland, ME 04732
Tel. (207) 435-7969/ Tel. (207) 435-7970
FAX (207) 435-7184

In accordance with the Commission's Chapter 12 rule, **a public hearing must be held** for this zoning petition. Details on the public hearing, including how to participate in the hearing, request intervenor status, receive future notifications, and the date the record closes, will be posted in a separate Notice of Public Hearing as soon as that information is available. Public comments are welcome up until the close of the record. The LUPC encourages interested persons to submit written comments on this petition electronically to the e-mail address wolfdenrezoning.LUPC@maine.gov. Written comments submitted in hard copy should be sent to the Maine Land Use Planning Commission's Augusta Office address, attention: **Tim Carr, and must be received by the Commission in a timely manner.** For additional information, contact Tim Carr at the Augusta Office, or through the project e-mail address listed above.

Published Jan. 11, 2023


# NEWS REPORTER

The Bangor Daily News and the Houlton Pioneer Times are seeking a smart, hard-charging news reporter to join our team and cover news in Houlton Maine.

This reporter would join a growing team dedicated to producing direct, honest, comprehensive and compelling coverage of the Houlton Maine area. If you're the right person for this challenge, this is how we would describe you: You are an aggressive self-starter with a passion for landing important scoops. You have excellent critical thinking skills. You can develop sources who share information no one else has. You are a savvy digital news consumer comfortable presenting information in different formats — from straight-up news stories to analyses and explainers. You want to own the story.

We are Maine's most-read media outlet, with a staff of journalists that stretches from the border of Canada to the boundaries of the Granite State. We blanket Maine's political, social, cultural and economic trends, drive our state's public conversation, and hold our officials accountable. We are committed to informing our community, and we see this role as key to fulfilling that commitment.

In doing so, we bring Maine together.

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Irving Woodlands, LLC and Irving Forest Products, Inc. are Equal Employment Opportunity employers

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## NOTICE OF AGENCY RULEMAKING

**Public Input for Rules**

..... are published each Wednesday to alert the public regarding state agency rulemaking. You may obtain a copy of any rule by notifying the agency contact person. You may also comment on the rule, and/or attend the public hearing. If no hearing is scheduled, you may request one - the agency may then schedule a hearing, and must do so if 5 or more persons request it. If you are disabled or need special services to attend a hearing, please notify the agency contact person at least 7 days prior to it. **Petitions:** you can petition an agency to adopt, amend, or repeal any rule; the agency must provide you with petition forms, and must respond to your petition within 60 days. The agency must enter rulemaking if the petition is signed by 150 or more registered voters, and may begin rulemaking if there are fewer. You can also petition the Legislature to review a rule; the Executive Director of the Legislative Council (115 State House Station, Augusta, ME 04333, phone (207) 287-1615) will provide you with the necessary petition forms. The appropriate legislative committee will review a rule upon receipt of a petition from 100 or more registered voters, or from "...any person who may be directly, substantially and adversely affected by the application of a rule..." (Title 5 §11112). **World Wide Web:** Copies of the weekly notices and the full texts of adopted rule chapters may be found on the internet at: http://www.maine.gov/sos/cec/rules. There is also a list of rulemaking liaisons (http://www.maine.gov/sos/cec/rules/liaisons.html), who are single points of contact for each agency.

### PROPOSALS

**AGENCY: 16-633** – Department of Public Safety (DPS), **Gambling Control Unit**
(Regulation of Sports Wagering)
CHAPTER NUMBER AND TITLES:
**Ch. 50** – Introduction
**Ch. 51** – Definitions
**Ch. 52** – License Application, Fee and Renewal
**Ch. 53** – Internal Controls
**Ch. 54** – Facility Operator Operational Requirements
**Ch. 55** - Physical Premise Requirements
**Ch. 56** - House Rules
**Ch. 57** – Sports Wagering System Requirements
**Ch. 58** – Sports Wagers
**Ch. 59** – Sports Wagering Kiosks
**Ch. 60** – Sports Wagering Accounts
**Ch. 61** – Sports Wagering Revenue Reconciliations
**Ch. 62** – Geolocation and Remote Access
**Ch. 63** – Responsible Wagering Program
**Ch. 64** – Advertising and Promotions
**Ch. 65** – Management Service Contract Criteria
**Ch. 66** – Complaints and Disciplinary Actions
TYPE OF RULES: Routine Technical
PROPOSED RULE NUMBERS: **2023-P001** to **P017**
BRIEF SUMMARY: These rules are to comply with changes in state law under 8 MRSA Ch. 35. Establishes rules for Sports wagering to include eligibility for license, operational and physical premise requirements, wagering systems and accounts, responsible gaming, advertising and promotions and complaints.
PUBLIC HEARING: January 31, 2023 – 9 a.m. - at 45 Commerce Drive, Augusta, ME 04333
COMMENT DEADLINE: March 3, 2023
CONTACT PERSON FOR THIS FILING / SMALL BUSINESS IMPACT INFFORMATION: Milton Champion, Gambling Control Unit, 45 Commerce Drive, Augusta ME 04333 Telephone: (207) 626-3900. Email: Milton.F.Champion@Maine.gov.
FINANCIAL IMPACT ON MUNICIPALITIES OR COUNTIES: N/A

### ADOPTIONS

Pursuant to Ch. 380 of the Public Laws of 2011, notice of the adoption of rules are no longer published in the newspaper rulemaking notices; our Wednesday web notices will continue to carry them, however. Information on rules adopted through the **Maine Administrative Procedure Act** as well as the full text of adopted rules is available on the internet at http://www.maine.gov/sos/cec/rules.

Published Jan. 11, 2023

**PUBLIC NOTICE**

Katahdin Woods and Waters National Monument (KAWW) intends to solicit assistance from the Department of Defense's Innovative Readiness Training Program. The assistance will include the use of a helicopter to sling load a radio repeater to the top of Deasey Mountain (T3 R8 WELS) to assist with administrative and search and rescue activities. The proposed assistance would take place during summer-fall of 2023. Construction contractors, labor unions, or private individuals who have questions or who wish to voice opposition to military assistance for this project may contact Superintendent Wimmer from the National Park Service, KAWW, by e-mail at sheldon_wimmer@nps.gov or by phone at 207-456-6001, no later than thirty (30) days after the first publication of this notice. Persons not filing comments within the time frame noted will be considered to have waived their objections to military assistance for this project.

Dec. 21, 2022 Jan. 11, 2023

## Legal Notices

**ADVERTISEMENT FOR BIDS**

Bids for the **TRANSMISSION MAIN REPLACEMENT** will be received by the **HOULTON WATER COMPANY** at the **WATER COMPANY OFFICE, 21 BANGOR STREET, HOULTON, ME 04730** until **THURSDAY, FEBRUARY 2, 2023, 11:00 A.M.** and then at said office publicly opened and read aloud.

CONTRACT DOCUMENTS may be examined at:

CONSTRUCTION SUMMARY, 734 CHESTNUT STREET, MANCHESTER, NH 03104

ASSOCIATED CONTRACTORS OF MAINE, 188 WHITTEN ROAD, AUGUSTA, ME 04330

and obtained at the office of A.E. Hodsdon located at 10 Common Street, Waterville, Maine, upon payment of **$50.00** for electronic copy; **$150.00** for paper copy nonrefundable.

Jan. 11, 2023

## Legal Notices

**NOTICE OF FILING OF ZONING PETITION WITH THE MAINE LAND USE PLANNING COMMISSION**

This is to notify you that Wolfden Mt. Chase LLC., a wholly owned subsidiary of Wolfden Resources Corporation, with the address of 1100 Russell Street, Suite 5, Thunder Bay, Ontario, Canada P7B 5N2 will be filing a zoning petition with the Maine Land Use Planning Commission, pursuant to provisions of 12 M.R.S.A Section 685-A (8-A), to rezone 375 acres of land located in T6R6 WELS Penobscot County, Maine from its present General Management and Protection Subdistrict designations to a Planned Development (D-PD) Subdistrict, referred to as its Pickett Mountain Project, for purposes of development, operation and closure of an underground metallic mineral mine pursuant to Chapters 10 and 12 of the Land Use Planning Commission regulations. The petition will be filed for public inspection at the Maine Land Use Planning Commission offices below on or about January 17th of 2023.

**AUGUSTA OFFICE**
18 Elkins Lane - Harlow Bldg.
22 State House Station
Augusta, ME 04333-0022
Tel. (207) 287-2631/TTY. Maine Relay 711
FAX (207) 287-7439

**EAST MILLINOCKET OFFICE**
191 Main Street
East Millinocket, ME 04430
Tel. (207) 485-8354
FAX (207) 746-2243

**ASHLAND OFFICE**
45 Radar Road
Ashland, ME 04732
Tel. (207) 435-7969/ Tel. (207) 435-7970
FAX (207) 435-7184

In accordance with the Commission's Chapter 12 rule, **a public hearing must be held** for this zoning petition. Details on the public hearing, including how to participate in the hearing, request intervenor status, receive future notifications, and the date the record closes, will be posted in a separate Notice of Public Hearing as soon as that information is available. Public comments are welcome up until the close of the record. The LUPC encourages interested persons to submit written comments on this petition electronically to the e-mail address wolfdenrezoning.LUPC@maine.gov. Written comments submitted in hard copy should be sent to the Maine Land Use Planning Commission's Augusta Office address, attention: **Tim Carr, and must be received by the Commission in a timely manner.** For additional information, contact Tim Carr at the Augusta Office, or through the project e-mail address listed above.

Jan. 11, 2023

## Legal Notices

**TOWN OF NORTH HAVEN, MAINE**
**NOTICE OF PUBLIC MEETING TO APPROVE A GENERAL OBLIGATION BOND ANTICIPATION NOTE AND GENERAL OBLIGATION BOND IN A PRINCIPAL AMOUNT NOT TO EXCEED $5,050,000**

Notice is hereby given that the Selectmen of the Town of North Haven, Maine will meet at the Town Office located at 16 Town Office Square at 5:00 p.m. on January 18, 2023, to consider the adoption of a resolution to authorize issuance, delivery and sale of a General Obligation Bond of the Town in an amount not to exceed $5,050,000 (the "Bond") to a bank or other lender chosen by the Selectmen, all to provide funding for the construction of a public works building in the Town, as well as a General Obligation Bond Anticipation Note in the same amount, the proceeds of which will be used to fund construction expenses incurred prior to the issuance of the Bond. The public is invited to attend. Written comments received before the meeting will be considered.

Jan. 11, 2023

## Legal Notices

STATE OF MAINE
SOMERSET, ss.

DISTRICT COURT
SKOWHEGAN
CIVIL ACTION
DOCKET NO. SKODC-RE-22-23

SELECT PORTFOLIO SERVICING, INC.
PLAINTIFF
v.
MELISSA L. STEWARD
DEFENDANT(S)
AND
TERRENCE STEWARD, JR.
PARTY(IES) IN INTEREST

**ORDER FOR SERVICE BY PUBLICATION**

Upon Motion by Plaintiff, Select Portfolio Servicing, Inc., with supporting affidavit brought pursuant to M.R.Civ.P. 4(g) it is hereby ORDERED as follows:

1. This is an action brought by Plaintiff pursuant to 14 M.R.S.A. 6321 et. seq. for foreclosure upon a certain mortgage given by the Defendant to Mortgage Electronic Registration Systems, Inc., as nominee for Advanced Financial Services, Inc., and recorded in the Somerset County Registry of Deeds in Book 3792, Page 40, subsequently assigned to Plaintiff, which real estate is located at 49 Dr. Mann Road, Skowhegan, in the County of Somerset and State of Maine. Reference is made to said mortgage for a description of the subject real estate.

2. Defendant Melissa L. Steward and Party in Interest Terrence Steward, Jr. are directed to appear and defend this action by serving an Answer to the Complaint filed in the Skowhegan District Court, 47 Court Street, Skowhegan, ME 04976, upon Plaintiffs Attorneys Korde & Associates, P.C., 707 Sable Oaks Dr., Suite 250, South Portland, Maine 04106.

Said Answer must be filed within twenty (20) days after service by publication is complete and failure to do so will result in judgment by default against said Defendant and Party in Interest for the relief demanded in the Complaint.

3. Plaintiff is hereby ordered to cause publication of this order once a week for three (3) successive weeks in the newspaper of general circulation in the county of Somerset. The first such publication shall be made within twenty (20) days after granting of this order and service shall be complete on the twenty-first day after the first publication. Once complete, Plaintiff shall file with the Court an affidavit that publication has been made. Plaintiff is also ordered to mail a copy of the order as published to Defendant and Party in Interests' last known address of 49 Dr. Mann Road, Skowhegan, ME 04976.

4. The deadline by which the Plaintiff shall file the affidavit of publication shall be 90 days from the date that this order is entered upon the docket.

The Clerk is specifically directed pursuant to Rule 79(a) of the Maine Rules of Civil Procedure to enter this Order on the civil docket by notation incorporating it by reference.

Dated: 12-25-22 Judge, District Court

22-000951

Jan. 11, 18, 25, 2023

## Legal Notices

**Public Hearing Notice**
**to Comply with Title VI Requirements**
**Public Hearing Notice**
**The Town of Eagle Lake**

The Town of Eagle Lake will hold a Public Hearing on Wednesday, January 18, 2023 at 5:30 p.m. at the Eagle Lake Town Office located at 36 Devoe Brook Road in Eagle Lake to discuss an application being submitted to the State of Maine CDBG program for a Public Infrastructure Grant. The purpose of the grant application is to assist the Eagle Lake Water and Sewer District with needed upgrades to their waste water treatment plant, collection system and pumping stations. Public comments will be solicited at this Hearing and will be submitted as part of the application. All persons wishing to make comments or ask questions about the grant application are invited to attend this Public Hearing. Comments may be submitted in writing to the Town of Eagle Lake, P.O. Box 287, Eagle Lake, Maine 04739 at any time prior to the Public Hearing. TDD/TTY users may call 711. If you are physically unable to access any of the Town's programs or services, please call Eagle Lake Town Manager John Sutherland at (207) 444-5511 so that accommodations can be made.

EQUAL HOUSING OPPORTUNITY

Published Jan. 11, 2023

## Legal Notices

**PUBLIC NOTICE**

On January 17 and 18, 2023, at 9:00 a.m., the Maine Labor Relations Board will conduct an evidentiary hearing via videoconference in Mersereau v. Teamsters Local Union No. 340, case no. 23-PPC-02. Please contact the Board at (207) 287-2015 for further information about attending the hearing.

Jan. 11, 2023

**GMC 2013 SIERRA 1500 SLT** w/Fisher plow. 160k miles. Leather, sunroof, runs great, serviced regularly, good tires. $21,000 OBRO. 207-404-4888

## Tractors/Trailers/Trucks 390

**FORD 2019 F-250** 54,500 Mi, 4x4 Crew Cab Lariat Super Duty, 6.2L V8 Eng, color Magma Red appears black, black leather int. $47,000 207-852-7589

WOW!

**GMC 2010 CANYON SLE** Ext. Cab 4X4 V8, Maroon. 39,600 Mi. In excellent condition with many extras! $26,500 Firm. Call for more info 564-8555

**UTILITY TRAILER** 6x10, all pressure treated, excellent rubber, tilts. Good to go. $700 obo. 207.299.5678

## Transportation General 351

**5TH WHEEL HITCH** for pickup bed camper. $800 OBO. Bangor, 207-745-9351

REDUCED

**TOYOTA FJ-40 PROJECT** 2 1977 frames with 1 good tub, and a pickup load of spare parts. Eddington. $3700 207-249-3763

## Sports/Recreation 450

**2001 BIG SKY MONTANA KEYSTONE 5TH WHEEL** 35 ft. extremely nice, you will love this home. $13,800. Call 207-356-4178

**2014 FOREST RIVER WILDCAT 5TH WHEEL** 38 foot, 3 slide-outs. Very good Condition. $23,500. 207-659-1036

**FLA. 5TH WHEEL** '13 Infinity 38" 4 slides, hard piped in, 2 TVs, 2 a/cs, storage area. Lot rent pd til Oct. '23. Loc. Morningside Estates, Dade City, Fl. $5k bonus take over mthly financing. Trade for house/land. 949-6491.

**JOHN DEERE 2 FAMILY TRACTOR 2720 WITH 200CX FRONT END LOADER AND 46 BACKHOE, WITH CHIPPER ATTACHMENT. LOW HRS 200-0916** .

**HEARTLAND 2010 BIG HORN 5TH WHEEL CAMPER** 36 foot, 3 slide outs. New tires 2019, very good condition. $20,000, 207-989-6828

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## Agriculture General 505

## Merchandise General 605

**ARIENS ZERO TURN MOWER** 2018, Commercial 60" deck, Exc. Cond. $3850. Bangor, 207-745-9351

**DISPLAY CASES** Located in Holden. Individual cases starting $50. Ralph 207-843-6205

**ELECTRIC WHEELCHAIRS** (2) 1 year old, seasonal use only, good condition. $1000 each obo. 207-924-2057

**REFRIGERATOR** Samsung. Four years old. No ice-maker. Freezer on the bottom, black stainless. Works great. $800 207-942-3445

**SEGA ARCADE VIDEO GAME CABINET** Zaxxon, good shape, made in 1982. $2500, 207-949-3562

**WOOD FIRED HOT TUB** cedar barrel, 6'x3'8'', 800 gallons, soaks four. External jet pump, insulated cover, welded aluminum sub-surface stove. Argyle, Maine $1,800 207-394-2803

## Fuel & Firewood 610

**DYSARTS FIREWOOD**
Clean, high quality, cut & split.
You pick up or delivered.
Green, $299/cord. 3 cord minimum.
Pellets available. 942-4878, ext. 166

## Pets 620

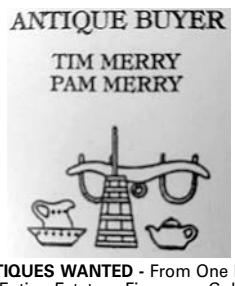
**LABRADOODLE PUPPIES** Are here! Taking $100 deposits. Ready March 1st. 207-479-3634

WOOF

**MULTI-POO PUPS**
Repeat breeding litter. 3m/2f, ready Jan. 14 (12 wks.) in Madawaska. 3 colors. Local Bangor refs. avail. Breeder willing to meet 1/2 way for pickup (ME state only). Pics. & video avail. $1,000 & deposit req. Breeder will be in Bangor on Dec. 29 & 30 to view puppies. For more info: 423-519-7734.

## Wanted To Buy 625

CALL NOW!




**ANTIQUES WANTED -** From One Item To Entire Estates, Firearms, Gold & Silver, Over 40 yrs exp. **Merry's Antiques, 207-338-3371 or 207-323-0304**

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**SPORTS CARDS CASH BUYER**
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**LARGE COLLECTIONS NEEDED**
**Baseball, basketball, football, hockey, unopened. 207-852-0397**

**WHEAT PENNIES**
Will pay 3 cents a piece.
207-299-7219

## Free Found Ads 715

**FOUND PROPERTY** A variety of items have been found at Bangor International Airport. In order to claim lost property, the owner must show reasonable evidence of ownership. Found items will be retained for 60 days. For more information, contact Bangor International Airport, City of Bangor at (207) 992-4600.

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# EXHIBIT 14.0 FINANCIAL PRACTICABILITY

## 14.1 ESTIMATED DEVELOPMENT COSTS

The total estimated development cost for the mine is $64.43 million (**Table 14-1**). If utilized, the solar farm would have an additional up-front cost of up to $19 million and result in a net positive cashflow and return on investment. The PEA developed by A-Z Mining Professionals Limited (A-Z) in October 2020 is attached as **Attachment 14-A** and a letter from September 2022 confirming these estimates as valid are attached as **Attachment 14-B.**

### Table 14-1: Total Project Development Costs

| Project Cost Category | Cost |
|---|---|
| Mine Development | $ 21,440,000 |
| Underground Infrastructure | $ 10,160,000 |
| Surface Infrastructure | $ 20,110,000 |
| Mining Equipment | $ 1,980,000 |
| Mine Contingency (20%) | $ 10,738,000 |
| **Total Mine Development Costs** | **$ 64,428,000** |

Source: PEA, A-Z Letter

## 14.2 ECONOMIC VIABILITY

A PEA is a study that includes an economic analysis of the potential viability of mineral resources taken at an early stage of the project prior to final study or development of a project.

The 2020 PEA prepared by A-Z, estimated positive returns with $1.36 billion in sales revenue during the life of the mine (**Attachment 14-A**). It has been submitted to and is subject to standards under the NI 43-101 (National Instrument – Standards of Disclosure for Mineral Projects) by the Ontario Securities Commission (OSC). In addition, the December 2022 letter update concluded “The project still remains extremely robust and provides an excellent return on investment” (**Attachment 14-B**).

## 14.3 FINANCING PLAN

Funding for the Pickett Mountain Project to date has been a combination of equity raises and timber sales from the larger Wolfden property. Wolfden’s market capitalization will be an important factor for its ability to fully finance the construction of the Project. Wolfden is the first company to attempt to build a metallic mineral mine in Maine and the first under the Chapter 200 rules. As a result, investors may be more cautious to invest in the Project until the principle regulatory requirements (such as rezoning, baseline studies, feasibility studies, and a mining permit) have been successfully completed. Wolfden anticipates that this trend will continue for the Project until milestones like the rezoning have been achieved and the Project is proceeding through its baseline studies.

Typically, mining projects are funded through a combination of project debt and equity. For small mining companies, the equity portion of the project financing is usually raised through several share issuances as the project completes the principal milestones as those listed above, such as the 1) full Feasibility Study with a positive outcome; 2) mine permitting approvals; 3) approval of a project debt facility with a lead financial arranger; and 4) positive results from any ongoing exploration that indicate the potential for additional resources. Project debt facilities are provided by lenders who are sophisticated and experienced with the mining sector. Wolfden's management and board members have experience in all facets of mine project financings as founders and executives of other junior and senior public mining companies, in challenging locations.

Wolfden's two largest shareholders (Kinross and Altius) are larger mining companies with the excess financial capacity to finance the construction of the Project. Kinross is considered to be one of the largest international gold mining companies and the owner of the Fort Knox mining operation in Alaska. Altius, is a primarily a royalty company that participates in project financing and share ownership of companies with high quality assets. As the company progresses through the permitting process, it is likely to become more attractive to other larger producing mining companies with a focus on North American high-grade mineral deposits. In summary, financing for the project will take place through a combination of equity raises, short term and long-term debt facilities or a joint venture with a larger producer. The PEA (**Attachment 14-A**) demonstrates the financial viability of the project.

## 14.4 FINANCIAL ASSURANCE TRUST FUND

Unlike other forms of development, the Chapter 200 rules provide additional protection and ensure that funds are available to fully reclaim the site and address any corrective action. Specifically, Chapter 200 requires the applicant to provide financial assurance in an amount sufficient to cover the cost for the DEP to administer and hire a third-party to implement all necessary investigation, monitoring, closure, post-closure, treatment, remediation, corrective action, reclamation, operation and maintenance activities under the environmental protection, reclamation and closure plan, including the cost to respond to a worst-case catastrophic mining event or failure (06-096 CMR 200 4.17). The form and the amount of the financial assurance must be reviewed by an independent third-party expert, and Wolfden must deposit the required financial assurance in a trust fund (the "Financial Assurance Trust Fund") prior to issuance of a Chapter 200 permit. (06-096 CMR 200 4.17.D) The financial assurance requirements ensure that the mine facilities in T6 R6 will be fully reclaimed, and that there are sufficient funds to cover any corrective action, irrespective of Wolfden's financial strength and without taking into account operating revenue.

The PEA (**Attachment 14-A**) takes into account the requirements to establish the Financial Assurance Trust Fund, in an amount sufficient to cover both the mine in T6 R6 as well as the processing and tailing facilities that will be located outside of T6 R6. That analysis demonstrates that the financial assurance trust fund does not adversely impact the financial practicability of the project.

# EXHIBIT 14 FIGURES

Not Applicable

# EXHIBIT 14 ATTACHMENTS

Attachment 14-A: Preliminary Economic Assessment (PEA) Report

Attachment 14-B: December 2022 Update Letter to PEA

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 14-A: Preliminary Economic Assessment (PEA) Report

# Preliminary Economic Assessment
# Pickett Mountain Project

## Penobscot County, Maine, USA

**68.468°W Longitude and 46.134°N Latitude**

**Effective Date: September 14, 2020**

**Filing Date: October 29, 2020**

**Prepared For**

WOLFDEN
Wolfden Resources Corporation

**By**

**A-Z Mining Professionals Limited**

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# 1.0 Executive Summary

The Pickett Mountain Property area has been explored from the 1950s to present day. Getty Oil made the first significant discovery in the early 1980s. The property was sold to Chevron, which employed the polygonal resource calculation method and stated the historic figure of 3.15 million short tons of resource with an estimated grade of 9.66% zinc, 4.30% lead, 1.24% copper, 0.029 opt gold, and 2.96 opt silver (Laverty, 1983; Riddell, 1983).

The polymetallic deposit is separated into two main zones: the West Zone and the East Zone. The focus of mining will be zinc. The West Zone is narrow but high grade while the East Zone is broader and has a larger volume with a large portion of it currently sub-economic.

## 1.1 Resources and Reserves

Wolfden Resources (Wolfden) acquired the property in 2017, through its subsidiary Wolfden Mt. Chase LLC, with the goal of conducting advanced exploration to further the property toward an economic assessment. With the addition of the Wolfden drilling between 2017 and October of 2018, the estimate of the mineral resources, as of January 2019 using a 9% ZnEq cut-off grade, are shown in Table 1.1, below [**Note:** Historical resources are reported in tons and ounces per ton; current resources are reported as tonnes and grams per tonnes].

**TABLE 1.1**
**MINERAL RESOURCE STATEMENT – JANUARY 2019 WITH 9% ZNEQ CUT-OFF**

| Category | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| Indicated | 2,050,000 | 9.88 | 3.93 | 1.38 | 101.58 | 0.92 | 3.99 | 19.32 |
| Inferred | 2,030,000 | 10.98 | 4.35 | 1.2 | 111.45 | 0.92 | 4 | 20.61 |

For the purposes of this document, mineral resources were updated using a 7% Cut-off grade shell. The updated estimate is shown in Table 1.2, below. Note, no other information was included or deducted from the estimate and the same methodology as those used in 2019 were applied.

**TABLE 1.2**
**MINERAL RESOURCE STATEMENT – UPDATED SEPTEMBER 2020 WITH 7% ZNEQ CUT-OFF**

| Category | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| Indicated | 2,177,000 | 9.25 | 3.68 | 1.32 | 96.4 | 0.9 | 3.98 | 18.23 |
| Inferred | 2,294,000 | 9.79 | 3.88 | 1.15 | 101.1 | 0.9 | 3.99 | 18.62 |

It should be noted that the Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as Mineral Reserves. Metallurgical and cost projections are to PEA level of accuracy. Therefore, there is no guarantee that the economic projections contained in this Preliminary Economic Assessment would be realized.

The Pickett Mountain deposit, as currently defined to a depth of 875m, has significant infill and expansion opportunities. The local exploration target expansion range is 6 to 10 million tonnes grading 12% to 20% ZnEq, based on the current geological model, without the addition of other lenses. This target size is derived from the interpretation of the drilling, geological structure, geology, and surface sampling carried out on the property to date. The potential quantity and grade of the target is conceptual in nature. There

has been insufficient exploration of this target to define a Mineral Resource and it is uncertain if further local exploration will result in this target being delineated as a Mineral Resource.

There are no reserves for the project at present.

## 1.2 Project Operating Plan

The focus of the project has been to get the regulatory issues resolved while conducting the engineering components. To that end, the approval for the project is currently in Month Six of a six- and one-half month stage of an overall 13½ month rezoning process for the permitting of the mine and mine infrastructure. The project is filing its findings and plan to the Land Use Planning Commission (LUPC), which will certify to the Maine Department of Environmental Protection (MDEP) that it will meet or exceed all requirements in protection of the environment. Underground production rates have been set at 1,300 tpd for all underground mining operations. Initially mining will begin on the upper West Zone.

The 1,200 tpd processing plant will be developed and commissioned, which is expected to take approximately one year. Initially, plant feed will originate from the West Zone and then the East Zone.

## 1.3 Mine Plan

The bulk of the high value material sits in narrow veins, which is conducive to raise platform mining. The mine will be accessed from the surface by a decline collared in the hillside. An excavation will be cut into the hillside to create a large free face in which to collar the portal. The floor of the cut and the first two rounds of the decline will be designed to be upgrade at a sufficient grade to allow water to drain away from the portal. The decline will be driven at a nominal 15% downgrade and access the upper sections of the ore zone at 100m intervals.

Initially, waste rock and mineralised rock will be trucked to the surface via low profile haul trucks. To hoist the mineralised material during commercial production, a small vertical shaft will be developed from the underground to create an opening such that a 10-tonne skip and counterweight can be employed to move the ore to surface (Figure 1.1).

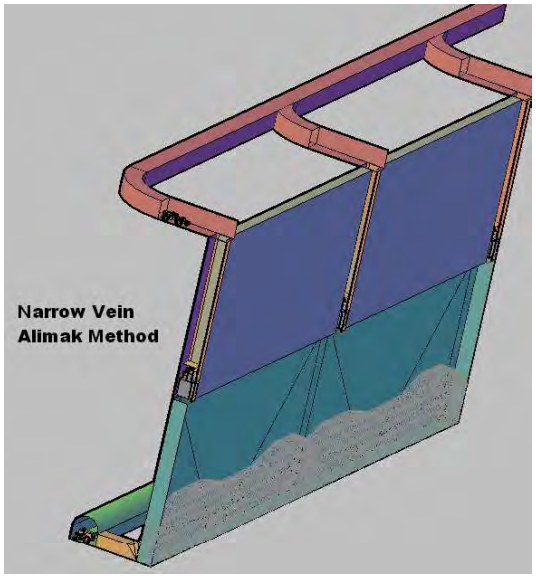



**Figure 1.1 Narrow Vein Mining Using Alimak Raise Platforms**

## 1.4 Processing

Pickett mountain potentially economic mineralisation will be processed in a conventional sequential process flowsheet for recovery of copper, lead, and zinc concentrates.

The ore will be processed in a three-stage crushing circuit followed by a ball mill to produce a ground product with a $P_{80}$ of 37 micrometers. The slurry will be conditioned with chemicals and a rougher copper concentrate floated. The concentrate will be reground to $P_{80}$ of 21 micrometers and cleaned several times to produce a marketable-grade copper concentrate.

The tailings from rougher and first cleaner flotation will be combined as feed to the lead circuit. Lead rougher concentrate will be floated following conditioning of the slurry with reagents. The lead rougher concentrate will be reground to $P_{80}$ of 14 micrometers and cleaned several times to produce a marketable lead concentrate.

The lead rougher and first cleaner flotation tailing will be combined as feed to the zinc circuit. The slurry will be conditioned with reagents and rougher zinc concentrate will be floated. The concentrate will be reground to $P_{80}$ of 22 micrometers and cleaned several times to produce a marketable-grade zinc concentrate.

The combined zinc rougher and first-cleaner flotation tailing will constitute the final tailing.

## 1.5 Infrastructure

The Pickett Mountain Project is a green field mining project amid a logged area that has access roads used by the foresters to reach timber lots. A right-of-way has been established and it requires upgrading to meet safety standards for higher volumes of traffic that will occur with the advent of construction and operation of the mine. A total of $19.5 million will be required to supply and install the infrastructure for the project. Infrastructure includes the tailings storage facility and associated collection ponds as well as water run-off catchments surrounding the property. There are water treatment plants for industrial effluent as well as domestic sewage field beds. The plant design includes storage of soils and organics such that the operator may use it to complete restoration upon closure. There are roads to connect the various facilities and pads around the site including areas for cold storage waste rock storage and potential resource storage. A mill will be built on site to process material hoisted from underground and the main access for mine workings is a portal connecting to the decline. Electrical power will be brought to site by the utility supplier in the area.

## 1.6 Capital Expenditures

The initial capital cost estimate for the Project is summarised in Table 1.3 by major area. All costs are expressed in United States Dollars unless otherwise stated and are based on 2020 pricing and deemed to have an overall accuracy of ±40%. Equipment pricing was based on a combination of budget quotations and actual equipment costs from recent similar A-Z Mining Professionals Ltd. projects and are considered to be representative of the Project.

**TABLE 1.3**
**CAPITAL COST ESTIMATE BY AREA**

| Component | Expenditures ($ millions) | | Total Expenditures ($ millions) |
|---|---|---|---|
| | Year -2 | Year -1 | |
| Mine Development | 6.75 | 14.69 | 21.44 |
| Underground Infrastructure | 3.21 | 6.95 | 10.16 |
| Surface Infrastructure | 10.00 | 10.11 | 20.11 |
| Mining Equipment | 0.99 | 0.99 | 1.98 |
| Contingency | - | - | 10.74 |

## 1.7 Operating Costs

The estimated total average operating cost for the life of mine (excluding smelting and refining) for the Pickett Mountain Project is approximately $93.08 per tonne. Table 1.4 presents a summary table of life-of-mine average operating costs for each department on a cost per tonne basis of potentially economic mineralisation.

**TABLE 1.4**
**PROJECT TOTAL OPERATING COSTS**

| Department | Cost |
|---|---|
| Underground Mining | $ 47.73 |
| Processing | $ 31.25 |
| Dry Stack Placement of Tailings | $ 1.30 |
| Surface Services | $ 2.63 |
| General and Administration | $ 7.95 |
| Environmental and Sustainable Development | $ 2.21 |
| **Total Cost** | **$ 93.08** |

## 1.8 Economic Analysis

The expected cash flow estimates are calculated using the forecast mine plan, operating costs, and capital expenditures incorporating expected long-term metal prices based on industry consensus pricing supplied by Wolfden Resources Corporation (Table 1.5).

**TABLE 1.5**
**COMMODITY PRICING**

| Commodity | Consensus Pricing |
|---|---|
| Zinc | $ 1.15 |
| Copper | $ 3.00 |
| Lead | $ 1.00 |
| Gold | $ 1,500.00 |
| Silver | $ 18.00 |

A summary of the expected parameters used for the financial analysis is presented in Table 1.6.

**TABLE 1.6**
**CASHFLOW MODEL INPUT PARAMETERS**

| Undiluted Mineral Resources ~50/50 Indicate & Inferred | 4,471,000 tonnes at grades of 9.51 % zinc, 1.23% copper, 3.77% lead, .88 g/t gold and 98.67 g/t silver | Average Mill Head Grade: | Payability | Average Long Term Pricing |
|---|---|---|---|---|
| Estimated Mining Dilution | 10% at 0 grade | | | |
| Projected Mining Recovery | 85% | | | |
| Zinc % | | 8.56 | 0.85 | $ 1.15 |
| Copper % | | 1.11 | 0.95 | $ 3.00 |
| Lead % | | 3.40 | 0.95 | $ 1.00 |
| Gold g/t | | 88.80 | 0.95 | $ 1,500 |
| Silver g/t | | 0.79 | 0.93 | $ 18.00 |
| Pre Production Capital, incl Working Capital | $ US 147.4 million | | | |
| Total Sustaining Capital | $ US 100 million | | | |
| Financial Assurance Trust: Reclamation & Closure | $ US 13.7 million | | | |
| Royalties | None | | | |
| Estimated Operating Costs ($/Tonne) | $ US 93.08 /tonne | | | |
| Life of Mine | 9.7 years | | | |

## 1.9 Sensitivity Analysis

Sensitivity analyses were performed for metal prices, capital expenditures, operating costs, mined grades, smelter charges, and recoveries with ranges up to 20% positive and negative variations. The project is most sensitive to changes in metals prices and reasonably sensitive to changes in all the other variables.

The NPV and IRR sensitivities to variations in key parameters are depicted graphically in Figure 1.2 and Figure 1.3. The IRR is most sensitive to variations in metal prices and mined grades and less sensitive to capital and operating costs.

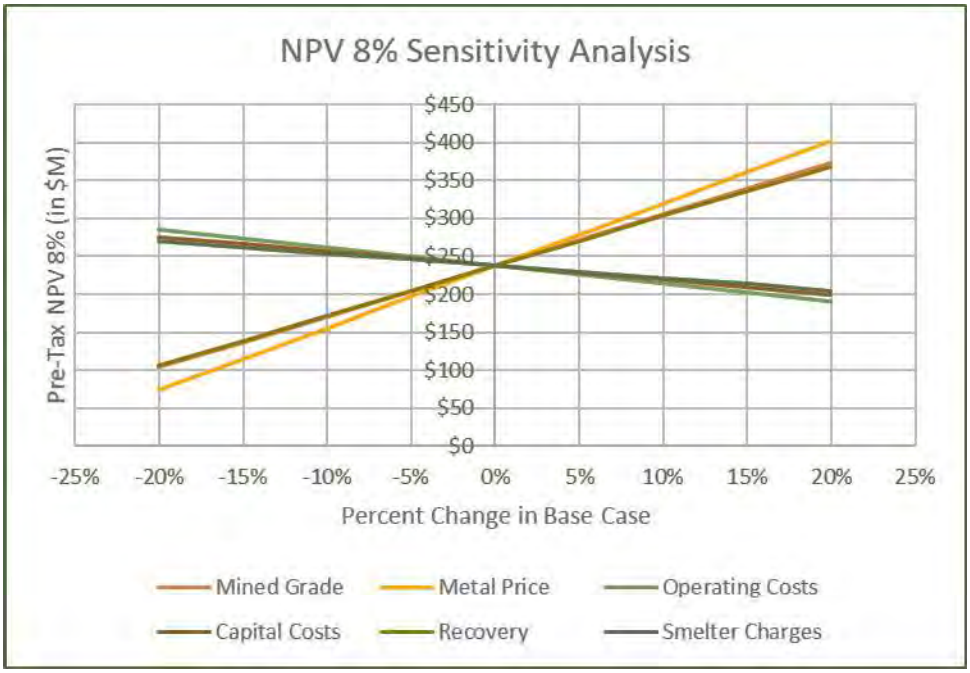



**Figure 1.2 NPV at 8% Discount Sensitivity Analysis**

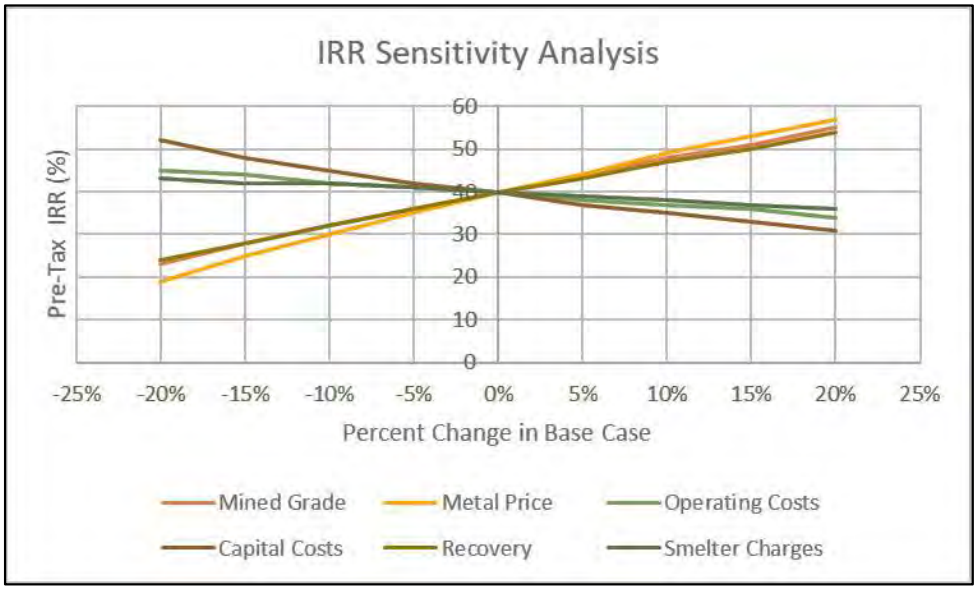



**Figure 1.3 IRR Sensitivity Analysis**

## 1.10 Conclusions

This Preliminary Economic Assessment has identified a diluted mineral resource of 4.2 million tonnes at 8.56% zinc, 1.11% copper, 3.4% lead, .79 g/t gold, and 88.8 g/t silver. This resource is comprised of 50% Indicated Resources and 50% Inferred Resources. It should be noted that the Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as Mineral Reserves. Mineral Resources that are not mineral reserves do not have demonstrated economic viability; therefore, there is no guarantee that the economic projections contained in this Preliminary Economic Assessment would be realized.

The deposit would be mined by underground mining methods with metals extracted in a processing plant custom built for the purpose. The mine site infrastructure facilities would be minimised but include a processing plant, small surface shop, warehouse, office complex, water treatment facility, dry stack tailings facility, and transformer and power distribution. Water for the project is assumed for this study to be provided from a well(s) near to the project initially then mainly recycled within the project site.

The mine would operate at 432,000 tonnes per annum and produce $1.36 billion in cash flow during the life of the mine.

Based on the study results, the conclusions of AMPL are:

1. The project provides positive returns based on the parameters and metal prices used in this study and should be developed further with the aim of bringing the deposit to production.

2. The proposed project would be considered a small to medium sized underground mining operation, which can be developed for production at a reasonable cost in a near-term horizon, provided regulatory approval and permits are acquired.

3. The mined grade of potentially economic mineralisation is an important variable for the success of the operation as are operating costs. Operating management efforts during mine production must be focused on these parameters.

4. The scoping level test work has indicated that a sequential flotation process will produce marketable-grade copper, lead, and zinc concentrates. Arsenic and antimony levels were high in copper concentrates produced in open-cycle and locked-cycle tests. Additional geo-metallurgical test work will provide additional information on the impurities in the marketable-grade copper concentrate to determine if penalties need to be paid. In addition, blending of ores from different areas in the mine will keep impurities (As/Sb) below penalty levels.

5. The following conclusions can be drawn based on the historical and current scoping level metallurgical studies:

    - The sequential flotation process is a process of choice for recovering marketable-grade concentrates of copper, lead, and zinc that include in each, quantities of previous metals.

    - Blending of material into the mill and/or final copper concentrate may be required to maintain low levels of arsenic and antimony, below the penalty limits for the concentrate.

    - Metal recoveries of 78% to 88% for copper, lead, and zinc are expected in the selected flowsheet while maintaining high quality concentrates.

    - Further testing is needed to optimise metal recoveries and reagent quantities in order to maximise revenue and reduce Capex and Opex for the milling circuit.

The project will be required to first obtain, from the Maine LUPC, approval of a rezoning petition that will allow for mining in this unorganised township. The petition was submitted and has been accepted by the LUPC as complete for its review. Based on initial soil and wetland field survey,s in addition to desktop studies as described in the petition, it was concluded that the preliminary designs of the proposed project would have no undue impact on the natural resources and could be completed in a manner that would fit

harmoniously within the surrounding area, and therefore, would satisfy the goals and specific requirements of the LUPC.

The socio-economic analysis completed for the petition indicated there is adequate local capacity to provide municipal services and a sufficient labor pool to be employed and trained as employees. Wolfden correspondence and presentations with the towns proximal to the project resulted in concurrence letters from these towns in support of the project and that it would not pose an undue burden on municipal services provided by these communities and that other purchased services (solid waste, communications, power) had adequate capacity.

Following a rezoning approval, Wolfden will need to obtain a Maine Metallic Mining permit from the MEDEP under the Maine Chapter 200 rules. The Chapter 200 rules, with respect to metallic mines, only allow for underground mining methods and require tailings disposal as dry stacked tailings, in lined facilities, to be closed with a final cover of equal hydraulic performance. It is technically and financially feasible for the project to meet these two requirements. Review of the requirements for mine design, mine operation, mine closure, water collection and treatment, and reclamation and environmental monitoring, did not identify technical or operational requirements that could not be met by a well-designed and responsibly managed project. The future Baseline Characterisation Studies needed to support an MEDEP permit application are being developed and discussed with the MEDEP.

As part of Chapter 200 rules, the MEDEP will require that a financial assurance trust fund is established, prior to the issuance of a mining permit. In accordance with Section 17 of the Chapter 200 rules, the project will need to continuously maintain a financial assurance trust, as a condition of the mining permit, until the MEDEP determines that all reclamation, closure, post-closure maintenance and monitoring, and corrective actions have been completed and for as long as the MEDEP determines that the mining operation and any associated waste material could pose an unreasonable threat to public health and safety or the environment. The financial assurance trust must include sufficient funds for the following:

a) the cost to investigate all possible releases of contaminants at the site, monitor all aspects of the mining operation, close the mining operation in accordance with the closure plan, conduct treatment activities as necessary for all fluids and wastes generated by the mining operation and those post closure for a minimum of 100 years, implement remedial activities for all possible releases, and maintenance of structures and waste units as if these units have released contaminants to the groundwater and surface water, conduct corrective actions for potential environmental impacts to groundwater and surface water resources, as identified in the environmental impact assessment, and conduct all other necessary activities at the mine site in accordance with the environmental protection, reclamation and closure plan; and

b) the cost to respond to a worst-case catastrophic mining event or failure, including, but not limited to, the cost of restoring, repairing, and remediating any damage to public facilities or services, to private property, or to the environment resulting from the event or failure.

A filter cake TMF sized to contain the projected life of mine filtered tailings within the siting constraints identified can be constructed. Contact water from the TMF can be collected in an adequately sized pond constructed at the base of the TMF on the south side of the facility. The TMF would have a maximum elevation of 380 m, which is approximately the elevation of the treetops as measured from the ground surface at the topographic divide at the south side of the facility. There is potential for expansion of the TMF using the land to the south and there is flexibility for phased construction and progressive reclamation of the TMF.

## 1.11 Recommendations

It is recommended that infill drilling should continue with the aim of upgrading the Inferred Resources to Indicated Resources.

1. Metallurgical test work should be undertaken to optimise the process parameters for the proposed process flowsheet including confirmation that the process flowsheet is capable of processing variable ores from the mine and determine whether the variable ores respond to mechanical sorting technologies.

2. Perform sufficient test work to size equipment for the planned throughput. Some test work may be required at the Vendor's facility (*i.e.*, regrind mill sizing, thickener size, etc.).

Perform a detailed rock mechanics analysis for stope geometry and mine design including oriented core geotechnical drilling.

Continue to advance the project toward production by undertaking an advanced exploration program in parallel with finalising the project design and capital requirements. The goal of the Advanced Exploration Program will be to confirm resources with the objective of converting Mineral Resources to Mineral Reserves.

Complete a geochemical characterisation of simulated processed tailings for possible metal leaching and acid rock drainage (MI/ARD) potential.

It is recommended that Wolfden proceeds with the rezoning and mine permitting process, using contacts it has established with LUPC and MEDEP and engage with them in a proactive and collaborative fashion. Aligning with the State of Maine on how to meet legislative requirements for financial assurance trust fund should be prioritised. Future feasibility studies and designs should seek to avoid and minimise impacts to environmental, natural, cultural, scenic, and recreational resources to the extent possible. While the current mine development plan for treated water is subsurface infiltration, going forward Wolfden should consider other alternatives to provide greater flexibility and redundancy for the management of re-infiltration of treated water if soil site conditions warrant. These alternatives should, at a minimum, consider spray irrigation, which is an established method for treated waters in the State of Maine and which could be designed to operate year-round.

Further studies are recommended to advance the tailings facility design including geotechnical and hydrogeological investigations including laboratory testing to confirm site conditions, identify any potential geologic hazards, characterise foundations and groundwater conditions, and identify suitable borrow sources for construction fill. Tailings characterisation testing is recommended to better define the geochemical, physical, settling, and filtration properties to validate the TMF design criteria. Site specific precipitation and evaporation data should be collected and a site-specific water balance model performed to confirm collection pond sizing and discharge water volumes. A grading plan should be developed that optimises the cut/fill balance for the TMF base grade. Consider amending the closure cover if it can be demonstrated that the compacted tailings have an equivalent permeability and do not pose a chemical stability risk.

All recommendations should be performed as part of a follow up Pre-Feasibility Study or Feasibility Study. The cost to complete a Pre-Feasibility or Feasibility Study for the Pickett Mountain Project is estimated to be between US$3 million to US$5 million plus the cost of any additional infill drilling to upgrade the mineral resources.

# 2.0 Introduction

## 2.1 Terms of Reference

This technical report was prepared by A-Z Mining Professionals Limited (AMPL) for the purpose of providing a National Instrument (NI) 43-101 Technical Report describing the geology and previous exploration history for the base metal deposit known as the Pickett Mountain Project (formerly known as Mount Chase) in Penobscot County, Maine, USA. This report also provides a Mineral Resource estimate for the Pickett Mountain base-metal deposit.

The Pickett Mountain Project property was acquired in 2017 by Wolfden Mt. Chase LLC, a wholly-owned subsidiary of Wolfden Resources Corporation (Wolfden), in an arm's length, third party transaction of US$8.5 million.

AMPL was retained by Mr. Jeremy Ouellette, Vice President Corporate Development, to prepare this Preliminary Economic Assessment for Wolfden.

As of the date of this Report, Wolfden is a Canadian junior exploration and development company listed on the Canadian TSX Venture stock exchange (WLF.TSXV) and with a corporate office at:

1100 Russell Street, Unit 5
Thunder Bay, Ontario P7B 5N2
Canada
Tel: 807-624-1136

This Report is considered effective as of September 14, 2020 with a filing date of October ??, 2020.

AMPL's qualified persons are responsible for the areas in this report identified in their "Certificates of Qualified Persons" submitted with this report to the Canadian Securities Administrators. AMPL has relied on and believes there to be a reasonable basis to rely on the following experts who have contributed the information stated in this report, as noted below:

- Finley Bakker, P. Geo, Contract Resource Geologist to AMPL
- Jerry Grant, P. Geo, Contract Geologist, QA/QC, and Geology
- Brian LeBlanc, P. Eng, President and Senior Engineer, AMPL
- Eric Hinton, P. Eng, Principal and Senior Engineer, AMPL
- Darryl Boyd, HBSc, Principal and Manager of Regulatory Compliance, AMPL
- Frank Palkovits, P.Eng, Mining Engineer, President of Mine Paste Ltd.
- Eric Sellars, P.Eng, Consultant Geotechnical Engineer, SLR
- Deepak Malhotra, President, Pro Solv Consulting, LLC
- Peter Baker, Senior Program Manager, Wood Environment and Infrastructure, Inc.
- Peter Thompson, Senior Project Manager/Senior Hydrologist, Cedere Associates, LLC

## 2.2 Sources of Information

This Report is based, in part, on internal company technical reports and maps, published government reports, company letters and memoranda, public information, documented results concerning the project, and discussions held with technical personnel from the company regarding all pertinent aspects of the project as listed in the "References" (Section 27.0) of this report.

AMPL has not conducted detailed land status evaluations, but has obtained tenure information from previous technical reports, public documents, and statements by Wolfden regarding property status and legal title to the project, which is owned by Wolfden Mt Chase LLC.

## 2.3 Site Visit

Mr. Alan Aubut, P. Geo., previously of A-Z Mining Professionals Ltd. (AMPL), a qualified person under the terms of NI 43-101, conducted a site visit to the Pickett Mountain Property on September 27, 2017. A site visit to a core storage facility, housing the Pickett Mountain core and maintained by Huber Engineered Woods at their Easton, Maine production facility, was conducted on September 26, 2017. Mr. Jerry Grant, P.Geo, a qualified person under the terms of NI 43-101 and acting as a consulting geologist for Wolfden, worked on site on the 2018, 2019, and 2020 drill programs, verified current and previous data, and oversaw the QA/QC results and program. An updated site visit was not achieved during this study due to health and safety concerns and travel restrictions related to the Covid-19 pandemic ongoing throughout the duration of this study.

## 2.4 Units and Currency

Unless otherwise stated:

- All units of measurement in the report are in the metric system
- All currency amounts in this report are stated in US dollars (“US$”)
- Gold (Au) and Silver (Ag) assay values are reported in ounces per tonne (opt)
- Copper (Cu), Lead (Pb), and Zinc (Zn) assay values are reported in percent (%)
- Maps are either in UTM coordinates or in the latitude/longitude system

## 2.5 Glossary and Abbreviations of Terms

| Abbreviation | Meaning |
|---|---|
| °C | degrees Celsius |
| C$ and CA$ | currency of Canada |
| Ag | silver |
| Altius | Altius Minerals Corporation |
| AMPL | A-Z Mining Professionals Ltd. |
| Au | gold |
| Chevron | Chevron Resources Company, a subsidiary of Chevron Oil |
| cm | centimetre |
| Cu | copper |
| DDH or ddh | diamond drill hole |
| E | east |
| EM | electromagnetic |
| g | gram |
| g/t | grams per tonne |
| Getty | Getty Mineral Company, a subsidiary of Getty Oil |
| ha | hectare |
| HLEM | Horizontal Loop electromagnetics (geophysical survey method) |
| IP | induced polarization |
| km | kilometre |
| kW | kilowatts |
| MDEP | Maine Department of Environmental Protection |
| m | metre |
| mm | millimetre |
| Mt | millions of tonnes |
| N | north |
| NSR | net smelter return |
| opt | ounces per ton |
| P.Geo | Professional geoscientist |
| PEA | Preliminary Economic Assessment |
| Pb | lead |
| ppm | parts per million |
| QP | Qualified Person |
| t | tonne (metric) |
| $t/m^3$ | tonne per cubic metre |
| TDEM | time domain electromagnetic |
| US$ | currency of the United States of America |
| USA | United States of America |
| USGS | United State Geological Survey |
| UTM | Universal Transverse Mercator |
| VTEM™ | Versatile time domain electromagnetic |
| WCC | Woodward-Clyde Consultants |
| Wolfden | Wolfden Resources Corporation |
| Zn | zinc |
| ZnEq | zinc equivalent |

# 3.0 Reliance on Other Experts

The updated Mineral Resource estimate, used for the purposes of this report, using a 7% cut-off grade, has been prepared by Independent Qualified Persons (QP), Mr. Finley Bakker (P. Geo.) and has an effective date of September 14, 2020. The updated estimate is based on the same methodology as the January 7, 2019 estimate, without the insertion or deletion of any data, that was prepared by Independent Qualified Persons (QP), Mr. Finley Bakker (P. Geo.), Mr. Jerry Grant (P. Geo.), and Mr. Brian LeBlanc (P. Eng.), of A-Z Mining Professionals Ltd.

Qualified Person, Mr. Ron DeGagne of Environmental Applications Group, has relied on information supplied by Mr. Peter Baker, Senior Program Manager, Wood Environment and Infrastructure Inc. of Portland, Maine and Mr. Peter Thompson, Senior Hydrogeologist of Credere Associates LLC of Westbrook, Maine for information relating to the environmental studies, permitting, water management, and closure.

Qualified Person, Dr. Deepak Malhotra, Ph.D., President, Pro Solv Consulting, LLC and consultant to Resource Development Inc., is responsible for all matters pertaining to metallurgy, specifically Sections 1.4, 13.0, 17.0, and 21.1.5.

Qualified Persons, Mr. Frank Palkovits, P.Eng, Mining Engineer, President of Mine Paste Ltd. and Mr. Eric Sellars, P.Eng, Consultant Geotechnical Engineer, SLR, are responsible for all matters pertaining to the design, construction, and operation of the Tailings Management Facility.

## 4.0 Property Description and Location

The Pickett Mountain Property is in northeastern Maine, in the southeast quarter of Township 6, Range 6, Penobscot County. The Property consists of 2,781 hectares (6870 acres) of private land. It is about 16 km (10 miles) north of the village of Patten and about 153 km (95 miles) north of Bangor (Figure 4.1). It is approximately 53 km ( 33 miles) from the Canadian border and is approximately 67 km (42 miles) due west of the town of Woodstock, New Brunswick.

**Figure 4.1 Pickett Mountain Project Location Map**

## 4.1 Land Tenure

Wolfden acquired, through its indirect wholly-owned subsidiary Wolfden Mt. Chase LLC, all of the mineral, timber, oil, and surface rights, exclusive of the surface area of great ponds (lakes that include the waters of Pickett Mountain Pond, Pleasant Lake and Mud Lake) covering approximately 2,781 hectares (Figure 4.2). More specifically, the Property consists of the southeast quarter of Township 6, Range 6, in

Penobscot County, Maine. The only known encumbrances are two small surface rights parcels on the north shore of Pleasant Lake and a small surface rights lease on the south side of Pleasant Lake for recreation purposes.

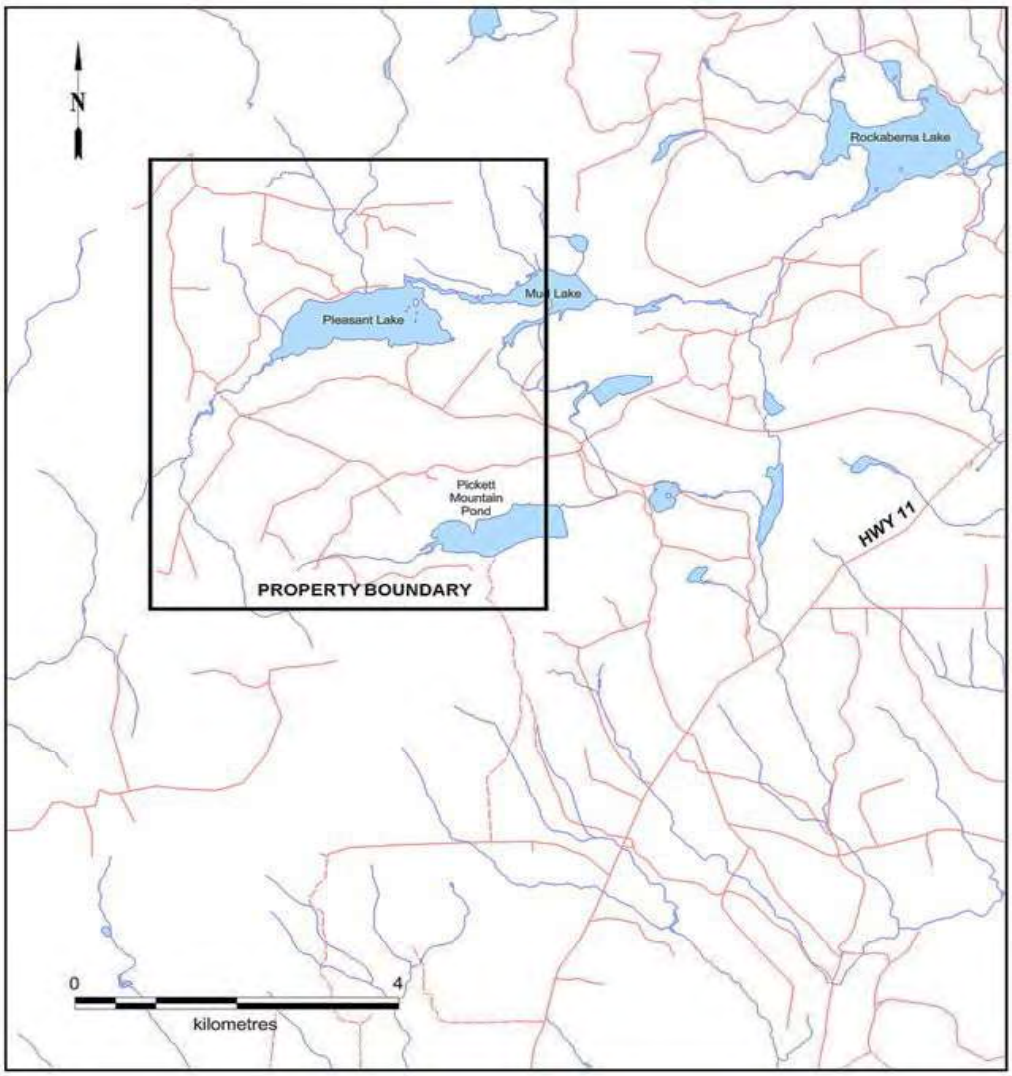



**Figure 4.2 Pickett Mountain Property Map**

Wolfden advises that it does not require any permits to complete the contemplated exploration work on the Property. The authors are not aware of any other significant factors and risks that may affect access, title, or the right or ability to perform work on the Property as currently contemplated. There are no known environmental liabilities to which the Property is subject to.

## 4.2 Purchase Agreement

On November 15, 2017, Wolfden Mt. Chase LLC acquired a 100% interest in the Pickett Mountain Project for a cash purchase price of US$8.5 million (the "Acquisition") from a third-party vendor. To fund the acquisition, the Company granted a 1.35% gross sales royalty on the Pickett Mountain Project to a subsidiary of Altius Minerals Corporation for cash consideration of US$6 million and completed a non-brokered private placement of 20,200,000 subscriptions at a price of C$0.25 per subscription receipt for gross proceeds of C$5,050,000.

# 5.0 Accessibility, Climate, Local Resources, Infrastructure and Physiography

## 5.1 Accessibility

Access to the Property from State Highway 11 is by an 8.4 km long, well used logging road. From State Highway 11, there are paved primary and secondary highways with access to Interstate Highway 95 at Island Falls, a total distance from the Property of about 36 km. The presence of existing infrastructure permits exploration to be carried out year-round.

## 5.2 Climate

The climate of Northern Maine is a typical humid continental climate. The average annual temperature in Patten is 4.2°C. In a year, the average rainfall is 1,002 mm. Between the driest and wettest months, the difference in precipitation is 42 mm. During the year, the average temperatures vary by 30.1°C. Summer temperatures typically vary between 6°C and 25°C while winter temperatures usually range between 2°C and -17°C with an average January temperature of -11°C (Figure 5.1). The region usually receives approximately 63 to 105 mm of precipitation per month with November being normally the wettest month (www.Climate-Data.org).

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg. Temperature (°C) | -11.5 | -10 | -4 | 3.2 | 10.1 | 15.8 | 18.8 | 17.3 | 12.4 | 6.4 | 0.1 | -8 |
| Min. Temperature (°C) | -17.8 | -16.9 | -10.3 | -2.6 | 3.1 | 8.9 | 11.9 | 10.6 | 5.8 | 0.6 | -4.4 | -13.4 |
| Max. Temperature (°C) | -5.1 | -3.1 | 2.4 | 9.1 | 17.2 | 22.8 | 25.4 | 24.1 | 19 | 12.3 | 4.6 | -2.6 |
| Avg. Temperature (°F) | 11.3 | 14.0 | 24.8 | 37.8 | 50.2 | 60.4 | 65.5 | 63.1 | 54.3 | 43.5 | 32.2 | 17.6 |
| Min. Temperature (°F) | -0.0 | 1.6 | 13.5 | 27.3 | 37.6 | 48.0 | 53.4 | 51.1 | 42.4 | 33.1 | 24.1 | 7.9 |
| Max. Temperature (°F) | 22.8 | 26.4 | 36.3 | 48.4 | 63.0 | 73.0 | 77.7 | 75.4 | 66.2 | 54.1 | 40.3 | 27.3 |
| Precipitation / Rainfall (mm) | 69 | 63 | 67 | 74 | 83 | 85 | 98 | 98 | 85 | 87 | 105 | 88 |

**Figure 5.1 Patten, ME Historical Weather Data**
(**From** https://en.climate-data.org/location/140940/)

## 5.3 Local Resources

The nearest community to the Property is Patten, Maine, located 16 km south-southeast along Highway11. It has a population of approximately 1,000 and is the site where Wolfden established its operational base for the project. By taking Secondary Highway 159 east, approximately 14.5 km, one can connect to Interstate Highway 95 at Island Falls. There, it is possible to connect to a railway operated by the Maine Northern Railway.

## 5.4 Infrastructure

The area is well supported by local infrastructure, including well maintained roads, highways, and access to rail in the town of Sherman Station (27 km from the Property), as well the state's electric grid that runs along Highway 11.

## 5.5 Physiography

The Property lies within rolling hills just to the northeast of a range of hills with the highest elevation being at nearby Mount Chase at 744m above sea level. The average surface elevation is about 366m. The area is well wooded with a mixture of hardwood and softwood. Hardwood species present include maple, beech, and birch with lesser ash. Softwood includes spruce and some pine and cedar.

# 6.0 History of the Property

Exploration in Maine for massive sulphides commenced soon after 1953 when the Brunswick #6 deposit was discovered in neighbouring New Brunswick. This early work concentrated on the volcanic rocks known to exist along the Maine coast and resulted in two deposits being found and developed: Cape Rosier and Blue Hill. Intermittent exploration continued in northern and western Maine through to the 1970s. In 1967, a consortium of exploration companies operated under the name "The Northeast Joint Venture." This group eventually discovered the base metal deposit at Bald Mountain in 1977 (Scully, 1988).

The first documented mineral exploration work in the immediate area was done by Humble Oil and Refining Company in 1968. Their subsidiary, North American Exploration Co., completed regional geochemical surveys that resulted in a 915m by 1,830m grid being established around Pickett Mountain and distinct anomalies were detected (Luethe, 1989).

**1978 – 1984:** In 1978, Getty Mineral Company (Getty) explored the area and again using a regional geochemical sampling program located an anomalous area close to Pickett Mountain (see Figure 6.1 to Figure 6.3, below). The program involved collecting stream, seep, and soil samples averaging about 30 samples per square mile. This program was followed by a more detailed soil sampling program that further defined the geochemical anomaly. During the summer of 1979, a Max-Min horizontal loop electromagnetic (HLEM) and magnetic surveys were conducted (see Figure 6.4, below). A bedrock conductive source was identified and drilled in the fall. This drilling intersected massive sulphides within volcanics. The initial drill program consisted of 12 holes totaling 1,473m (Luethe, 1989).

During 1980, Getty undertook additional geophysics. In 1981, 10 diamond drill holes were completed totaling 1,602m to test some outlying targets. The drilling failed to locate any massive sulphides. In 1982, an EM-37 survey was undertaken (see Figure 6.4, below) to test for deeper mineralisation. An airborne "Input" survey was flown over the Property in 1983.

Hole 23 was drilled in 1982 and intersected significant sulphide mineralisation. A total of 28,020m in 96 holes were drilled between 1982 and 1984. During this same period, preliminary metallurgical testing, baseline environmental studies, and a pre-feasibility study were completed.

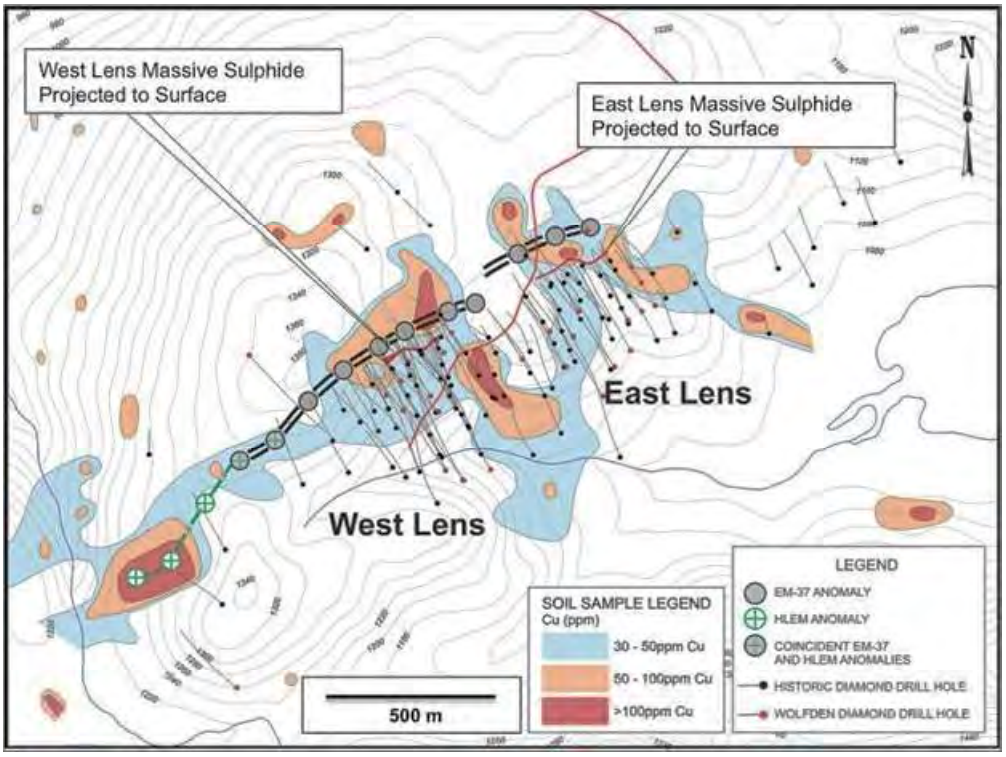



**Figure 6.1 Historic Soil Sampling Over the Pickett Mountain Property – Cu**

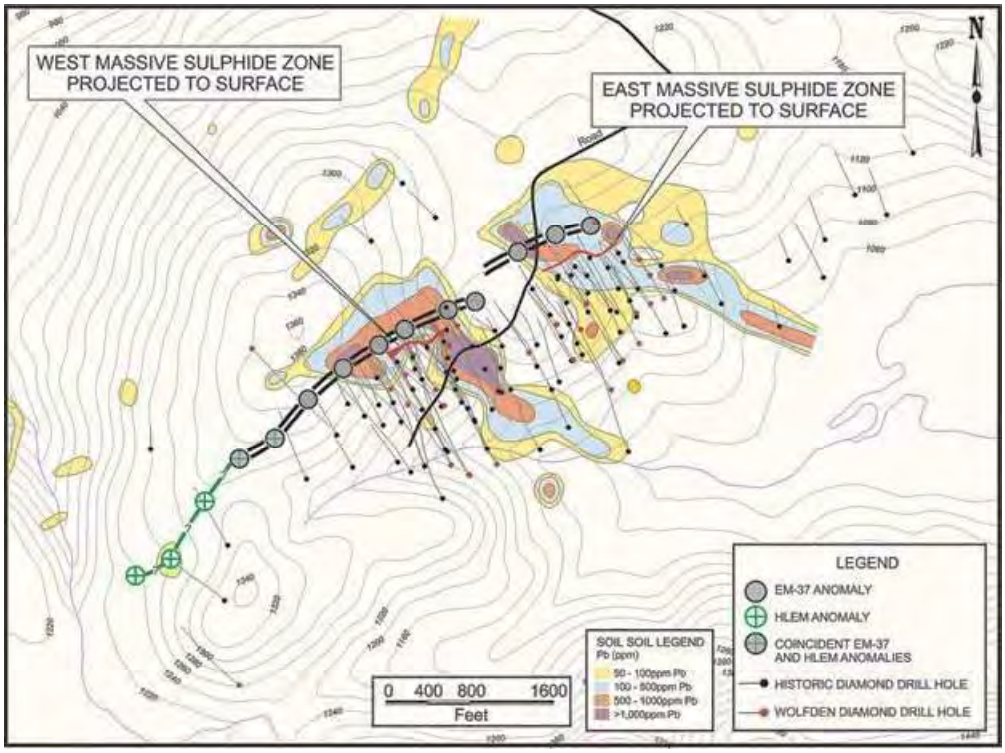



**Figure 6.2 Historic Soil Sampling Over the Pickett Mountain Property – Pb**

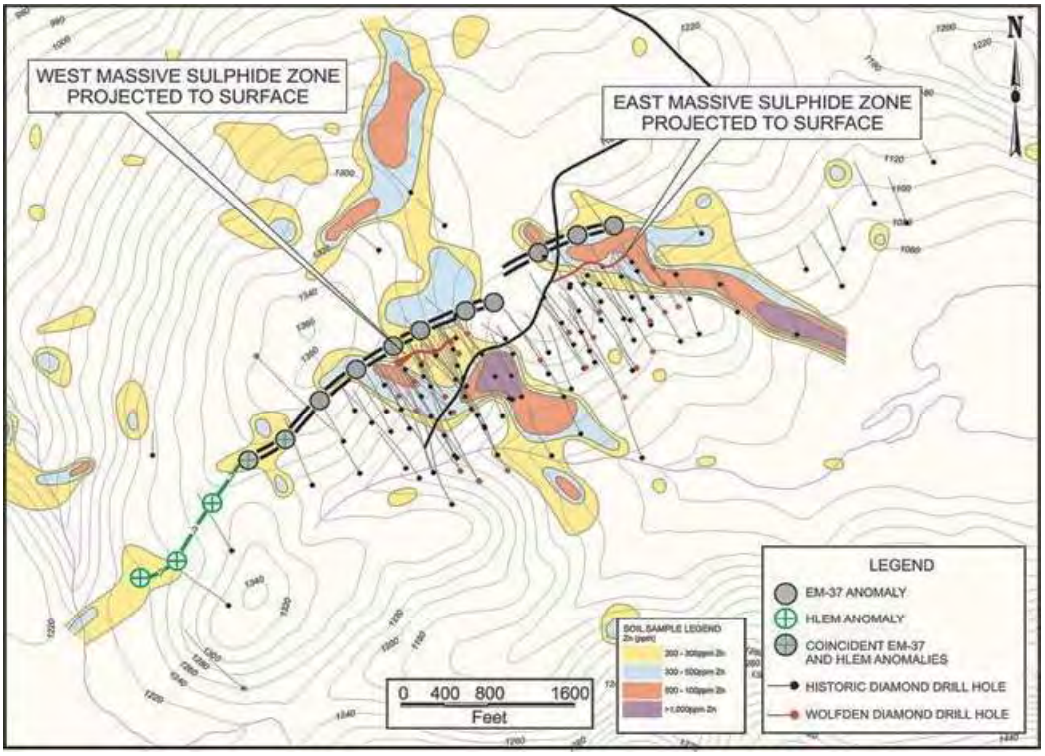



**Figure 6.3 Historic Soil Sampling Over the Pickett Mountain Property – Zn**

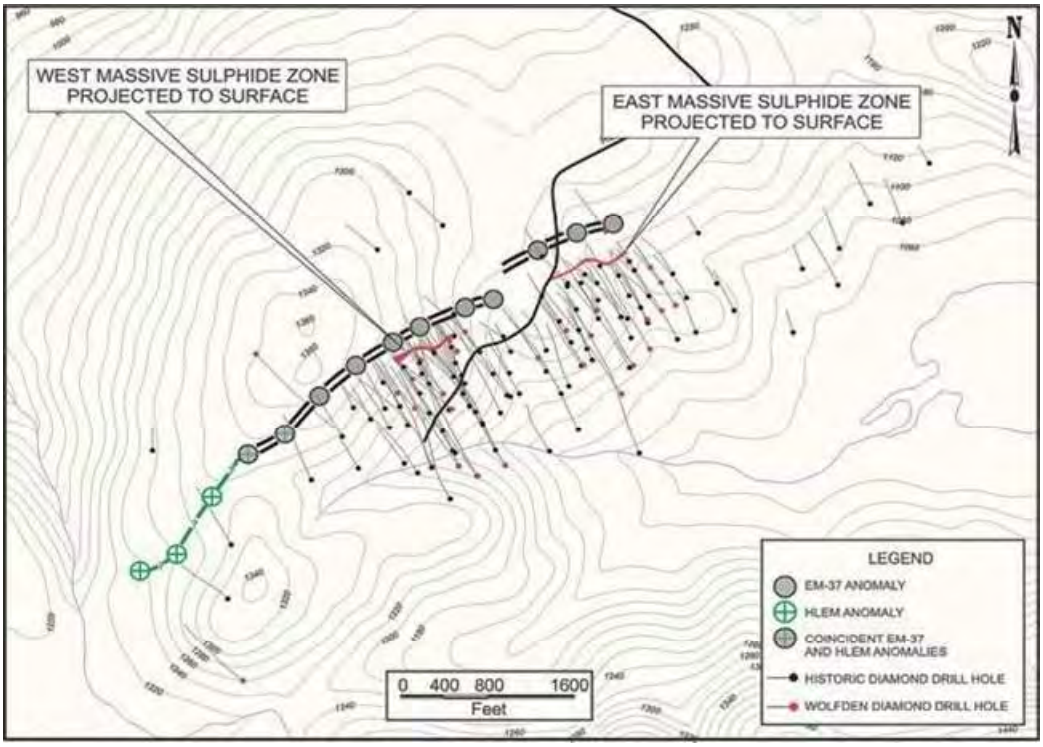



**Figure 6.4 Compilation of Historical Geophysical Surveys**

An historical resource estimate was undertaken using the "Contour Method" for Getty in 1983. The methodology used involved creating thickness and grade-thickness grids that used an eight-foot thickness and 4% total sulphide cut-off, with any area not meeting either threshold not being included in the calculation. As it was still early in the exploration of the deposit, no geologic interpretation was used to limit the deposit size. Using an average tonnage factor of 8.25 cubic feet (a density of 4.1 t/m$^3$) per ton,

to a depth of approximately 1,300 feet (400m), the estimated resource was 3.15 million tons with an average grade of 9.66% Zn, 4.30% Pb, 1.24% Cu, 2.96 opt Ag, and 0.029 opt Au (Laverty, 1983; Riddell, 1983). This historical resource does not use the classification terms "Inferred Mineral Resource," "Indicated Mineral Resource," and "Measured Mineral Resource" that have the meanings ascribed to them by the Canadian Institute of Mining, Metallurgy and Petroleum, as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council, as amended. The authors have not done sufficient work to classify this historical estimate as a current Mineral Resource and Wolfden is not treating this historical estimate as a current Mineral Resource and they are included in this section for illustrative purposes only and should not be disclosed out of context.

With the purchase of Getty Oil by Texaco in late 1984, the project was terminated and the leases put up for sale.

**1985 – 1989:** Chevron Resources Company purchased the Getty lease in October 1985 and then immediately renewed exploration on the Property primarily looking for additional massive sulphides along strike. Additional geophysical surveys, including a proprietary deep penetrating EM survey were completed. An additional 16 drill holes totalling 6,038m were drilled. Sulphides were intersected although no significant massive sulphides were located (Luethe, 1989).

In the second half of 1988, work was carried out in the vicinity of Getty hole 66-84-90. A detailed re-evaluation and a revised geologic interpretation was completed. Additional metallurgical work was also completed (Luethe, 1989).

Chevron completed another historical resource estimate using the updated geological interpretation. This estimate involved using the polygonal method to a depth of approximately 1,300 feet (400m). Grades were converted to zinc equivalent (% ZnEq = % Zn + (% Pb × 0.53) + (% Cu × 1.64) + (opt Ag × 0.45). Using a minimum horizontal thickness of 5 feet and an arbitrary cut-off grade of 11% ZnEq the resource was estimated to be 2.5 million tons averaging 11.42% Zn, 4.94% Pb, 1.62% Cu, and 3.3 opt Ag. Even though it has some of the highest grades intersected by drilling, the #1 lens was excluded as only 4 holes had tested the lens (Luethe, 1989). This historical resource does not use the classification terms "Inferred Mineral Resource," "Indicated Mineral Resource," and "Measured Mineral Resource" that have the meanings ascribed to them by the Canadian Institute of Mining, Metallurgy and Petroleum, as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council, as amended. The authors have not done sufficient work to classify this historical estimate as a current Mineral Resource and Wolfden is not treating this historical estimate as a current Mineral Resource and they are included in this section for illustrative purposes only and should not be disclosed out of context.

To the best of the knowledge of the authors of this report, the last historical work completed on the project and any related accessible data from that work was in 1989.

# 7.0 Geological Setting and Mineralisation

## 7.1 Regional Geology

The Pickett Mountain project is in the northern Appalachian orogenic belt. The Appalachians are a Paleozoic orogen that formed along the northern margin of Gondwana in the Neoproterozoic and early Paleozoic. It has been subdivided into 5 domains based on stratigraphic and structural contrasts: Humber, Notre Dame, Ganderia, Avalonia, and Meguma, as shown in Figure 7.1 (Hibbard, et al., 2007; Fyffe, et al., 2009). The Pickett Mountain project is located within the Ganderia Zone.

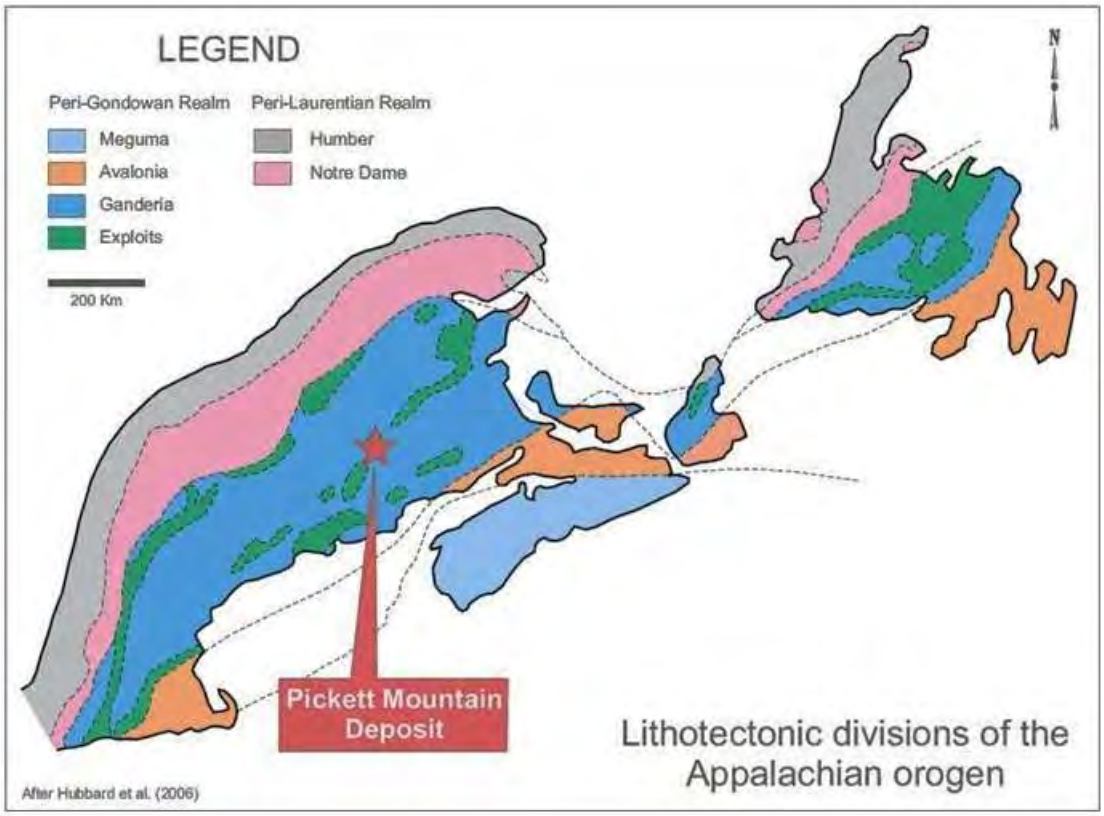



**Figure 7.1 Lithotectonic Divisions of the Northern Appalachian Orogen**
(**Source:** Adapted from Hibbard, et al., 2006)

The Ganderia Zone consists of Late Neoproterozoic to Early Ordovician rocks that are predominantly continent-derived, quartz-rich sediments and with Neoproterozoic volcanic and plutonic rocks (Fyffe, et al., 2009). These have undergone multiple stages of deformation, metamorphism, and plutonism and record the development and destruction of a continental margin (Williams, 1978).

The Property covers a portion of the southeast limb of the southwest plunging Weeksboro-Lunksoos Lake Anticlinorium that is cored by the Grand Pitch Formation, made up of complexly folded shale and siltstone with interbedded quartzite and greywacke and believed to be of Early Cambrian age (Figure 7.2). The stratigraphic sequence within the Anticlinorium and above the unconformity is illustrated in Figure 7.3.

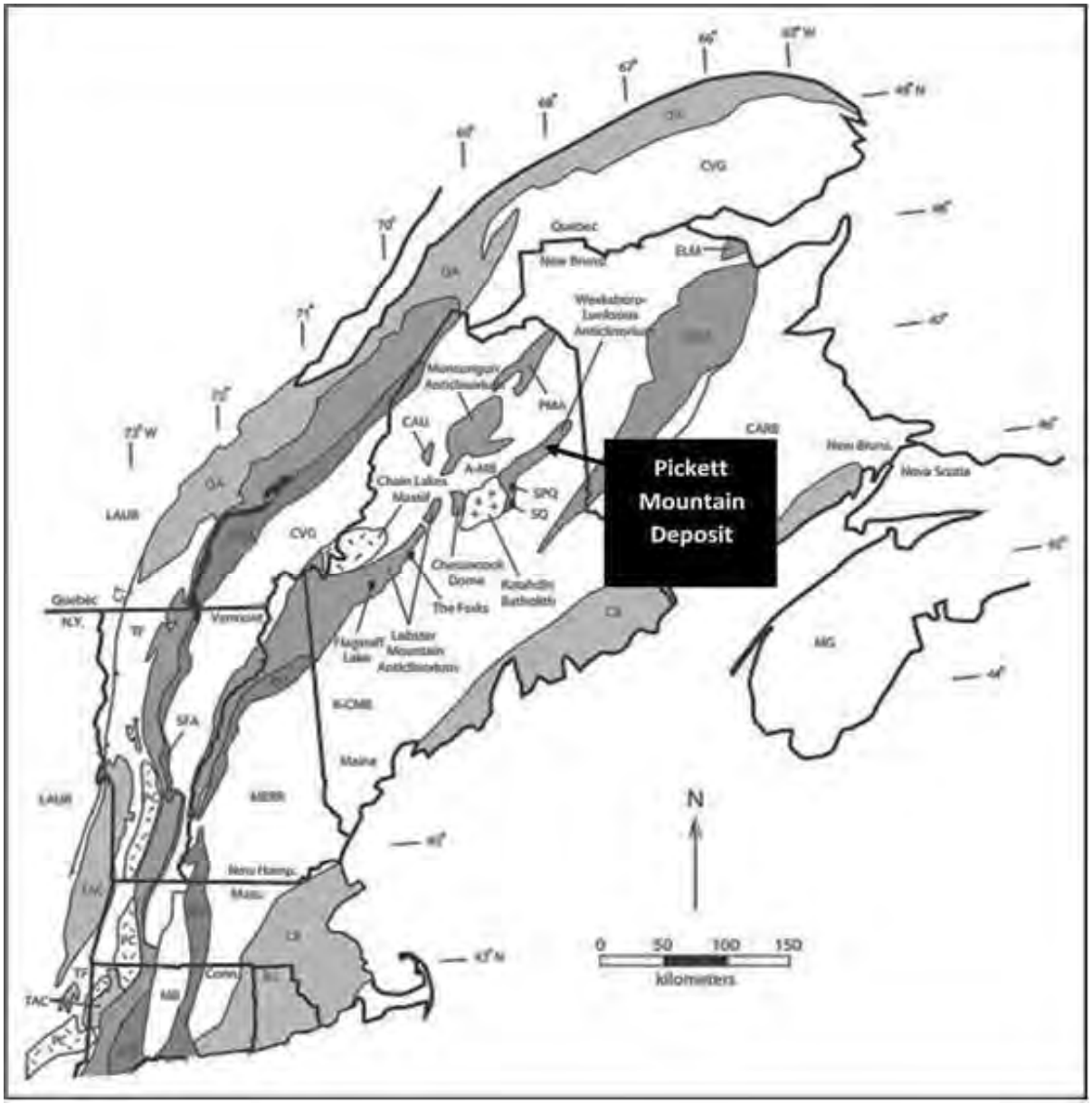



**Figure 7.2 Generalised Geology of the Northern Appalachians**
**(Source:** Schoonmaker, et al., 2017)

Pre-Devonian units are shaded. LAUR = autochthonous Laurentian margin, QA = Quebec Allochthons, TAG = Taconic Allochthons, TF = transported Laurentian margin and basin deposits, PC = Precambrian massifs, SFA-AWA = Shelburne Falls arc, Ascot-Weedon arc, and related oceanic rocks, including ophiolitic fragments (black), MB = Mesozoic basin, CVG = Connecticut Valley Gaspe Synclinorium, BH = Bronson Hill Arc, MERR = Merrimack Synclinorium, CAU = Caucomgomoc inlier, A-MB = Aroostook-Matapedia belt, SPQ = Shin Pond quadrangle, SQ = Stacyville quadrangle, PMA = Pennington Mtn. Anticlinorium, MIRA = Miramichi Highlands, K-CMB = Kearsarge–Central Maine belt, ELM = Elmtree-Belledune inlier, CARB = Carboniferous cover rocks, CB = Coastal belt, MEG = Meguma terrane

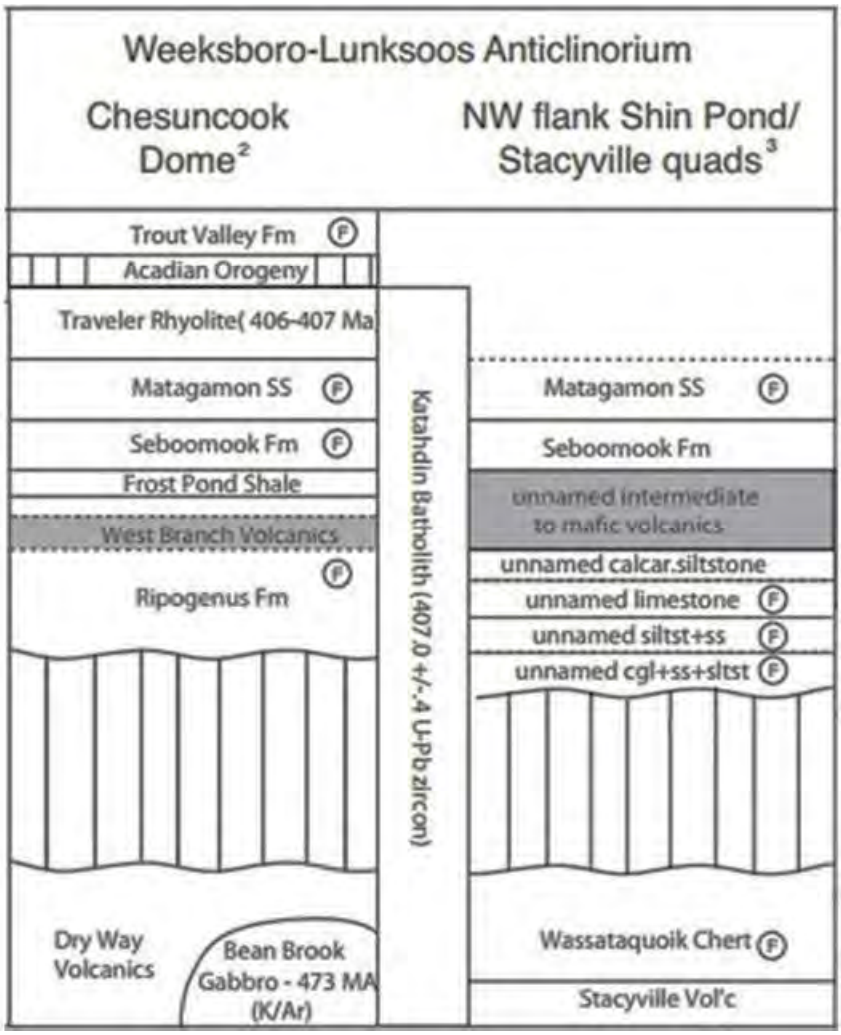



**Figure 7.3 Stratigraphic Section for the Weeksboro-Lunksoos Lake Anticlinorium, North-Central Maine, Showing Ordovician Through Devonian Rocks**
All units shown lie unconformably above the Cambrian Grand Pitch Formation (**Source:** Adapted from Schoonmaker, et al., 2011).

## 7.2 Local Geology and Structure

The local stratigraphy documented in this section is thought to be equivalent to the lower-most Ordovician-age volcanic rocks (Dry Way Volcanics and Stacyville Volcanics) illustrated on Figure 7.3. The geology of the Pickett Mountain deposit locale, as mapped in 2018, is illustrated in Figure 7.4 and a cross section of the deposit and associated lithotypes are depicted on Figure 7.5.

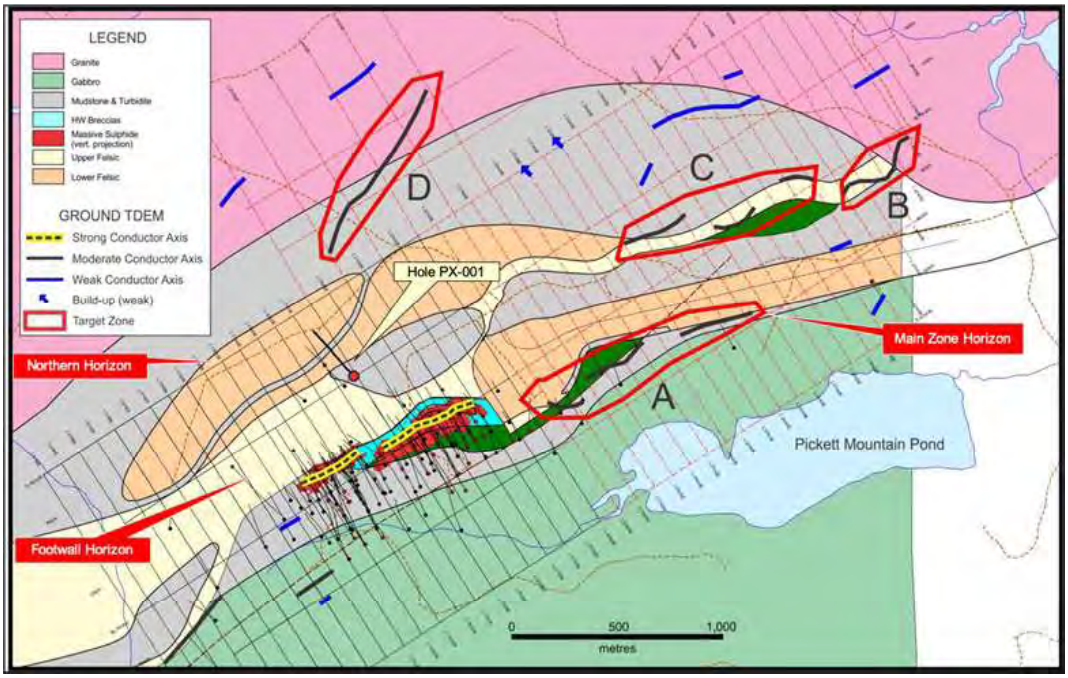



**Figure 7.4 Geology Plan Map of the Pickett Mountain Deposit**

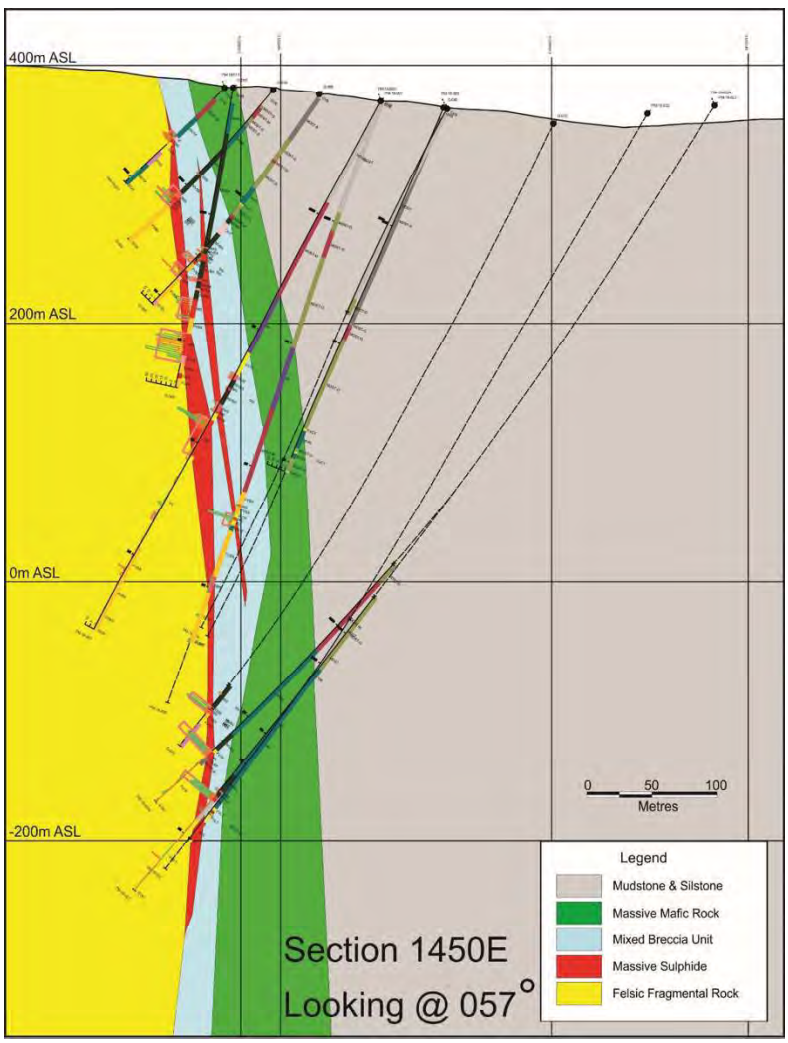



**Figure 7.5 Cross Section of the Pickett Mountain Deposit**

In 2018, geological mapping was completed in the deposit area as well as in the northwest portion of the Property. Outcrop exposure is quite poor; mapping was augmented with the logged drill-hole geology in the deposit area. Three main rock units were observed in the outcrop: footwall felsic volcanic rock, hanging wall mudstone-siltstone, and hanging wall massive mafic rock.

In the deposit area, the contact between the footwall and hanging wall rocks is occupied by an assemblage of mafic and felsic flows and breccia, mudstone, and massive sulphide. Generally, contacts and bedding strike northeast and dip steeply to the southeast. Repetitions of the contact between the footwall and hanging wall rocks suggest folding. The W1 and W2 Lenses are planar and steeply dipping. The E1 Lens is similarly oriented at its west edge, but the strike rotates clockwise and the dip shallows eastward, as it becomes affected by an interpreted synclinal fold nose with an axis that plunges towards the southwest.

### 7.2.1 Stratigraphy

#### 7.2.1.1 Footwall Felsic Rocks

The lowermost rock units appear to be comprised of three pulses of felsic volcanism and a clear time break represented by a heterolithic debris flow. These rocks are intruded by a unit of massive, quartz-feldspar porphyritic rock described herein as QFP and locally by a massive, medium to coarse grained feldspar quartz porphyritic felsic unit. An alternative theory is that the QFP cores a fold and that the initial and latter felsic sequences are stratigraphically equivalent.

The initial felsic volcanic unit is generally massive in character, often flow banded, sporadically hematitic, and often magnetic. It contains scattered, millimetre-sized quartz phenocrysts and forms a prominent magnetic high to the north (FW) of the West, and, in part, to the East Lens. Magnetic inversion modeling indicates that this unit does not extend much deeper than 150m vertically, but drilling is still required to validate this. Along strike to the east, this unit disappears and an argillaceous sequence appears; the nature of this 'facies' change is unknown at this time. Up stratigraphy, this massive unit gives way to a heterolithic debris flow, that is locally calcareous, locally base-metal bearing, and weakly to intensely altered. It is believed that the FW massive sulphide zone is associated with the upper contact of this unit. Locally, a quartz crystal tuff lies above the debris flow, this unit contains millimetre-sized quartz phenocrysts that locally agglomerate to form grape-like clusters. The next sequence is commonly felsic volcanic breccia, consisting of rounded, oblate fragments in a matrix of similar composition and texture, but a slightly different colour. Quartz and more commonly, feldspar phenocrysts, are generally round and less than 1 mm. Sections of the breccia contain abundant blocky patches of dark, fine-grained felsic rock with scattered 0.5 mm plagioclase phenocrysts thought to be fiamme, although wall rock rip-ups have also been reported. The fragmental rock also includes sections of tuff and lapilli tuff, which are compositionally similar to the volcanic breccia. Thin aplite dykes are reported in the drill logs. The foliation is usually penetrative and the aspect ratio of the fragments is 2:1:1. Sericitisation is always present and commonly minor, but increases to strong in the deposit area.

Several different types of generally massive textured 'QFP' have been recognised in core and outcrop. The QFP varies from quite coarse grained with centimetre-sized quartz phenocrysts with little to no obvious feldspar crystals, and, sometimes hornblende crystals to locally QFP with abundant 1-2 mm rounded quartz and feldspar phenocrysts in a fine-grained, hard, felsic matric. The quartz eyes tend to clump together in 0.5-1.0 cm masses somewhat resembling raspberries. In one area, below the East Lens sulphide zone, the QFP, with the mm-size quartz crystals, is obviously fragmental in character and extrusive. In other areas, the massive and extremely consistent texture of the QFP unit suggests that it is

intrusive. The foliation appears as anastomosing 0.5 cm-spaced cleavage, and alteration varies from very weak to intense, with abundant chlorite and sulphides.

#### 7.2.1.2 Massive Sulphide

The massive sulphide is fine-grained and weakly to moderately banded, with the banding defined by centimetre to decimetre scale variations in the content of pyrite, sphalerite, galena, chalcopyrite, and gangue minerals. Other minerals present in varying amounts include calcite, chlorite, tetrahedrite, arsenopyrite, and magnetite.

The massive sulphide attains a maximum horizontal width of up to 25m (E1 Lens).

#### 7.2.1.3 Breccia Unit

In the deposit area, a disrupted assemblage of rock types separates the deposit contact and a stratigraphically overlying massive mafic flow. The assemblage unit is 150m wide horizontally in the footwall to the East Zone, but thins to the west, pinching out near the West Zone.

The unit is not exposed on the surface; the drill logs suggest the unit is dominantly mafic breccia, with fist-sized mafic bombs in hyaloclastite. Other rocks include massive felsic and pyroclastic flows (which have Zr/Ti ratios distinctly lower than those of the footwall felsic rock), black and maroon mudstone (similar to those in the mudstone-siltstone unit), maroon chert, and semi-massive and massive sulphide.

A tentative interpretation of this unit is a flow breccia at the front of, and then overridden by the overlying mafic flow.

#### 7.2.1.4 Massive Mafic Flow

This thick unit was initially mapped as anorthosite, as it consists almost entirely of fine-grained, equant plagioclase with <5% clinopyroxene. The rock is featureless and massive and has been named massive mafic flow because of the associated breccias.

#### 7.2.1.5 Mudstone and Siltstone

Mudstone, with lesser siltstone, is the uppermost unit observed. The mudstone is dark green to black or, in a 200m thick horizon, alternating medium green and maroon. The siltstone is light beige and occurs in 5 cm to 30 cm beds. Bedding is otherwise faint to absent.

### 7.2.2 Metamorphism

Chlorite is the only prograde metamorphic mineral observed suggesting lower greenschist grade metamorphism.

### 7.2.3 Structure

Similar felsic volcanic rocks and mudstone-siltstone are repeated across several contacts throughout the mapped area. Regional USGS mapping of nearby stratigraphic units indicates contacts repeated by closely spaced anticlines and synclines, or folding, in nearby stratigraphic units rather than a history of alternating

volcanism and sedimentation. The deposit horizon is rotated into an interpreted syncline east of the East Zone, also arguing for fold repetitions of the contact.

Foliations in the rocks are axial planar to the interpreted folds near contacts but tend to be more northerly away from contacts. It is suggested that these foliations record a later flattening that produced cross-folding in the deposit area.

## 7.3 Mineralisation

The mineral zone at Pickett Mountain is a volcanogenic massive sulphide deposit that strikes at approximately 057°. It has been traced by drilling approximately 900m along strike and to 750 vertical metres below surface. It consists of 4 primary lenses and several minor lenses that likely reflect the original formation of the mineralisation. It is stratabound and is hosted primarily by an intermediate to felsic lapilli tuff to volcanic breccia unit (Scully, 1988).

Primary minerals of economic interest are chalcopyrite, galena, and sphalerite intercalated with variable amounts of pyrite. Accessory minerals include tetrahedrite and minor arsenopyrite. There are two primary lenses of massive sulphide that have been discovered to date that have been subdivided into four lenses (W1, W2, E1, and E2). These vary from 0.5m to about 25m in horizontal width and with the highest base metal grades situated at or near the base of the massive sulphide lenses. The high-grade Cu-Pb-Zn sulphides are typically finely laminated and are overlain and in sharp contact with massive pyrite (Scully, 1988).

The high-grade sulphides typically include 45% to 60% pyrite, 15% sphalerite, 3% galena, and 4% chalcopyrite. There are also minor amounts of tetrahedrite, tennantite, arsenopyrite, magnetite, and barite. Laminations are typically 2 mm to 5 cm in thickness and are compositionally defined (Scully, 1988).

The West Lens is the most prominent massive sulphide lens discovered to date having been traced by drilling over a 300m strike length and to a vertical depth of 825m. Notably, it also is the highest grade of all lenses based on current and historic drilling and the most intense footwall alteration. The West Lens, especially along its eastern edge, includes fold repetitions and structurally stacked mineralisation in the hanging wall (previously interpreted as W2 Lens). Re-logging, which is in progress, has been completed and lithogeochemical data are supporting the updated interpretation. It is also likely that additional holes will need to be drilled to finalise the updated interpretation. As well, the West Lens lies directly on either felsic volcanic in the upper part of the zone and sedimentary rocks, in the lower part of the zone. This suggests that, the massive sulphides were deposited, both on top of the felsic volcanic rocks and in local, likely structurally-controlled sub-basins, with local structures, likely controlling mineralising hydrothermal fluid flow.

The East Lens (E1 and E2 Lenses) can be traced over a strike-length of close to 550m and to a maximum vertical depth of about 550m below the surface with the bulk of the zone above 400m. The QFP unit occurring below the East Lens, may have modified the orientation of the lens resulting in a locally shallower dip and may have propagated a fault or dislocation between the East and West Lenses. In addition, the QFP and a massive feldspar quartz porphyry unit appears to partially truncate the East Lens at its eastern extremity, occurring as a felsic dome intruding the upper rhyolite. The continuation of the favourable stratigraphy hosting the West and East Lenses, beyond the eastern limits of this intrusive cut-off, is unknown.

Longitudinal sections for the massive sulphide lenses, that are subject to the resource estimate, are depicted in Figure 7.6 and Figure 7.7.

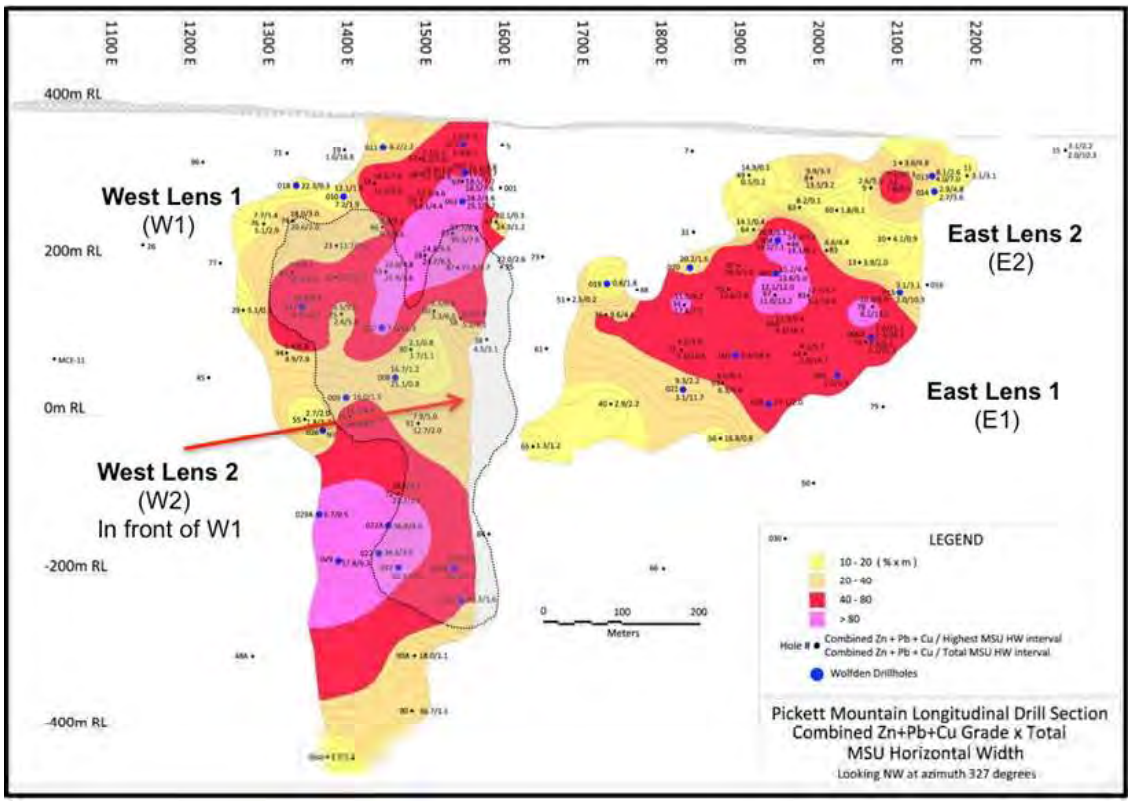



**Figure 7.6 Longitudinal Section of the W1, E1, and E2 Massive Sulphide Lenses**

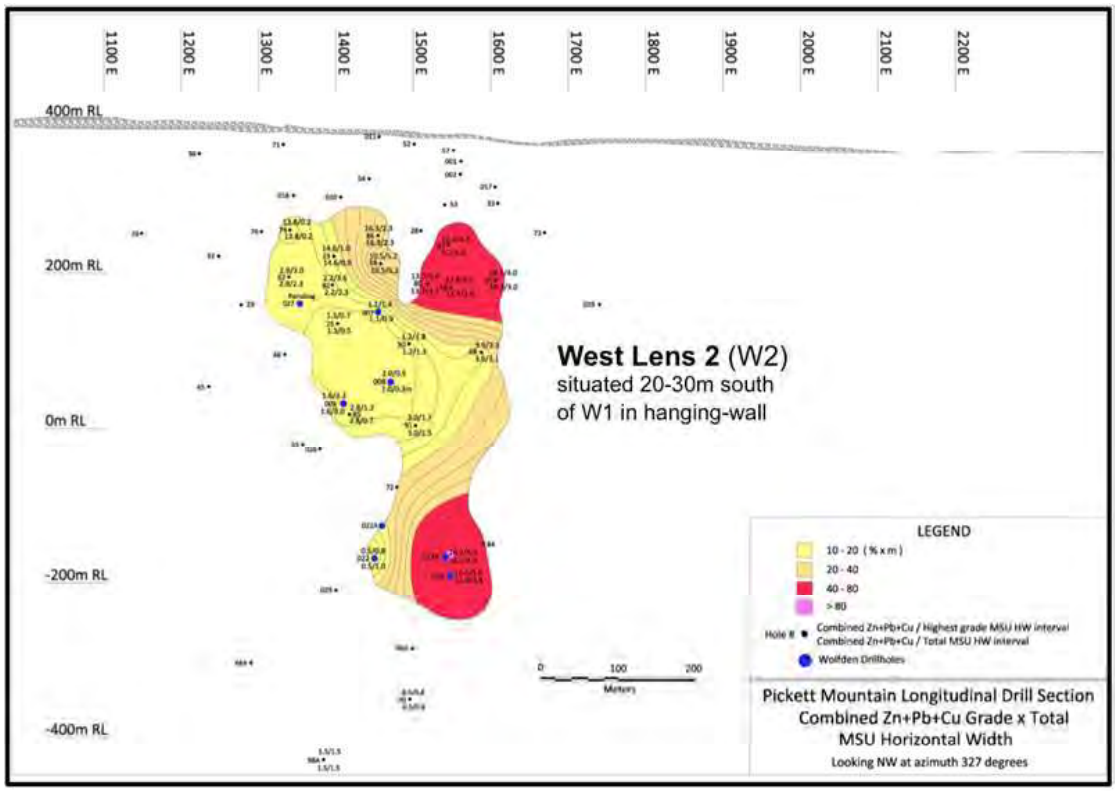



**Figure 7.7 Longitudinal Section of the W2 Massive Sulphide Lens**

The Footwall Zone (FWZ) occurs at the contact between the QFP and/or sediments and FWBX felsic units about 150m north of the trend of the West and East Lenses. First identified in the 2018 drill results, about 700m below the surface, it now appears that some of the historical drilling also intersected this zone. Notable intercepts from the 2018 and 2019 drill programs include 10.0% Zn, 5.0% Pb, 1.1% Cu, 396.9 g/t Ag, and 0.4 g/t Au (24.7% ZnEq) over 7.10m (PM-18-31) as well as 4.4% Zn, 2.2% Pb, 0.5% Cu, 62.7 g/t Ag, and 0.3 g/t Au (9.0% ZnEq) across 9.1m (PM-19-31a). The FWZ is generally narrow but can locally contain very high-grades. In a few drill holes, the FWZ consists of discrete zones of semi-massive to massive sulphide (as seen in PM-18-31 and PM-19-31A), while in others, it occurs as heavy disseminations, stringers, and bands of sulphide mineralisation. Stringer mineralisation along this time break, some 170m from the discovery hole, suggests potential for additional massive sulphide mineralisation between the discovery hole and the stringer zone. The FWZ is open both up and down plunge, and to the east, as depicted in the footwall longitudinal section. Further drilling to test extensions is warranted. This drill testing can be cost-effectively accomplished by extending a couple of the previous holes.

Table 7.1 tabulates the most significant intersections obtained from the 4 massive sulphide lenses based on historic drilling (Getty and Chevron) and by recent drilling completed by Wolfden.

## TABLE 7.1

## SIGNIFICANT DRILL INTERCEPTS FROM HISTORIC DRILLING AND WOLFDEN DRILLING (PM SERIES OF HOLES)

| Pickett Mountain Massive Sulphide Zone Comprehensive Drill Results - Historical and Recent | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Section | Zone | Hole # | From (m) | To (m) | Length (m) | Long HW (m) | Zn (%) | Pb (%) | Cu (%) | Ag (%) | Au (%) | Cu + Pb + Zn (%) | (Cu + Pb + Zn) * HW (%m) |
| 1250E | MS-W1 | 29 | 279.04 | 279.65 | 0.45 | 0.28 | 3.50 | 1.30 | 0.26 | 8.57 | 0.34 | 5.06 | 1.40 |
| 1300E | MS-W1 | 76 | 162.89 | 168.30 | 5.41 | 2.69 | 1.67 | 0.57 | 2.88 | 38.24 | 0.36 | 5.12 | 14.79 |
| 1350E | MS-W1 | 55 | 457.60 | 462.77 | 5.18 | 3.71 | 0.99 | 0.33 | 0.56 | 8.36 | 0.18 | 1.88 | 6.99 |
| 1350E | MS-W1 | 62 | 212.59 | 219.91 | 7.31 | 3.00 | 8.59 | 4.55 | 1.09 | 76.88 | 0.87 | 14.23 | 42.69 |
| 1350E | MS-W1 | 74 | 158.20 | 161.54 | 3.34 | 1.98 | 13.53 | 5.11 | 1.95 | 167.80 | 0.99 | 20.58 | 40.75 |
| 1350E | MS-W1 | 94 | 316.43 | 322.25 | 15.82 | 7.89 | 2.71 | 1.08 | 1.09 | 44.55 | 0.73 | 4.88 | 38.61 |
| 1350E | MS-W1 | PM-18-018 | 110.10 | 110.60 | 0.49 | 0.29 | 11.70 | 8.31 | 2.25 | 100.00 | 0.46 | 22.26 | 6.48 |
| 1350E | MS-W1 | PM-18-027 | 254.99 | 279.40 | 13.20 | 10.21 | 6.47 | 2.72 | 1.41 | 96.92 | 0.56 | 10.60 | 108.28 |
| 1350E | MS-W1 | PM-18-029A | 612.46 | 613.42 | 0.95 | 0.70 | | | | | | Pending | Pending |
| 1400E | MS-W1 | 23 | 197.92 | 201.32 | 3.40 | 2.45 | 6.32 | 3.22 | 2.12 | 65.37 | 0.71 | 11.66 | 28.61 |
| 1400E | MS-W1 | 25 | 314.55 | 321.47 | 6.92 | 5.78 | 1.35 | 0.33 | 0.72 | 10.74 | 0.24 | 2.39 | 13.83 |
| 1400E | MS-W1 | 82 | 254.20 | 259.10 | 4.90 | 3.66 | 7.22 | 2.85 | 2.64 | 115.21 | 0.95 | 12.71 | 46.52 |
| 1400E | MS-W1 | 85 | 398.50 | 411.21 | 12.71 | 5.70 | 8.61 | 4.04 | 1.88 | 92.74 | 1.02 | 14.72 | 83.88 |
| 1400E | MS-W1 | 98A | 925.92 | 927.32 | 1.40 | 1.16 | 1.58 | 0.01 | 0.10 | 1.30 | 0.10 | 1.69 | 1.96 |
| 1400E | MS-W1 | PM-18-010 | 123.60 | 126.89 | 3.30 | 1.91 | 5.02 | 1.63 | 0.50 | 40.10 | 0.30 | 7.15 | 13.68 |
| 1400E | MS-W1 | PM-18-026 | 492.49 | 497.20 | 4.71 | 3.21 | | | | | | Nil | Nil |
| 1400E | MS-W1 | PM-18-029 | 657.60 | 668.15 | 10.55 | 6.34 | 19.32 | 7.24 | 1.24 | 206.36 | 1.28 | 27.80 | 176.37 |
| 1450E | MS-W1 | 54 | 112.93 | 121.30 | 8.37 | 6.01 | 7.76 | 2.27 | 1.23 | 44.25 | 0.71 | 11.26 | 67.65 |
| 1450E | MS-W1 | 59 | 194.28 | 211.99 | 17.70 | 3.60 | 14.98 | 7.80 | 3.14 | 150.75 | 1.19 | 25.92 | 93.30 |
| 1450E | MS-W1 | 72 | 526.77 | 530.69 | 3.92 | 2.44 | 18.10 | 8.54 | 0.56 | 210.05 | 1.13 | 27.20 | 66.30 |
| 1450E | MS-W1 | 86 | 172.20 | 180.20 | 8.00 | 5.53 | 3.04 | 1.11 | 2.23 | 35.79 | 0.59 | 6.38 | 35.30 |
| 1450E | MS-W1 | PM-18-007 | 279.70 | 311.19 | 31.49 | 15.32 | 4.41 | 1.65 | 0.97 | 60.54 | 0.61 | 7.03 | 107.69 |
| 1450E | MS-W1 | PM-18-008 | 342.29 | 344.70 | 2.41 | 0.79 | 16.78 | 3.98 | 0.37 | 68.38 | 0.53 | 21.13 | 16.78 |
| 1450E | MS-W1 | PM-18-009 | 360.90 | 384.40 | 3.50 | 1.50 | 10.58 | 4.14 | 1.26 | 85.15 | 0.59 | 15.97 | 23.96 |
| 1450E | MS-W1 | PM-18-011 | 56.59 | 59.59 | 3.00 | 2.15 | 4.22 | 1.42 | 2.60 | 34.26 | 0.54 | 8.24 | 17.75 |
| 1450E | MS-W1 | PM-18-022 | 662.20 | 666.91 | 4.71 | 3.01 | 23.83 | 9.88 | 0.88 | 262.59 | 1.52 | 34.58 | 104.25 |
| 1450E | MS-W1 | PM-18-022A | 639.40 | 645.30 | 5.90 | 4.25 | 23.95 | 11.84 | 0.95 | 324.08 | 1.35 | 36.73 | 156.13 |
| 1500E | MS-W1 | 28 | 200.75 | 210.82 | 10.06 | 6.53 | 15.91 | 7.41 | 1.42 | 181.06 | 1.83 | 24.74 | 161.57 |
| 1500E | MS-W1 | 30 | 342.36 | 344.00 | 1.62 | 1.13 | 0.90 | 0.40 | 0.36 | 22.00 | 0.27 | 1.67 | 1.89 |
| 1500E | MS-W1 | 52 | 54.03 | 68.00 | 13.79 | 6.96 | 4.03 | 1.71 | 0.92 | 33.75 | 0.50 | 6.66 | 46.39 |
| 1500E | MS-W1 | 68 | 64.77 | 85.64 | 20.87 | 4.55 | 7.80 | 2.59 | 1.13 | 44.75 | 0.52 | 11.51 | 52.44 |
| 1500E | MS-W1 | 69 | 91.28 | 121.60 | 30.32 | 4.37 | 8.40 | 3.55 | 1.16 | 107.32 | 0.95 | 13.11 | 57.34 |
| 1500E | MS-W1 | 80 | 283.46 | 293.06 | 9.61 | 6.04 | 1.61 | 1.09 | 0.58 | 14.74 | 0.44 | 3.27 | 19.76 |
| 1500E | MS-W1 | 90 | 812.43 | 814.34 | 1.91 | 1.10 | 25.21 | 10.66 | 0.87 | 140.53 | 0.85 | 36.75 | 40.27 |
| 1500E | MS-W1 | 91 | 432.51 | 435.12 | 2.62 | 1.95 | 8.26 | 3.00 | 1.45 | 70.65 | 1.45 | 12.72 | 24.81 |
| 1500E | MS-W1 | 90A | 761.76 | 763.13 | 1.37 | 1.05 | 12.50 | 4.75 | 0.77 | 93.24 | 0.79 | 18.02 | 18.96 |
| 1500E | MS-W1 | PM-18-023 | 722.00 | 724.40 | 2.40 | 1.60 | 20.39 | 3.75 | 1.39 | 107.14 | 1.05 | 25.53 | 40.82 |
| 1500E | MS-W1 | PM-18-023A | 696.90 | 690.19 | 3.29 | 2.42 | 15.83 | 7.78 | 0.70 | 167.87 | 0.93 | 24.30 | 58.78 |
| 1550E | MS-W1 | 53 | 157.89 | 171.79 | 13.90 | 7.58 | 18.61 | 10.25 | 1.63 | 229.89 | 1.62 | 30.49 | 230.94 |
| 1550E | MS-W1 | 57 | 81.40 | 95.99 | 14.58 | 7.64 | 11.06 | 5.91 | 1.54 | 145.75 | 0.92 | 18.51 | 141.36 |
| 1550E | MS-W1 | 58 | 278.07 | 292.61 | 14.54 | 8.15 | 2.97 | 1.30 | 0.94 | 78.25 | 0.45 | 5.21 | 42.49 |
| 1550E | MS-W1 | 87 | 214.97 | 220.70 | 5.73 | 3.71 | 15.53 | 6.02 | 2.25 | 181.42 | 0.88 | 23.80 | 88.19 |
| 1550E | MS-W1 | PM-17-001 | 84.25 | 92.20 | 7.95 | 5.69 | 7.88 | 3.83 | 1.51 | 104.01 | 0.85 | 13.23 | 75.25 |
| 1550E | MS-W1 | PM-17-002 | 109.80 | 119.59 | 9.90 | 5.19 | 16.31 | 7.09 | 1.73 | 185.61 | 1.42 | 25.13 | 130.40 |
| 1550E | MS-W1 | PM-18-012 | 37.30 | 48.70 | 11.40 | 8.14 | 3.63 | 1.43 | 0.83 | 34.84 | 0.30 | 5.89 | 47.94 |
| 1600E | MS-W1 | 33 | 156.88 | 158.44 | 0.76 | 1.25 | 13.60 | 9.78 | 0.90 | 186.76 | 1.01 | 24.28 | 30.25 |
| 1650E | MS-E1 | 65 | 413.30 | 416.59 | 3.29 | 1.16 | 0.77 | 0.26 | 0.32 | 4.86 | 0.53 | 1.35 | 1.57 |
| 1750E | MS-E1 | 36 | 275.37 | 282.30 | 6.33 | 4.52 | 6.11 | 2.46 | 1.07 | 63.61 | 0.72 | 9.64 | 43.60 |
| 1750E | MS-E1 | 40 | 385.66 | 388.90 | 3.20 | 2.22 | 1.54 | 0.59 | 0.77 | 0.00 | 0.55 | 2.90 | 6.43 |
| 1750E | MS-E1 | PM-18-015 | 235.90 | 238.80 | 2.90 | 1.83 | 0.40 | 0.08 | 0.28 | 3.88 | 0.05 | 0.76 | 1.39 |
| 1850E | MS-E1 | 34 | 245.04 | 259.10 | 14.06 | 7.53 | 8.68 | 3.28 | 0.82 | 78.59 | 0.99 | 12.78 | 96.23 |
| 1850E | MS-E1 | 37 | 320.03 | 341.99 | 21.96 | 15.62 | 1.64 | 0.69 | 0.72 | 51.18 | 0.73 | 3.05 | 47.71 |
| 1850E | MS-E1 | PM-18-020 | 194.60 | 197.80 | 3.20 | 1.65 | 13.15 | 5.34 | 1.70 | 124.66 | 1.14 | 20.20 | 33.24 |
| 1850E | MS-E1 | PM-18-021 | 350.00 | 371.00 | 21.00 | 11.69 | 1.99 | 0.69 | 0.34 | 15.02 | 0.30 | 3.02 | 35.25 |
| 1900E | MS-E1 | 47 | 181.19 | 187.60 | 6.40 | 3.02 | 17.09 | 6.42 | 1.02 | 128.91 | 1.40 | 24.53 | 74.20 |
| 1900E | MS-E1 | 49 | 67.21 | 67.57 | 0.30 | 0.22 | 0.21 | 0.17 | 0.12 | 0.17 | 0.14 | 0.50 | 0.11 |
| 1900E | MS-E1 | 56 | 396.85 | 398.80 | 1.95 | 0.81 | 12.00 | 4.68 | 0.67 | 96.38 | 1.30 | 16.76 | 13.53 |
| 1900E | MS-E1 | 64 | 118.06 | 130.82 | 12.77 | 0.35 | 6.24 | 3.71 | 1.36 | 83.84 | 0.78 | 13.32 | 4.72 |
| 1900E | MS-E1 | 92 | 225.31 | 229.50 | 4.19 | 2.82 | 8.41 | 3.29 | 0.87 | 76.64 | 0.81 | 12.57 | 35.48 |
| 1900E | MS-E1 | 93 | 330.04 | 343.70 | 13.66 | 6.62 | 3.34 | 1.46 | 0.85 | 72.97 | 1.12 | 6.25 | 41.38 |
| 1900E | MS-E1 | PM-18-005 | 279.11 | 323.91 | 45.80 | 18.29 | 1.30 | 0.51 | 0.59 | 24.04 | 0.43 | 2.41 | 44.28 |
| 1950E | MS-E1 | 39 | 236.52 | 268.70 | 32.15 | 14.09 | 2.31 | 0.90 | 0.85 | 22.46 | 0.44 | 4.06 | 57.26 |
| 1950E | MS-E1 | 46 | 161.85 | 171.91 | 9.30 | 8.08 | 9.58 | 3.66 | 0.79 | 86.27 | 0.72 | 14.04 | 113.34 |
| 1950E | MS-E1 | 67 | 172.66 | 254.12 | 68.28 | 13.20 | 6.78 | 3.84 | 1.20 | 50.22 | 0.65 | 11.82 | 145.65 |
| 1950E | MS-E1 | PM-18-003 | 192.89 | 202.60 | 9.71 | 4.99 | 9.27 | 3.39 | 0.99 | 58.78 | 0.73 | 13.64 | 68.10 |
| 1950E | MS-E1 | PM-18-004 | 170.61 | 180.89 | 10.29 | 7.12 | 10.96 | 4.06 | 1.23 | 117.31 | 0.96 | 16.25 | 115.76 |
| 1950E | MS-E1 | PM-18-028 | 380.89 | 384.30 | 3.41 | 2.04 | 15.14 | 7.37 | 0.60 | 151.04 | 1.16 | 27.12 | 55.22 |

## TABLE 7.1

### SIGNIFICANT DRILL INTERCEPTS FROM HISTORIC DRILLING AND WOLFDEN DRILLING (PM SERIES OF HOLES) *(CONTINUED)*

| Section | Zone | Hole # | From (m) | To (m) | Length (m) | Long HW (m) | Zn (%) | Pb (%) | Cu (%) | Ag (%) | Au (%) | Cu + Pb + Zn (%) | (Cu + Pb + Zn) * HW (%m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2000E | MS-E1 | 8 | 88.09 | 91.74 | 2.74 | 3.25 | 7.27 | 2.62 | 1.63 | 60.61 | 1.47 | 11.53 | 37.46 |
| 2000E | MS-E1 | 44 | 292.46 | 318.21 | 25.69 | 18.19 | 0.94 | 0.52 | 0.53 | 8.50 | 0.41 | 1.99 | 36.24 |
| 2000E | MS-E1 | 63 | 95.71 | 95.90 | 0.20 | 0.04 | 5.30 | 2.40 | 0.54 | 30.17 | 0.45 | 8.24 | 0.35 |
| 2000E | MS-E1 | 81 | 230.12 | 255.60 | 25.01 | 16.44 | 3.16 | 1.22 | 0.78 | 32.11 | 0.59 | 5.16 | 84.81 |
| 2000E | MS-E1 | 83 | 204.37 | 209.85 | 5.48 | 4.41 | 3.14 | 1.24 | 0.43 | 29.45 | 0.33 | 4.81 | 21.23 |
| 2050E | MS-E2 | 9 | 78.03 | 85.95 | 7.62 | 5.88 | 2.08 | 0.28 | 0.30 | 20.16 | 0.75 | 2.66 | 15.63 |
| 2050E | MS-E2 | 13 | 183.73 | 186.69 | 2.74 | 2.14 | 2.62 | 0.54 | 0.72 | 57.90 | 0.57 | 3.88 | 8.30 |
| 2050E | MS-E1 | 60 | 94.49 | 96.31 | 1.82 | 0.13 | 0.79 | 0.28 | 0.75 | 5.14 | 0.17 | 1.82 | 0.24 |
| 2050E | MS-E2 | 70 | 263.05 | 304.80 | 35.35 | 21.53 | 1.76 | 0.58 | 0.69 | 20.40 | 0.49 | 3.03 | 65.22 |
| 2050E | MS-E2 | 78 | 229.51 | 252.56 | 23.05 | 13.10 | 5.01 | 2.00 | 1.10 | 48.88 | 0.62 | 8.12 | 106.32 |
| 2050E | MS-E2 | PM-18-006A | 255.70 | 308.10 | 52.40 | 26.09 | 1.33 | 0.48 | 0.50 | 18.63 | 0.30 | 2.31 | 60.28 |
| 2100E | MS-E2 | 1 | 40.84 | 47.55 | 6.58 | 4.90 | 2.08 | 0.73 | 0.72 | 29.36 | 0.20 | 3.54 | 17.36 |
| 2100E | MS-E2 | 2 | 64.16 | 76.96 | 12.65 | 9.50 | 5.02 | 1.87 | 0.91 | 49.63 | 0.63 | 7.80 | 74.08 |
| 2100E | MS-E2 | 10 | 168.86 | 170.08 | 1.07 | 1.02 | 2.49 | 0.67 | 0.93 | 48.48 | 0.20 | 4.09 | 4.18 |
| 2150E | MS-E2 | PM-18-013 | 59.10 | 68.50 | 9.40 | 7.01 | 2.38 | 0.83 | 0.75 | 32.17 | 0.41 | 3.96 | 27.78 |
| 2150E | MS-E2 | PM-18-014 | 86.70 | 91.70 | 5.00 | 3.61 | 1.70 | 0.55 | 0.47 | 24.66 | 0.28 | 2.72 | 9.84 |
| 2100E | MS-E2 | PM-18-015 | 229.00 | 245.50 | 16.50 | 10.33 | 1.10 | 0.42 | 0.52 | 18.58 | 0.27 | 2.04 | 21.08 |
| 2200E | MS-E2 | 11 | 53.04 | 57.45 | 4.41 | 3.06 | 2.15 | 0.56 | 0.42 | 30.43 | 0.41 | 3.13 | 9.58 |
| 1350E | MS-W2 | 62 | 199.33 | 205.13 | 5.80 | 2.37 | 1.47 | 0.50 | 0.94 | 20.53 | 0.72 | 2.91 | 6.90 |
| 1350E | MS-W2 | 74 | 151.27 | 151.64 | 0.01 | 0.22 | 9.30 | 3.65 | 0.84 | 82.96 | 0.62 | 13.79 | 3.03 |
| 1350E | MS-W2 | PM-18-027 | 242.80 | 246.00 | 3.20 | 1.32 | | | | | | Pending | Pending |
| 1400E | MS-W2 | 23 | 192.02 | 193.32 | 1.30 | 0.92 | 8.08 | 5.01 | 1.58 | 101.95 | 0.87 | 14.66 | 13.51 |
| 1400E | MS-W2 | 25 | 308.46 | 309.07 | 0.61 | 0.50 | 0.60 | 0.23 | 0.50 | 14.23 | 0.33 | 1.33 | 0.67 |
| 1400E | MS-W2 | 82 | 242.83 | 245.97 | 3.15 | 2.32 | 0.94 | 0.32 | 0.91 | 26.52 | 0.46 | 2.17 | 5.03 |
| 1400E | MS-W2 | 85 | 382.21 | 383.87 | 1.34 | 0.72 | 1.75 | 0.85 | 0.23 | 7.54 | 0.24 | 2.83 | 2.03 |
| 1400E | MS-W2 | PM-18-009 | 369.60 | 376.40 | 6.79 | 2.92 | 0.78 | 0.25 | 0.53 | 16.53 | 0.23 | 1.56 | 4.56 |
| 1450E | MS-W2 | 59 | 167.19 | 181.66 | 14.47 | 2.88 | 6.16 | 2.75 | 1.58 | 88.43 | 0.62 | 10.49 | 30.17 |
| 1450E | MS-W2 | 86 | 162.00 | 164.59 | 2.59 | 1.76 | 11.18 | 3.86 | 1.28 | 85.01 | 1.03 | 16.31 | 28.63 |
| 1450E | MS-W2 | PM-18-007 | 251.60 | 253.39 | 1.80 | 0.85 | 0.63 | 0.15 | 0.34 | 9.03 | 0.14 | 1.12 | 0.96 |
| 1450E | MS-W2 | PM-18-008 | 331.88 | 332.88 | 0.98 | 0.33 | 0.96 | 0.36 | 0.73 | 17.60 | 0.17 | 2.05 | 0.67 |
| 1450E | MS-W2 | PM-18-022 | 656.80 | 658.30 | 1.50 | 0.96 | 0.00 | 0.00 | 0.54 | 28.92 | 0.58 | 0.54 | 0.52 |
| 1500E | MS-W2 | 30 | 309.67 | 311.63 | 1.95 | 1.31 | 0.39 | 0.08 | 0.74 | 0.00 | 0.17 | 1.22 | 1.60 |
| 1500E | MS-W2 | 80 | 217.63 | 223.87 | 6.24 | 3.73 | 8.15 | 3.90 | 1.64 | 110.32 | 1.00 | 13.68 | 51.01 |
| 1500E | MS-W2 | 91 | 413.00 | 415.10 | 2.10 | 1.51 | 1.00 | 0.37 | 1.65 | 9.25 | 0.38 | 3.02 | 4.56 |
| 1550E | MS-W2 | 58 | 212.63 | 218.45 | 5.82 | 2.93 | 8.08 | 3.31 | 2.40 | 123.54 | 1.12 | 13.79 | 40.43 |
| 1550E | MS-W2 | 87 | 151.27 | 163.37 | 12.10 | 6.63 | 5.54 | 2.35 | 1.28 | 56.94 | 0.56 | 9.17 | 60.81 |
| 1550E | MS-W2 | PM-18-023 | 661.14 | 667.06 | 5.92 | 3.79 | 7.48 | 3.21 | 1.31 | 62.66 | 0.73 | 12.00 | 45.44 |
| 1550E | MS-W2 | PM-18-023A | 646.60 | 652.60 | 6.00 | 4.33 | 10.19 | 4.69 | 1.28 | 52.93 | 0.49 | 16.17 | 70.01 |
| 1600E | MS-W2 | 35 | 210.65 | 215.10 | 4.39 | 3.03 | 12.82 | 5.65 | 0.86 | 87.84 | 0.83 | 19.34 | 58.61 |
| 1600E | MS-W2 | 38 | 327.57 | 331.55 | 3.98 | 3.09 | 2.26 | 0.88 | 0.73 | 32.37 | 0.45 | 3.87 | 11.98 |

The historical drill results included in Table 7.1 were generated between 1979 to 1989 by Getty Mining Company and Chevron Resources. The historic drill core samples were cut in half using a diamond saw or core splitter and sent to Skyline Laboratories in Tucson, Arizona for analyses. Copper, lead, and zinc were analysed utilising atomic absorption spectrometry (AA) while gold and silver were analysed utilising the fire-assay technique. High-grade copper, lead, and zinc assays obtained by AA were checked routinely utilising wet chemistry techniques. Wolfden is not aware of theQA/QC programs undertaken with these results, if any. The historical data, which does include most of the drill core in storage, does not include the original assay certificates. The historical results were compiled by Wolfden utilising original drill logs, drill sections, working files and reports, and databases prepared by the former owners of the Property at that time and subsequently acquired by Wolfden. Wolfden has not independently verified the historic results, although some corrections (non-material) have been identified since the January 7, 2019 Mineral Resource report and are now included in an updated historical drill hole table on the Company's website, readers should also see the Company's AIF filed on SEDAR and dated April 28, 2020. Holes drilled by Wolfden begin with PM-17, PM-18, PM-19, and now PM-20.

## 8.0 Deposit Type

VMS deposits are the product of hydrothermal vents on the sea floor that form syngenetically with active volcanism and/or plutonism. They form at or just below the sea floor as a product of the discharge of high temperature, seawater-dominated hydrothermal fluid. There are six main elements typically present and are considered essential for the formation of VMS hydrothermal systems and their associated base metal deposits.

This deposit type is typically an accumulation of massive to semi-massive sulphides that are syngenetic, stratabound, and in part strataform. They usually consist of two parts: a concordant massive sulphide lens and an underlying discordant vein-type sulphide stringer or stock-work zone that is within a footwall alteration zone (Figure 8.1). In some cases, the stringer zone extends into the hangingwall as well, which appears to be the case at Picket Mountain. This continuation of the stringer zone into the hangingwall may indicate the continuation of the hydrothermal system and could represent additional exploration opportunities.

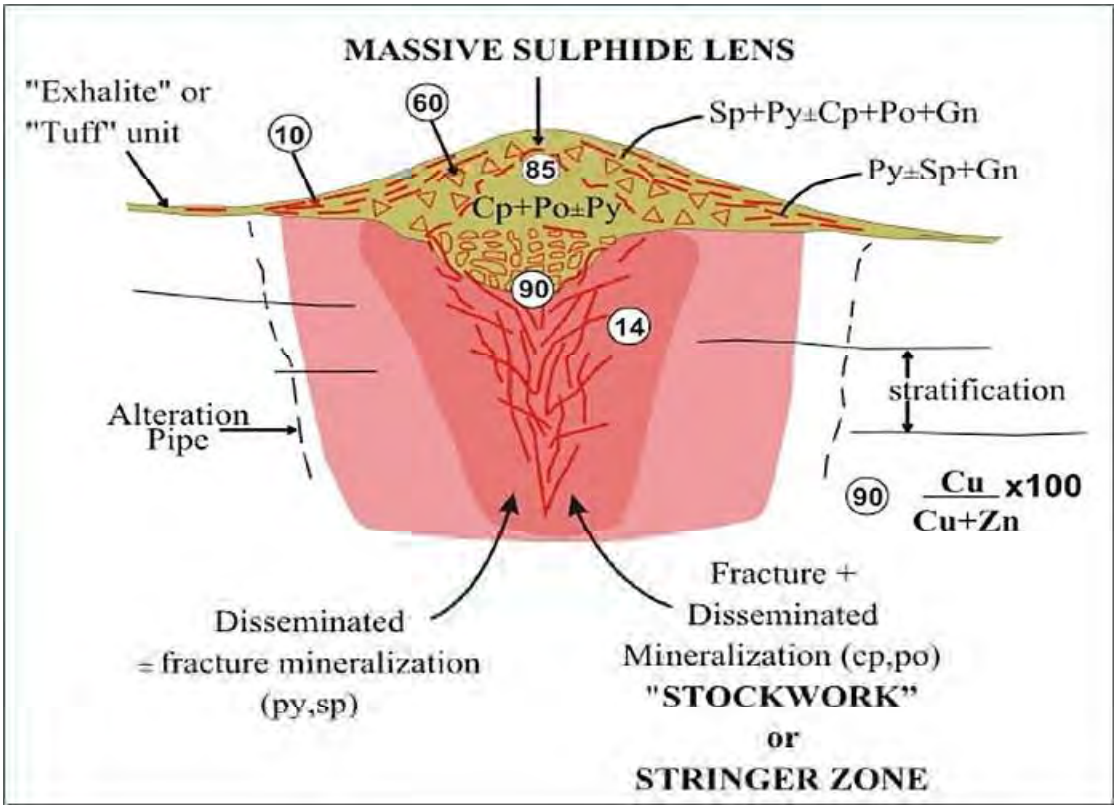



**Figure 8.1 Idealised VMS Deposit Showing a Strataform Lens of Massive Sulphide Overlying a Discordant Stringer Sulphide Zone within an Envelope of Altered Rock (Alteration Pipe)**

Base metal zonation is indicated by numbers in circles with the highest numbers being Cu-rich and the lower numbers more Zn-rich (Py = pyrite, Cp = chalcopyrite, Po = pyrrhotite, Sp = sphalerite, and Gn = galena (**Source**: Modified from Gibson, 2005).

VMS deposits are the product of hydrothermal vents on the sea floor that form syngenetically with active volcanism and/or plutonism. They form at or just below the sea floor as a product of the discharge of high temperature, seawater-dominated hydrothermal fluid, as illustrated in Figure 8.2. There are 6 main

elements typically present and are considered essential for the formation of VMS hydrothermal systems and their associated base metal deposits (Gibson, et al., 2007):

1. A heat source is required to drive the hydrothermal system. This may be syn-volcanic, high level intrusions.

2. There is a high-temperature reaction zone that forms through the reaction of seawater with volcanic and sedimentary strata that result in the leaching of metals from these rocks.

3. There need to be deep penetrating syn-volcanic faults that allow the recharge and discharge of the metal-bearing hydrothermal fluid.

4. The interaction of the ascending high-temperature fluids and mixing with ambient seawater results in footwall and hanging wall alteration zones.

5. Massive sulphide deposits form at or near the seafloor due to interaction with the overlying cold seawater and the ascending hydrothermal fluids resulting in the precipitation of dissolved metals.

6. Distal products, usually exhalites, form due to the contribution of the hydrothermal system to background sedimentation.

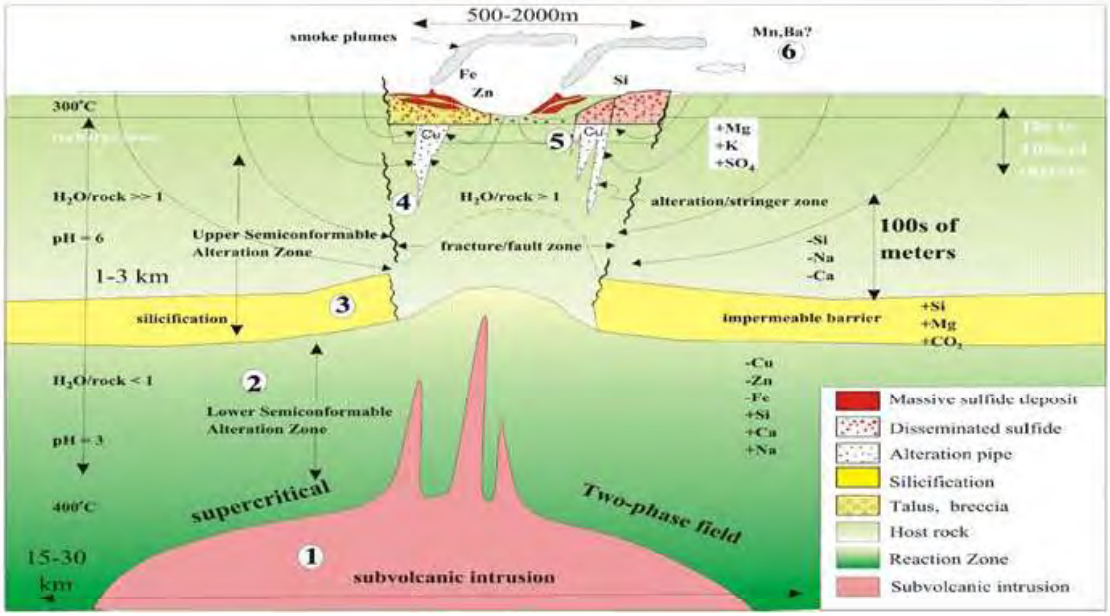



**Figure 8.2 Schematic Illustrating the Relationship between Subvolcanic Intrusions, Subsea-Floor Alteration, Syn-Volcanic Faulting and the Generation of VMS Deposits**

(**Source:** Modified after Galley, 1993 and Franklin, et al., 2005)

VMS deposits typically form in a diverse spectrum of volcanic-sedimentary environments that range from those dominated by flow, volcaniclastic, and or sedimentary rock types. Any of the three end members may be dominant, but what is characteristic for exploration purposes are the overall characteristics listed above.

## 9.0 Exploration

Since acquiring the Property in November 2017, Wolfden has completed an airborne geophysical survey (VTEM™), ground Time-Domain (TDEM) electromagnetic surveys, borehole electromagnetic surveys, ground induced polarization surveys (IP), as well as geological mapping. A summary of each component of the exploration program is presented in this section.

## 9.1 Airborne Geophysical Survey

During May 3 to May 24, 2018, Geotech Ltd. carried out a helicopter-borne geophysical survey over the Pickett Mountain project situated near Patten, Maine.

The geophysical surveys consisted of helicopter-borne electromagnetics (EM) using the versatile time-domain electromagnetic (VTEM™) plus a system with Full-Waveform processing. Measurementsconsisted of Vertical (Z) and In-line Horizontal (X) components of the EM fields using an induction coil and a horizontal magnetic gradiometer using two caesium magnetometers. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 2,853 line-kilometres of geophysical data, covering an area of 397 square kilometres, were acquired during the survey, as illustrated in Figure 9.1.

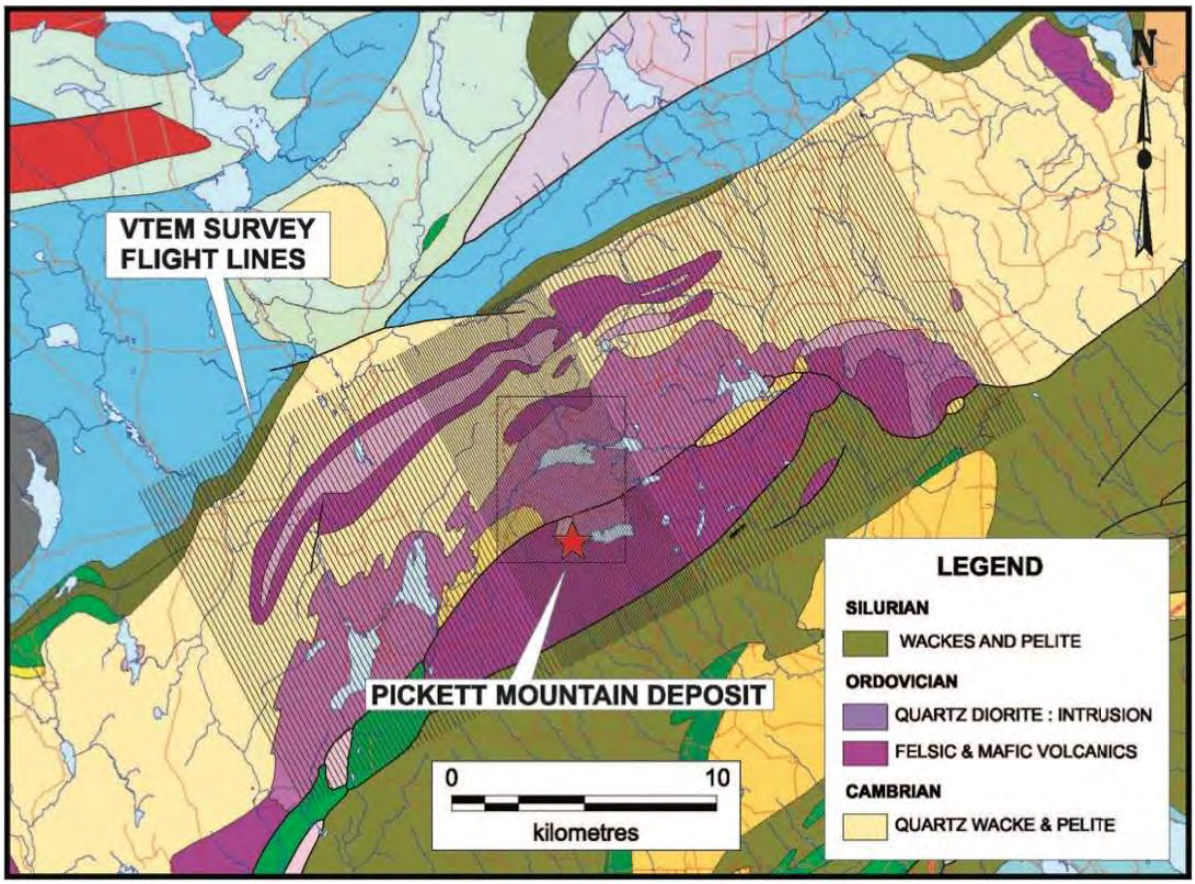



**Figure 9.1 VTEM™ Airborne Geophysical Survey Coverage**

Data QC/QA and preliminary data processing were carried out daily during the acquisition phase of the project. Preliminary and final data processing, including generation of final digital data and map products, were undertaken from the office of Geotech Ltd. in Aurora, Ontario.

Follow-up investigation is warranted where a clear indication of a bedrock conductor has been interpreted. The highest priority targets are reserved for those with a high conductance that can often indicate sulphide mineralisation. Lower priorities are assigned for lower conductance; however, it is important to note that lower conductance can be associated with economic mineralisation that is located deeper below the surface as well as less to non-conductive material, such as the dominant zinc-bearing mineral, sphalerite.

The VTEM™ survey delineated several EM anomalies across the Property, including prominent anomalies over the known Pickett Mountain deposit. According to calculated TAU values, most of the conductors defined by the survey correspond to low to moderate conductive targets. Additionally, most of the conductors delineated are associated with high magnetic gradient zones. Ground geophysical surveys were recommended to follow-up on the results of the airborne VTEM™ survey.

## 9.2 Ground Infinitem XL Time Domain Electromagnetic Survey

A ground TDEM survey was completed on the Pickett Mountain Property from April 16 to April 27, 2018 by Abitibi Geophysics, based out of Val d'Or, Quebec. The purpose of the survey was to establish an electromagnetic signature over the known Pickett Mountain massive sulphide deposit and to look for similar EM signatures in the locale of the known deposit or elsewhere on the Property that might be reflecting the presence of additional massive sulphide lenses or deposits.

A total of 18 lines were surveyed for total survey coverage of 21.4-line kilometres with readings being collected every 25m and 50m on the grid lines. The survey utilised the InfiniTEM XL configuration reading the X, Y, Z, B-field, and dB/dt components on lines spaced 100m and 200m apart, as illustrated on Figure 9.2.

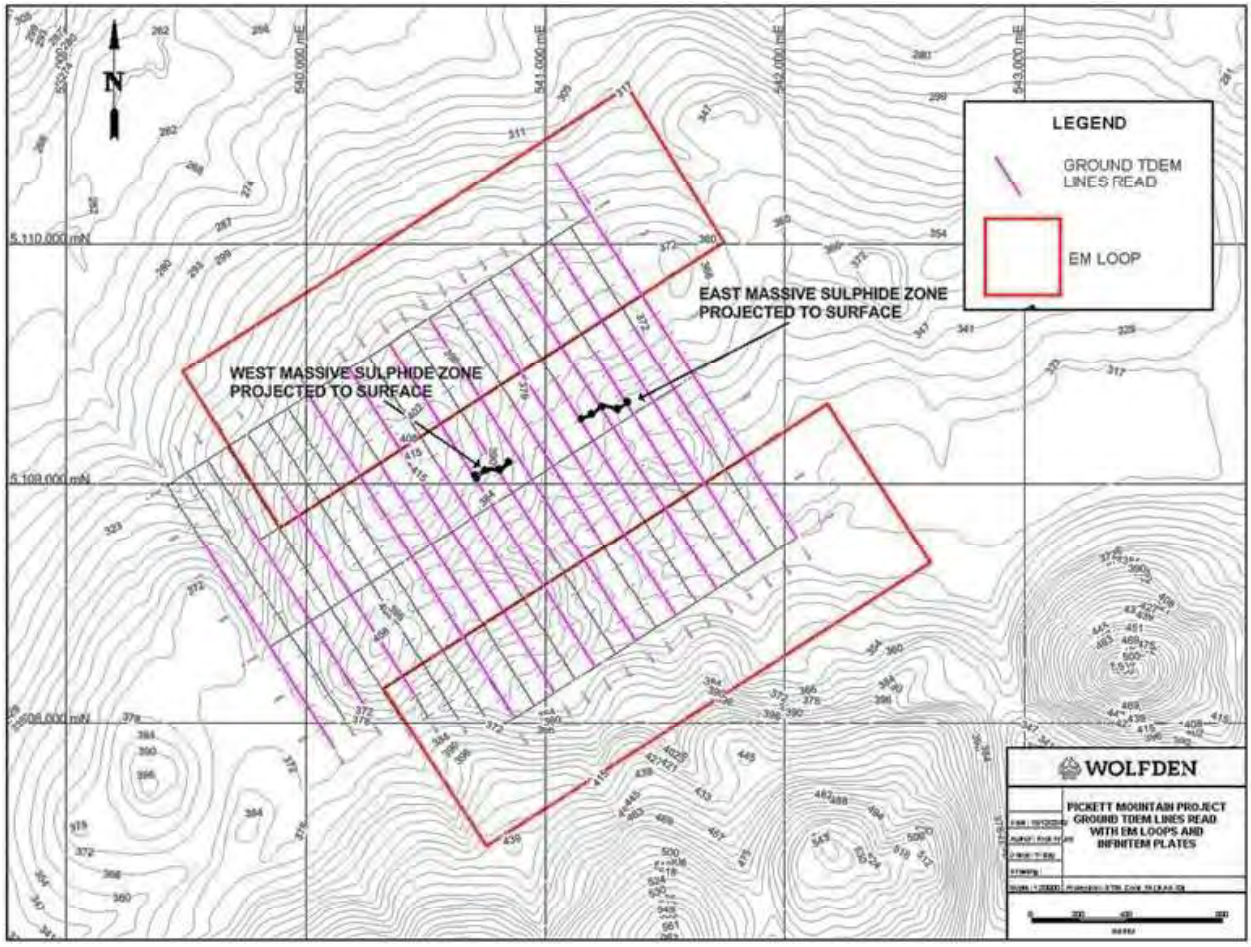



**Figure 9.2 Ground InfiniTEM Time-Domain EM Survey Coverage**

The surface probe utilised was the ARMIT 3 axis B-field and dB/dt sensor and the receiver used for the survey was the EMIT SMARTem 24. The survey employed 2 Tx Terrascope transmitters for a total of 36 kW.

The ground TDEM survey delineated several conductors or conductive plates, as illustrated on Figure 9.3. The conductive plates were modeled utilising the Maxwell™ software. Maxwell™ automates the handling of large data sets with inversion and forward modeling of conductive plate targets. Both the East and West Lenses of the Pickett Mountain massive sulphide deposit elicited prominent conductive responses and are reflected by coincident conductive plates. In addition to these conductors, 3 additional significant bedrock conductors were delineated by the survey.

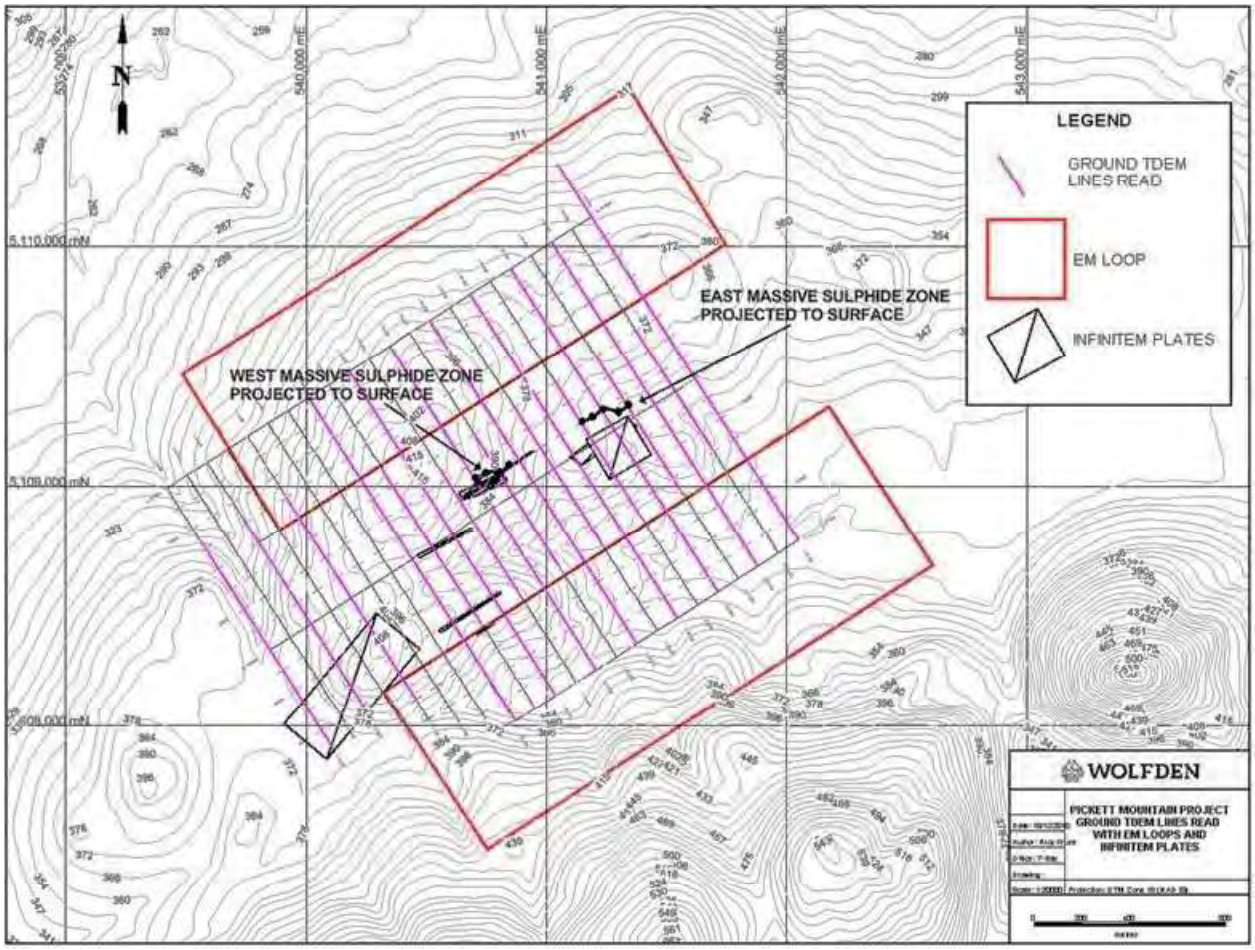



**Figure 9.3 Conductors Defined by the Ground InfiniTEM Time-Domain EM Survey**

## 9.3 Borehole Infinitem XL Time Domain Electromagnetic Survey

Borehole EM surveys were also completed by Abitibi Geophysics on the Pickett Mountain Property in 2018. The surveys were carried out in 2 phases; the first occurred in April 2018 and involved the surveying of 12 drill holes, while the second occurred in August 2018 and comprised the surveying of 3 drill holes, as illustrated on Figure 9.4. The purpose of the surveys was to help trace the depth and down-plunge extension of the known massive sulphide lenses, to detect and characterise deeply buried conductors potentially reflective of new massive sulphide mineralisation, and to identify additional targets for future exploration.

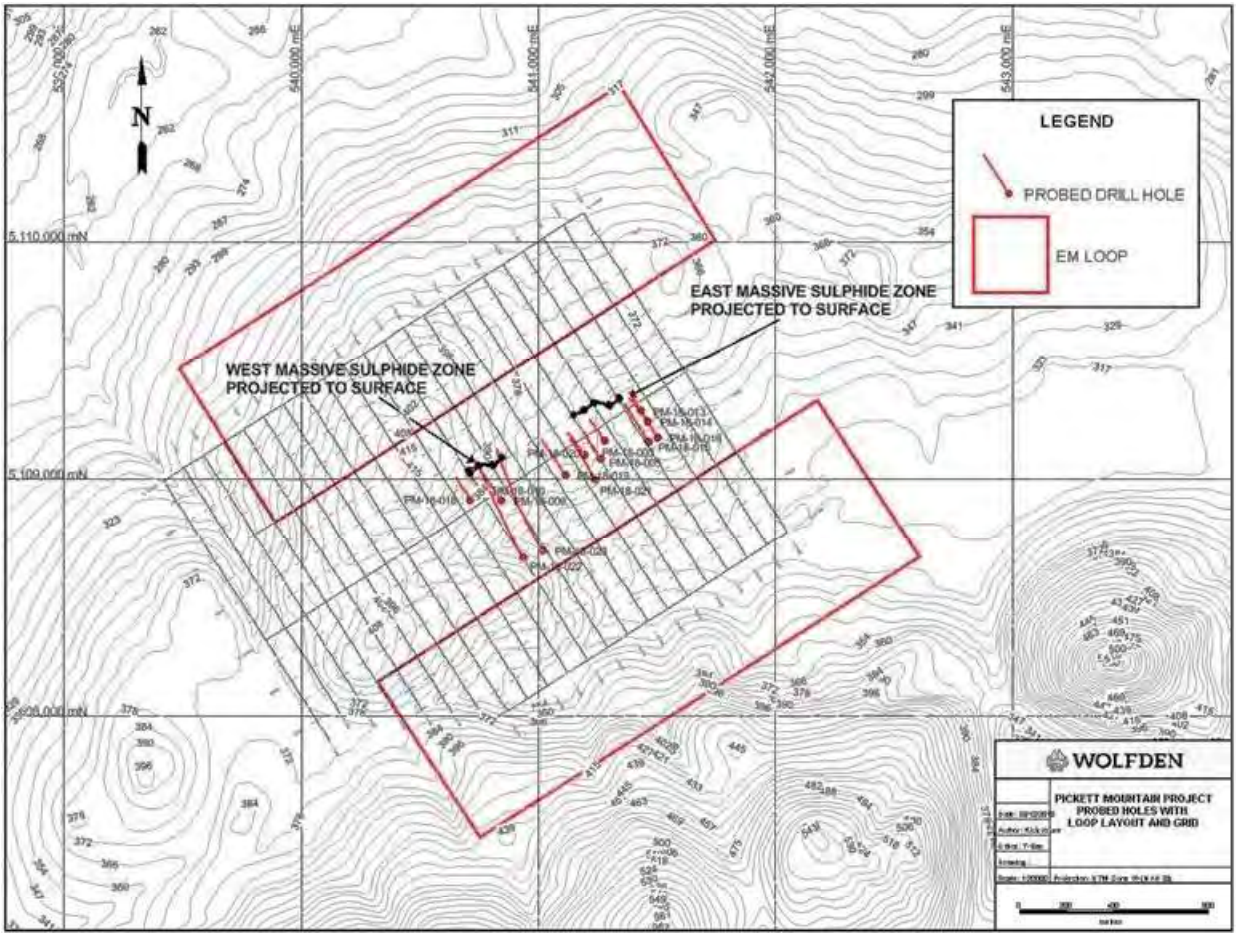



**Figure 9.4 Holes Surveyed by InfiniTEM XL TDEM Survey**

The borehole surveys utilised the InfiniTEM XL configuration and measured the secondary magnetic B-field as well as the axial (A) and orthogonal (U and V) components with the DigiAtlantis™ sensor. Reading intervals for the borehole surveys were at 5m and 10m intervals down-the-hole.

The surveys utilised 2 TX TerraScope 600V, 25A, 18 kW transmitters powered by a Voltmaster 12 kW generator. A DigiAtlantis™ receiver and probe was also employed during the survey.

Modeling of the electromagnetic data by the Maxwell™ software delineated several conductive plates, as shown in Figure 9.5. The known configuration of the West Lens is well reflected by conductive plates over much of its extent while the East Lens exhibits fewer conductive plates. The East Lens may have been subjected to more structural complexities, including folding or offsets. Notably, both the East and West Lenses show potential for expansion from their known extent as reflected by the location of the conductive plates.

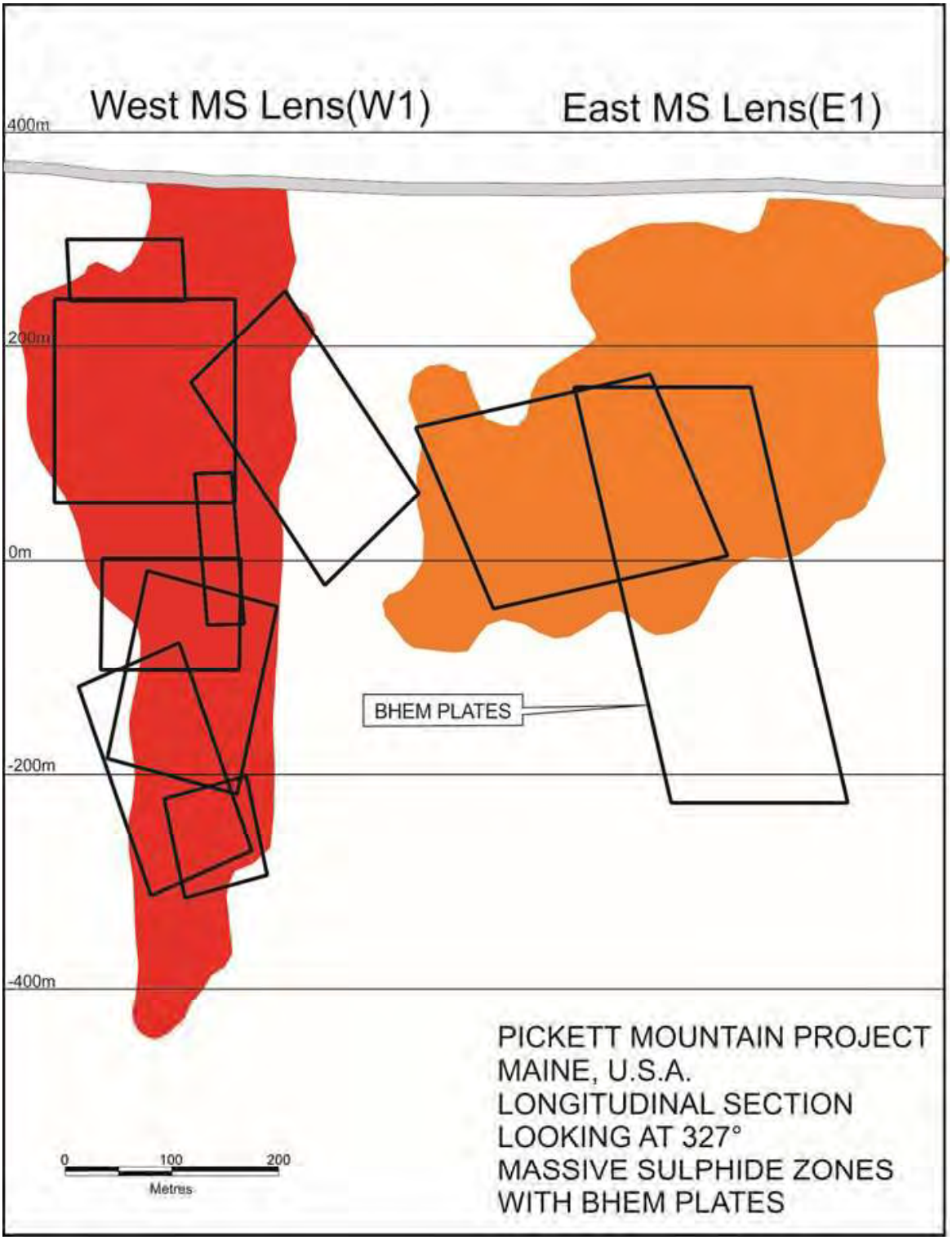



**Figure 9.5 Conductive Plates Defined by the down-the-hole InfiniTEM XL TDEM Survey**

## 9.4 OreVision Induced Polarization Survey (IP)

Abitibi Geophysics completed an OreVision Time Domain Resistivity/Induced Polarization survey on the Pickett Mountain Property during the period of March 24 to April 2, 2018. The purpose of the survey was to identify geophysical signatures over mineralised zones and to define and prioritise targets for future

mineral exploration. In all, the survey totaled 24.75-line-kilometres, comprising the surveying of 15 grid lines spaced 100m apart.

The IP transmitter utilised was the IRIS Instrument TIPIX with a maximum output of 2.2 kW employing a Honda 2000 VA as a power supply. The receiver employed during the survey was an IRIS Elrec-PRO with integrated SwitchPRO featuring 10 input channels. Electrode spacing or "a" spacing was 50m and readings were taken from "n" = 1 to 20.

Detailed interpretation of the pseudo sections reveals a number of chargeability sources or anomalies (Figure 9.6). The strongest chargeable sources were delineated over the East and West Lenses of the Pickett Mountain deposit. Other chargeability anomalies are located primarily to the north of the Pickett Mountain deposit and immediately to the south of it. A prominent chargeability low occupies the southern portion of the survey grid and the northern anomaly may represent a lens in the footwall, 180m from the East Lens.

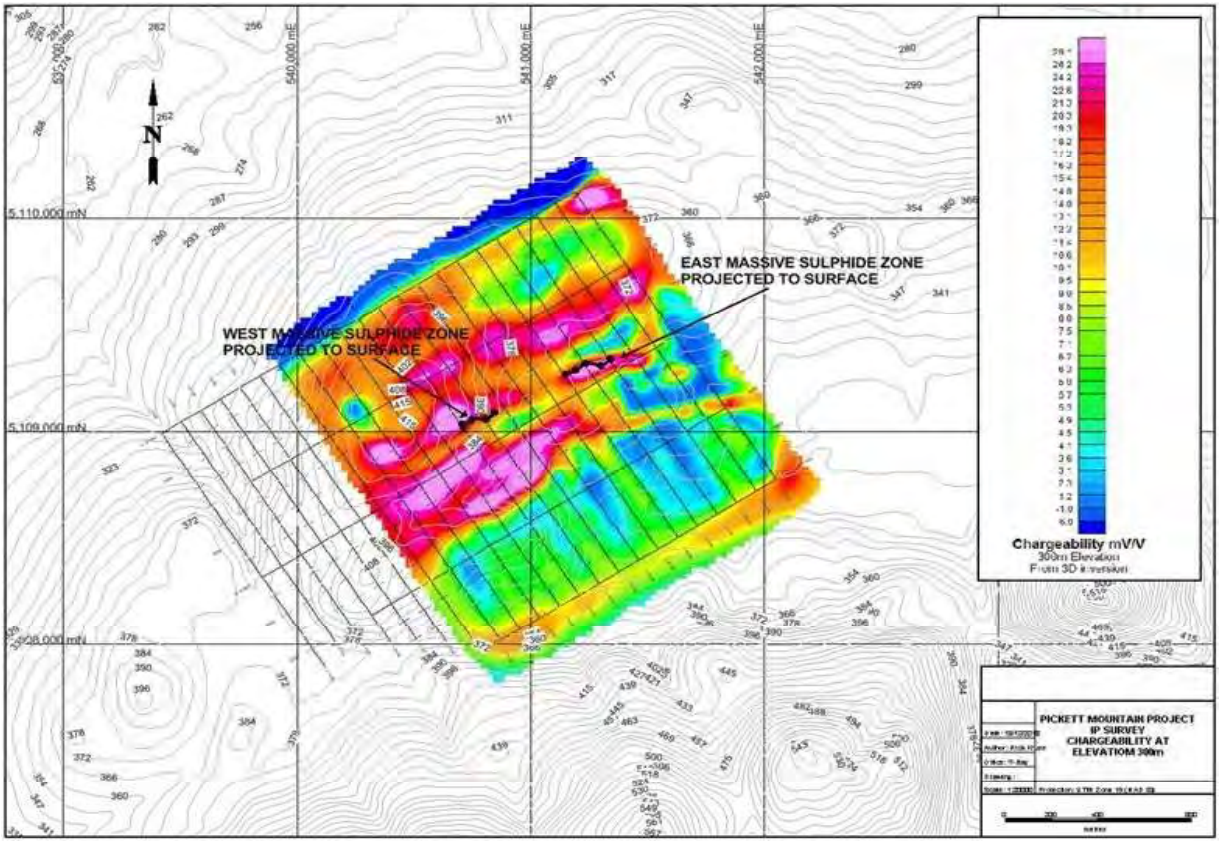



**Figure 9.6 Chargeability Anomalies Defined by the OreVision IP Survey**

Resistivity anomalies were also interpreted by studying the pseudo sections. As was the case with chargeability, both the East and West Lenses of the deposit were manifested by anomalous responses, in his case deep resistivity low trends, reflecting massive sulphide mineralisation (Figure 9.7). A broad area characterised by low resistivity located immediately to the south of the West Lens is thought to be reflecting the presence of sedimentary rocks.

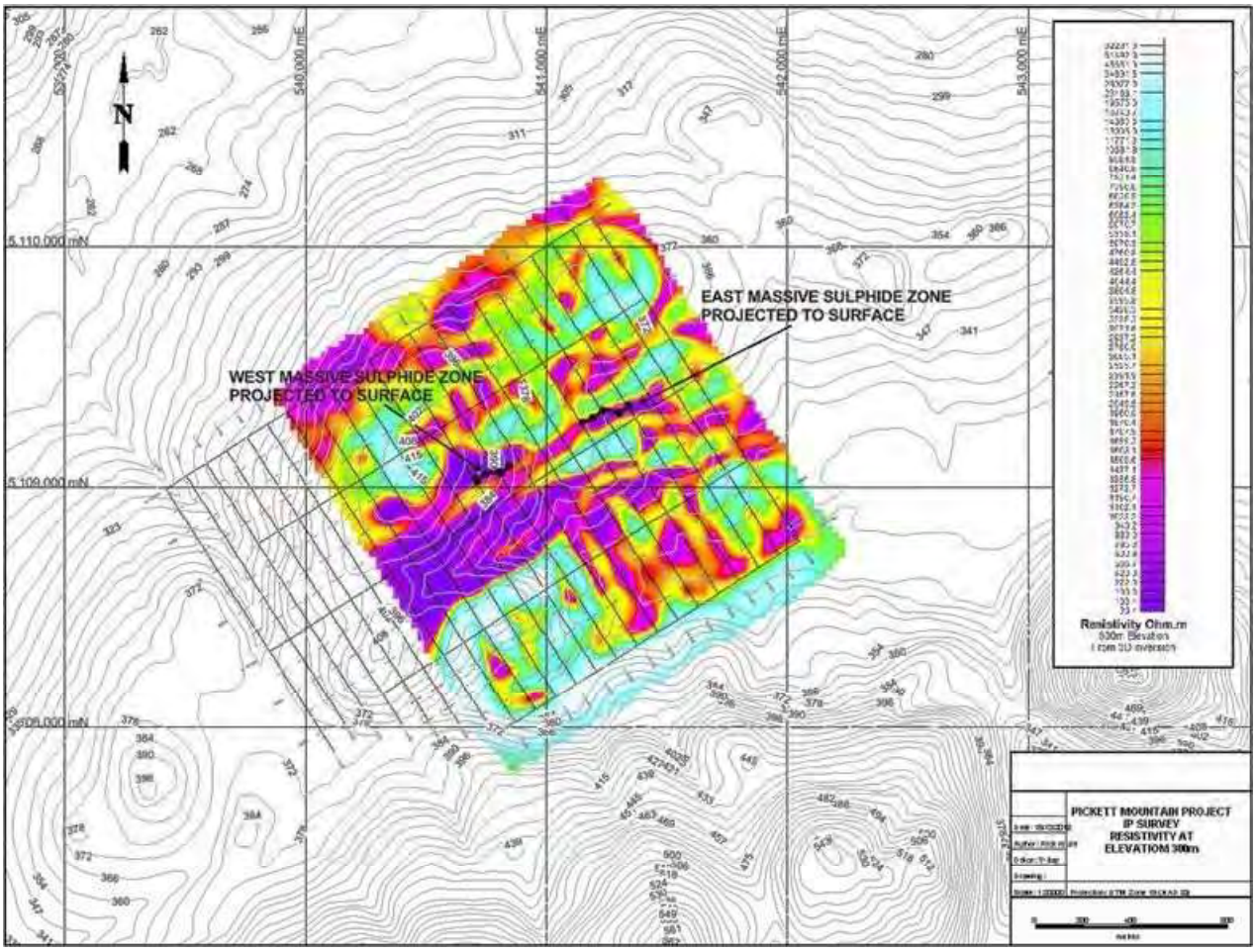



**Figure 9.7 Resistivity Anomalies Defined by the OreVision IP Survey**

## 9.5 Wolfden 2019 Exploration

The primary focus of the 2019 drill program (3,539m) sought to test the expansion potential of the Footwall Zone discovered in late 2018 in hole PM-031. The 2019 drill results completed on the West and East Lens were limited and considered to have no material impact on the 2019 mineral resource statement and, therefore, were not included in the updated 2020 Mineral Resource statement.

Drilling results yielded 7.1m at 24.7% ZnEq. The first wedge hole yielded 9.1m at 9.0% ZnEq. Additional deep drilling and other wedge holes were lost by the drillers and the program was terminated prematurely until a suitable crew could be assembled. Subsequent re-interpretation of the geology in this area has progressed and these ideas will be further tested in the next drill program. Similarly, deeper drilling to test the expansion potential of the West and East Lenses at depth, based on new structural interpretations, are priorities for the next drill program.

Other components of the 2019 program included geological mapping (see Section 7.0 – Geological Setting and Mineralisation) trenching, ground geophysical surveys, borehole EM surveys, whole rock geochemistry, and relogging of historic and Wolfden drill holes. Collectively, these surveys continue to suggest that the deposit and surrounding area holds potential for the expansion know mineralisation and the discovery of other massive sulphide lenses. Many of the historic drill holes in the area (off of the main horizon) contain broad intervals of highly anomalous Zn-Pb values within strongly altered volcanic rocks, similar to those of the Pickett Mountain deposit. An additional large-loop EM geophysical survey was completed during the fourth quarter that identified new drill targets along trend of the East and West Lenses that will be followed up in 2020 with additional ground surveys and diamond drilling.

Numerous quality targets were defined by Wolfden's VTEM airborne geophysical survey. Work on these targets included mapping, whole-rock geochemistry, and soil sampling that collectively, yielded compelling results. These targets have never been previously identified or drilled and Wolfden plans to be in a position to drill test these targets in 2020.

### 9.5.1 Borehole InfiniTEM XL Time Domain Electromagnetic Survey

Borehole EM surveys were completed by Abitibi Geophysics at Pickett Mountain the fall of 2019. In all, 13 drill holes were surveyed. The purpose of the survey was to assist in tracing the extent of massive sulphide mineralisation by the detection of conductors, situated along strike or down-plunge from known mineralisation. Such conductors may reflect the presence of extensions to known mineralisation, or new massive sulphide lenses.

Modeling of the electromagnetic data by Maxwell™ software delineated several conductive plates, as is illustrated on an older version of the longitudinal section below (Figure 9.8). Two conductors plates are located below the extent of massive sulphide at the East 1 Lens and are suggestive of expansion potential, below the 0m elevation (approximately 400m below surface). The upper-most plate was derived from a survey of hole G-066 and the lowermost plate was determined by a survey of hole G-137. These two conductive plates correlate well with the massive sulphide mineralisation in hole G-137A (5.54 ZnEq over 6.45m horizontal width) and supports the extension of mineralisation to hole G-056 (20.8% ZnEq over 0.8m horizontal width) a distance of approximately 175m, along an area where no holes were drilled. Additionally, a conductive plate, seen from hole G-048A, situated at depth associated with a high grade portion of the West Lens, suggests potential for additional mineralisation along trend to the west of the known deposit and in an area that has seen only wide spaced holes. Additional drilling is clearly warranted to test these targets and borehole surveying of the deepest hole, G-098A, so that some Wolfden can gain some insight into the depth extension of the West Lens.

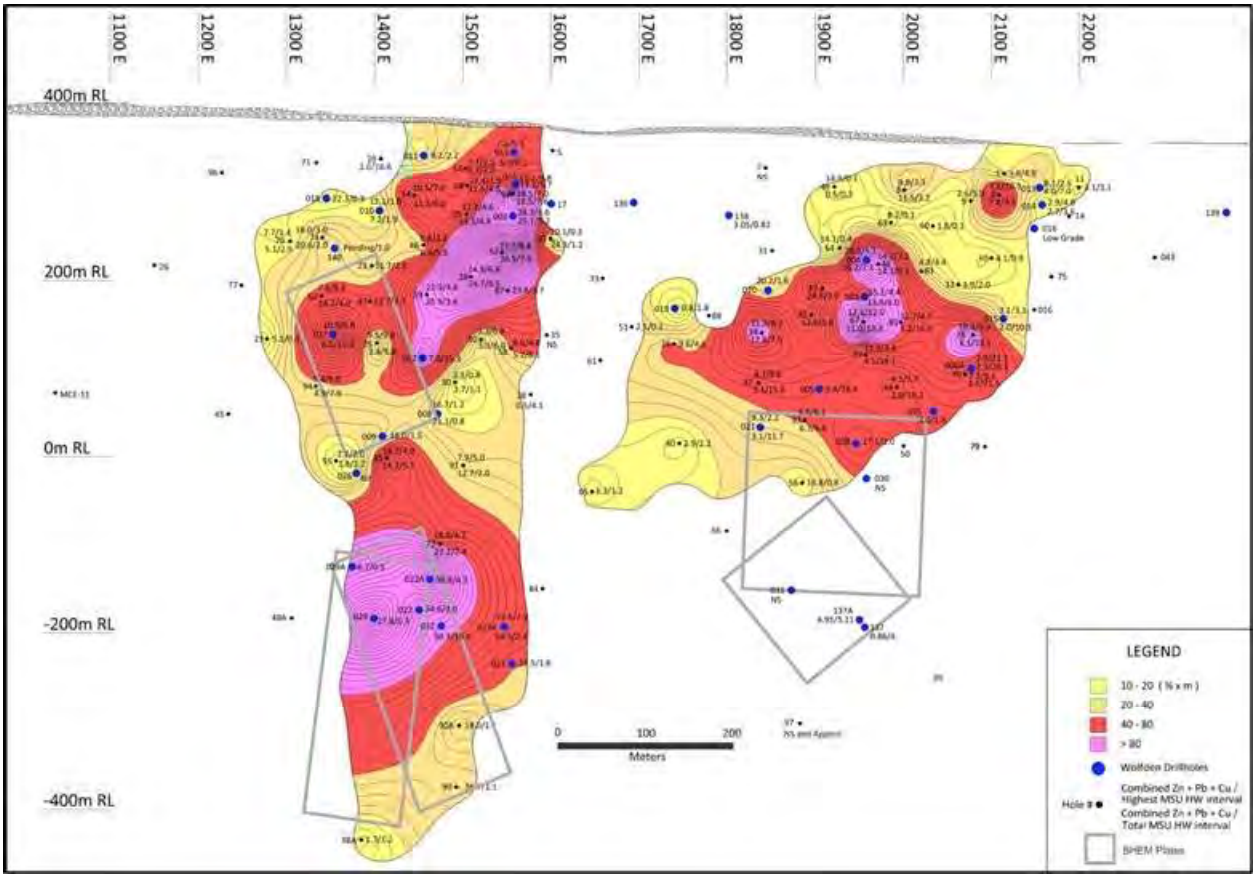



**Figure 9.8 Longitudinal Section Depicting Borehole InfinitTEM XL Time Domain EM Survey, Conductive Plates**

### 9.5.2 Ground InfintiTEM XL Time Domain Electromagnetic Survey

Ground TDEM surveys were also completed by Abitibi Geophysics at Pickett Mountain during October 2019. In all, 29 km of TDEM survey work was completed. The purpose of the survey was to detect conductors over untested stratigraphy, bearing similar electromagnetic signatures exhibited by the known East and West Lenses. The survey utilised the InfiniTEM XL configuration, reading the X, Y, Z, B-field, and dB/dT components, on lines spaced 100m apart.

The 2019 TDEM survey successfully delineated 4 target areas comprising linear sets of conductors (Figure 9.9). Target area A appears to be associated with the easterly extension of the main Pickett Mountain horizon and has been tested in part by 7 historic drill holes. Target areas B, C, and D are new target areas situated away from the known massive sulphide deposits, on portions of the property that have not been tested by drilling. All targets, based on preliminary interpretation, are classified as moderate in strength. Follow-up work is required and warranted to further characterise the nature and cause of these anomalies.

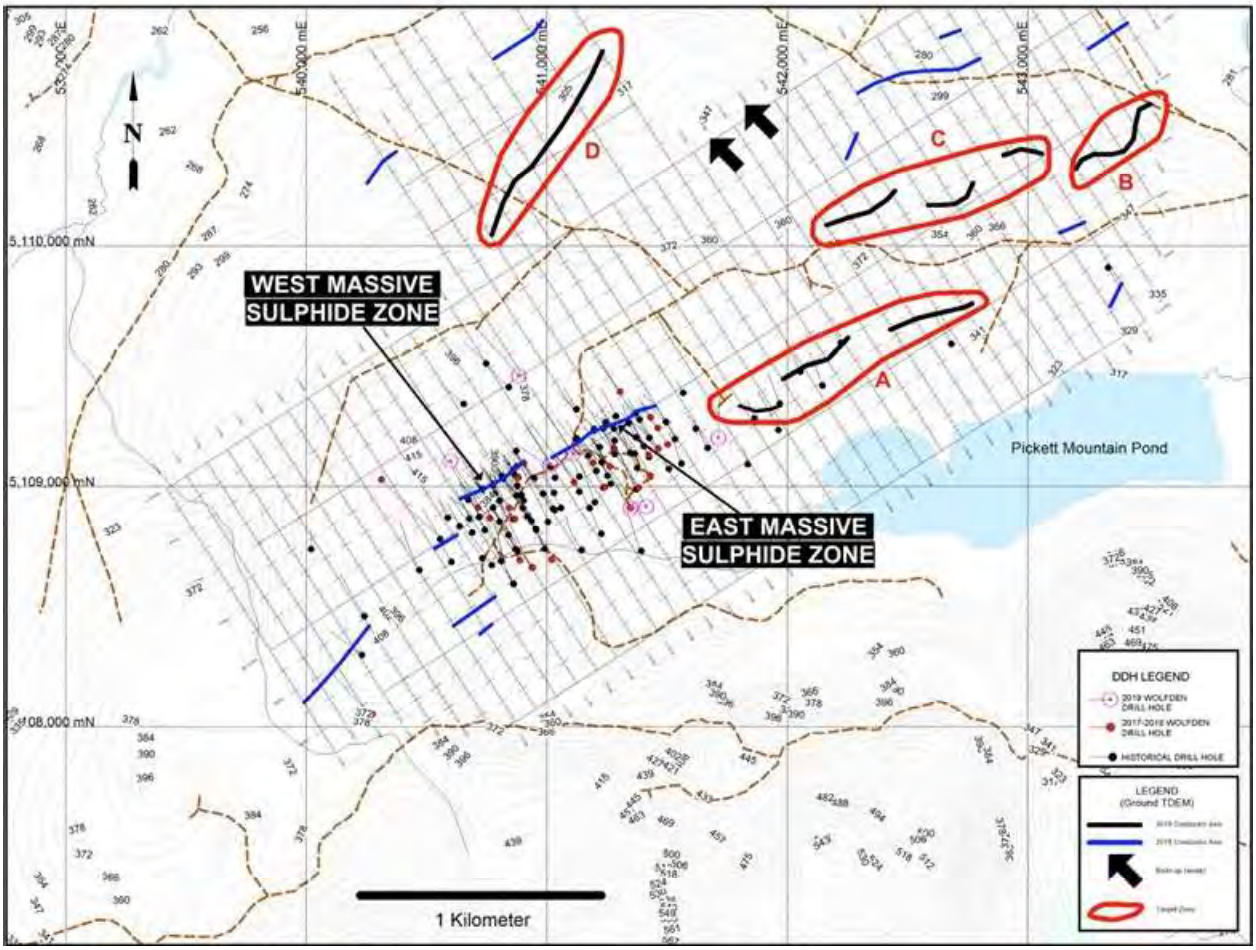



**Figure 9.9 Ground InfiniTEM XL Time Domain EM Survey, Conductors**

### 9.5.3 Gravity Survey

A gravity survey was also completed during 2019 by Great Lakes Exploration, based out of Menominee, Michigan. The purpose of the survey was to establish a density signature for the East and West Lenses and to outline areas of similar density elsewhere in the known deposit locale, in efforts to locate prospective targets for the discovery of additional massive sulphide lenses.

In all, 20 line-kilometres of gravity surveying was completed utilising a La Coste and Romberg Model D gravity meter. Stations were read at 25m and 50m intervals on grid lines spaced 100m apart. Station elevations were established with a high resolution Trimble RTK GPS system, with a base and rover and were processed for maximum accuracy.

Raw gravity data was processed in both Gravmaster® and Oasis Montage® software and both simple and complete bouguer gravity were calculated. Simple bouguer data (density of 2.67) was gridded to produce total, residual, and vertical derivative plots and line profiles were created from the total gravity.

The residual plot reveals gravity anomalies associated with the East and West Lenses, with amplitudes of 0.6 and 0.5 mGals, respectively. In all, 7 residual gravity anomalies were defined, including anomaly 2, a build-up target defined at the end of the survey line. Anomaly 2 yields an amplitude of +0.6 mGals and has only been partially established and will require additional gravity work to fully define its extent. This gravity anomaly may also be associated with a prominent conductor, located immediately to the northeast of it. The residual gravity anomalies defined by the survey are illustrated in Figure 9.10, below.

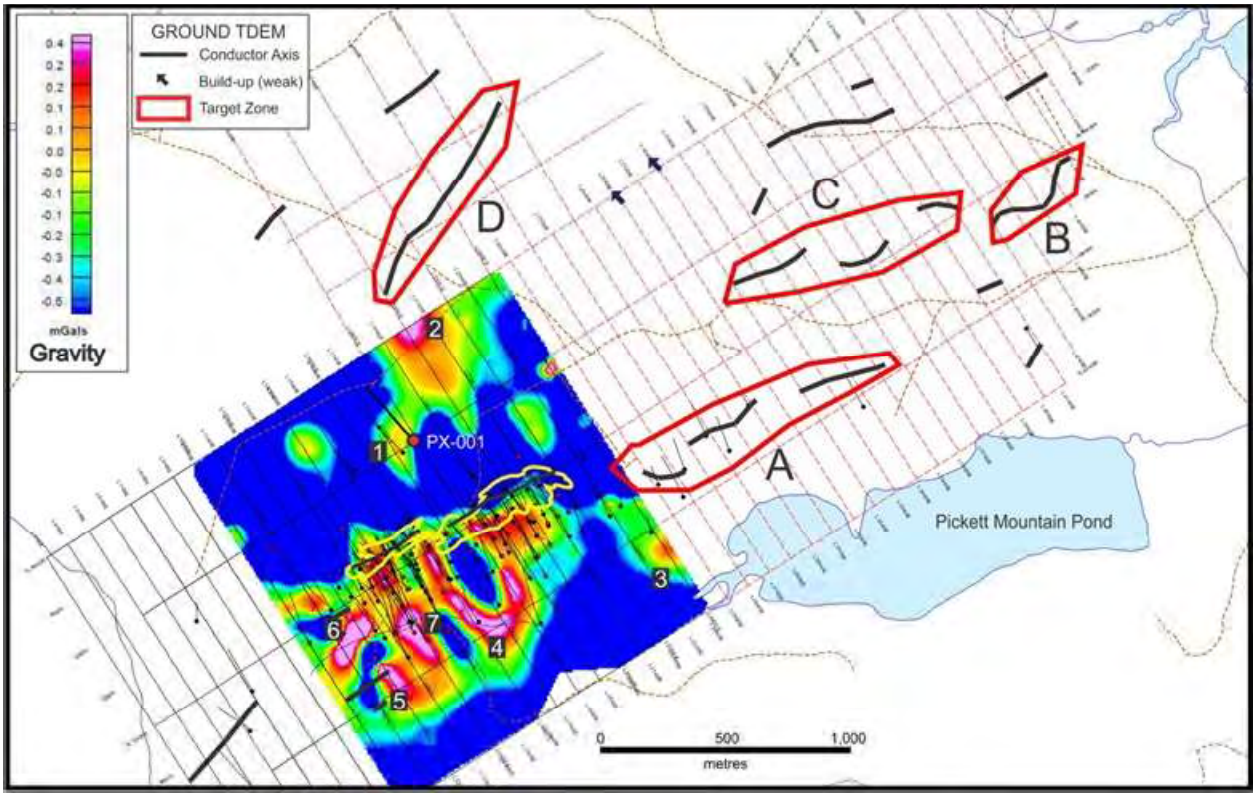



**Figure 9.10 Residual Gravity Anomaly Map**

### 9.5.4 Magnetics Survey

A ground magnetic survey was completed in 2019 at Pickett Mountain by GeoXplore Surveys Inc. of Bathurst, New Brunswick. The survey in total comprised 80 line kilometres-readings were collected at 25m intervals on grid lines spaced 100m apart. The magnetic survey employed a Scintrex Envi-Mag VLF instrument.

The total field magnetic map, shown in Figure 9.11, below, is useful to assist in determining rock types and is particularly helpful in areas of poor outcrop. Magnetic surveys can also assist in characterising alteration patterns (magnetite rich or magnetite poor) and for gleaning structural information.

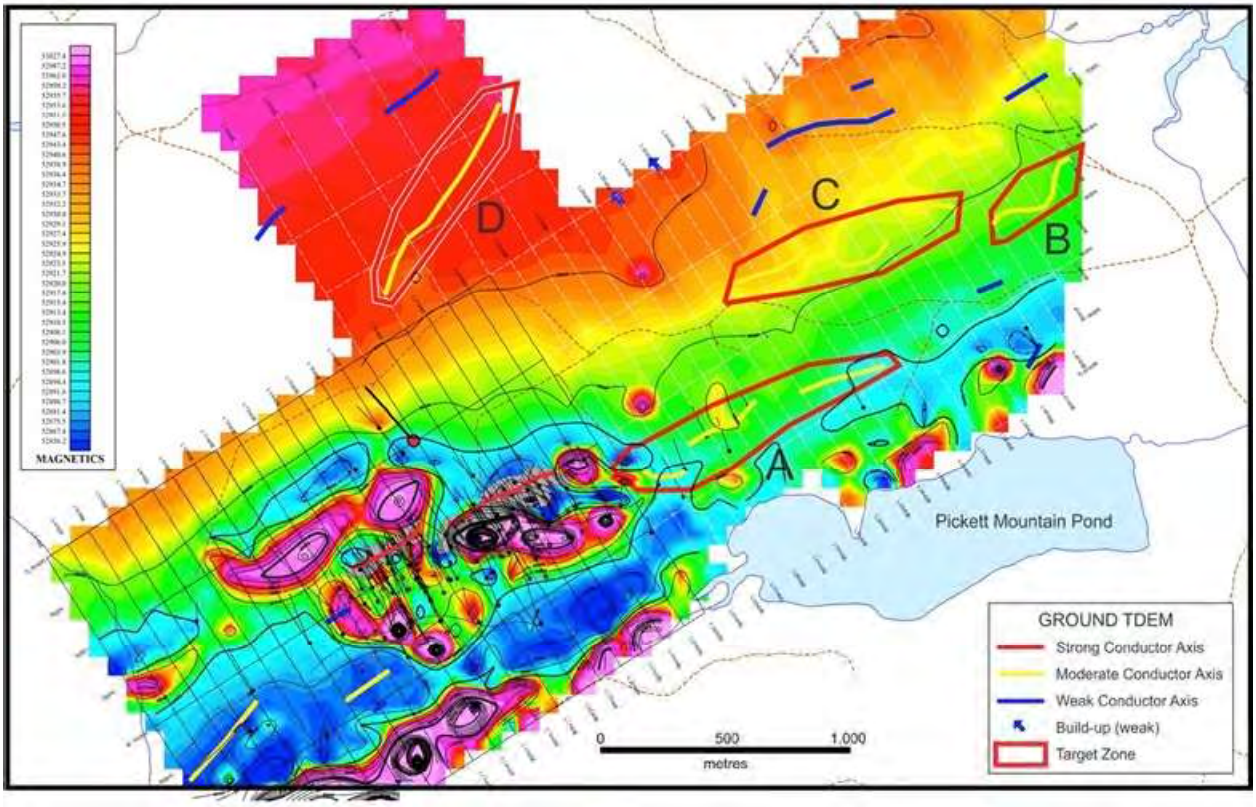



**Figure 9.11 Total Field Magnetic Survey**

The total field map shows a number of discrete magnetic highs flanking the East and West Lenses. The magnetic features situated to the south of the massive sulphide lenses are reflecting the presence of the mafic breccia and gabbro, while the magnetic high immediately to the north of the West Lens, is reflecting the presence of disseminated magnetite in footwall, felsic volcanic rocks.

The magnetic survey, in general, also outlined 2 contrasting domains of magnetic susceptibility. A disrupted domain of variable magnetic signatures is situated in the southern portion of the grid, reflecting various rock types. The northern domain comprises a magnetic high and is likely reflecting the presence of a more homogeneous sequence of rocks. Notably, conductors comprising target C, are located close to the interface of the 2 magnetic domains.

### 9.5.5 Whole Rock Geochemistry

In order to supplement the study of lithotypes and alteration patterns of enveloping rocks hosting the known massive sulphide deposit, whole rock geochemical analyses was completed on numerous samples, collected from outcrop and drill holes associated within the East and West Lenses.

Whole rock analyses were completed by Activation Labs utilising the 4B ICP OES whole rock package. This technique employs a lithium metaborate/tetraborate fusion. The resulting bead is rapidly digested in a weak nitric acid solution. The fusion ensures that the entire sample is dissolved. Whole rock data generated by this technique meets or exceeds the quality of data by conventional fusion XRF.

A primary use of WRA and trace element data is to help identify primary rock types to supplement visual core logging. Plots of relatively immobile elements including Ti versus Al, P versus Nb, and P versus Zr

serve this purpose and have been particularly helpful at Pickett Mountain, in breaking out the various felsic volcanic, volcaniclastic, and intrusive lithotypes, that host mineralisation. The analysis clearly shows that the volcanic stratigraphic sequence hosting the Pickett Mountain deposit is bimodal in nature.

An additional use of the data is to investigate elements that may have been removed from the rocks in up-flow zones beneath the massive sulphides, versus those that have been added to the rocks by the same fluids. This helps to characterise styles of alteration characteristic of the VMS deposit employing a number of alteration indices. Once appropriate alteration indices have been established for a given massive sulphide deposit, such indices can be extrapolated out and utilised elsewhere within a volcanic belt.

At Pickett Mountain, sampling of felsic volcanic rocks north of the East and West Lenses (in the footwall), is characterised by widespread sodium depletion (<1% $Na_20$), due to destruction of the feldspars by ascending hot hydrothermal fluids. Sampling of trenches and drill core in the vicinity of drill hole PX-001, exhibit similar intensities of Na depletion as do footwall rocks immediately below the East and West Lenses. This augurs well for the existence of an additional potential mineralised horizon in and along trend from hole PX-001 and to the southwest of the West Lens, given the similarity in alteration patterns, as is illustrated in Figure 9.12.

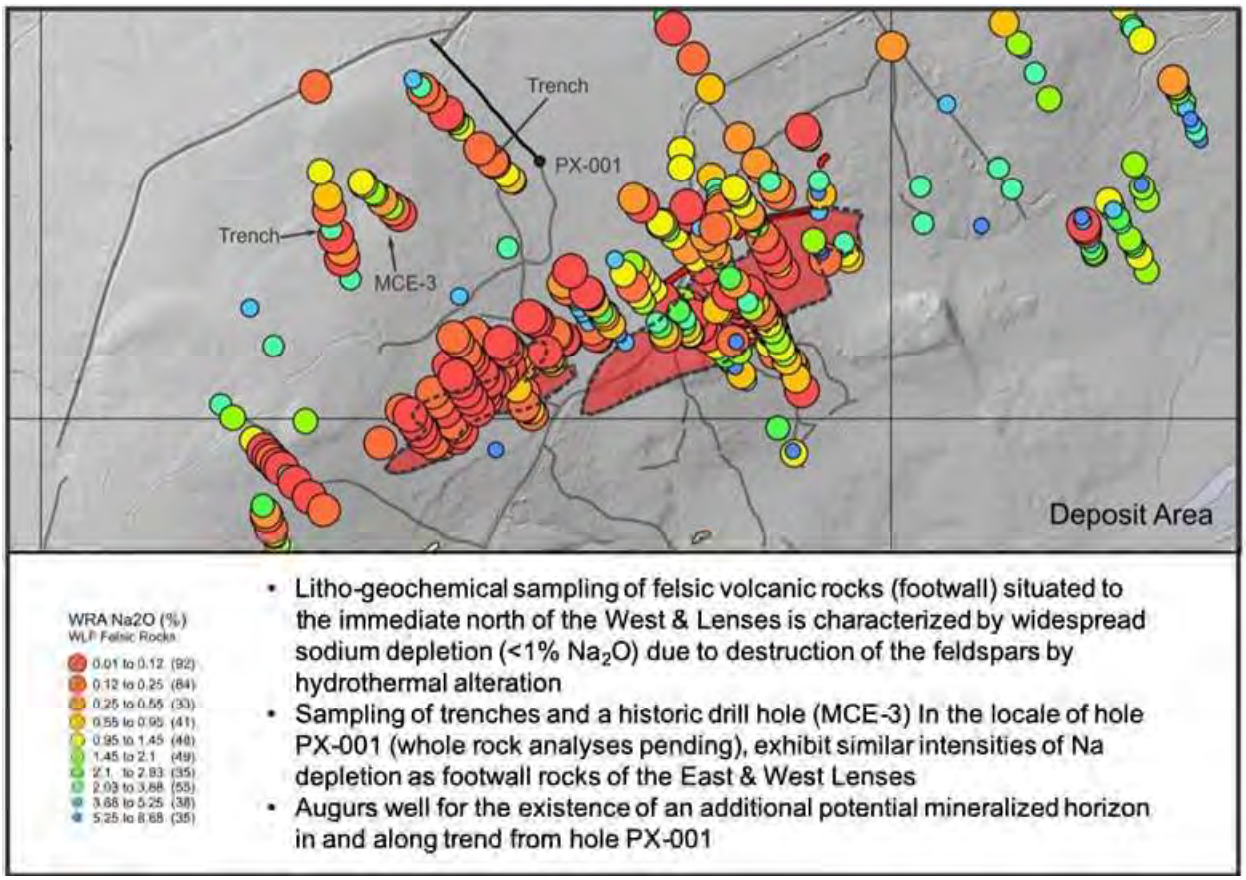



**Figure 9.12 Whole Rock Geochemistry ($Na_20$) in the locale of the East and West Lenses**

### 9.5.6 Soil Geochemistry Compilation

Getty Mines Ltd. completed detailed soil sampling in the locale of the East and West Lenses in the early 1980s. They utilised a grid for tie-in and analysed the soils samples for zinc, lead, copper, and silver, employing an aqua-regia digestion and utilising AA spectrometry for analyses.

The soil geochemistry map (Figure 9.13) clearly shows that both the East and West Lenses are reflected by strong, well defined soil anomalies (Zn + Pb + Cu). There is also a significant component of dispersion of such soil anomalies to the southeast of the massive sulphide lenses, likely due to glacial smearing of overburden in the down-ice direction. The ice direction is from the north-northwest to the south-southeast (170°), as evidenced by the presence of glacial striae observed in outcrops proximal to the East and West Lenses.

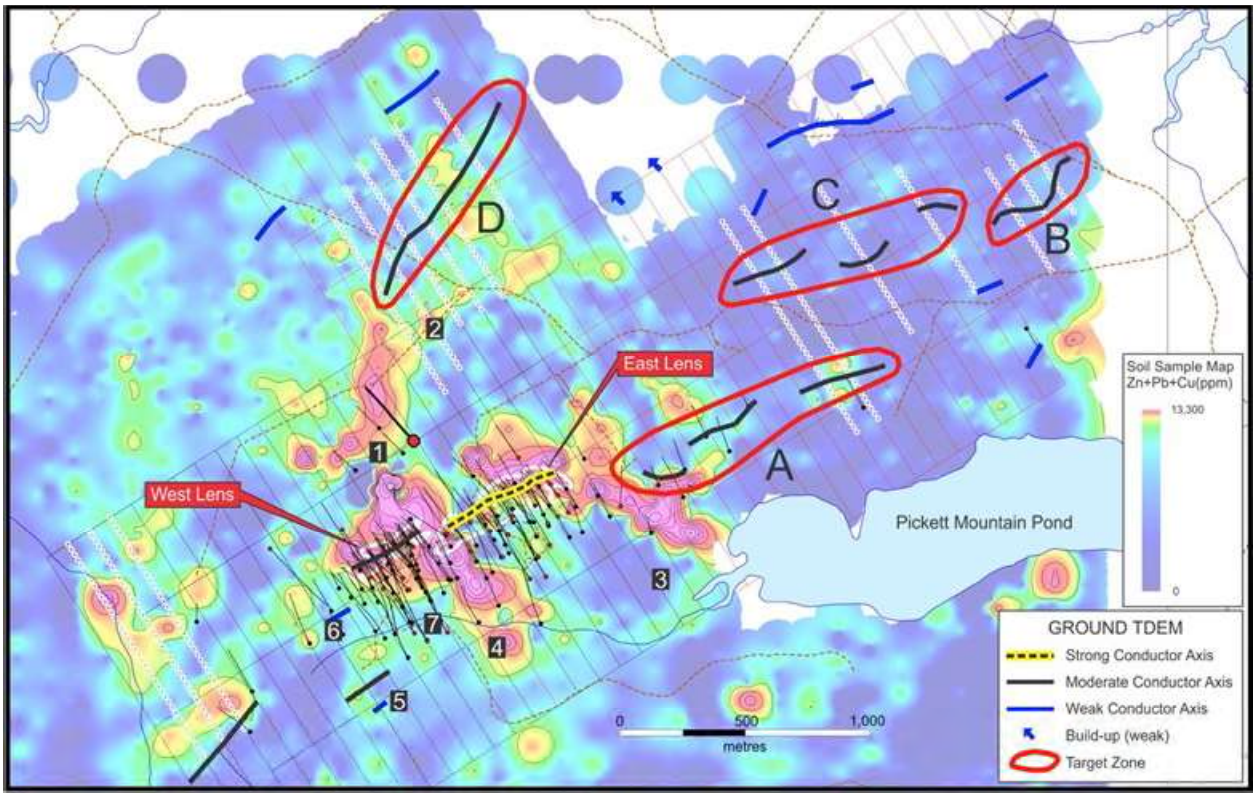



**Figure 9.13 (Zn+Pb+Cu) Compilation Map**

Other soil anomalies defined are compelling targets and warrant further investigation. In particular, a prominent anomaly located immediately to the west of the West Lens on the western fringe of the grid has not been tested by diamond drilling and may represent the southwestern extension of the main Pickett Mountain horizon. Strong soil anomalies persist immediately to the north and upslope from the East and West Lenses. The presence of such anomalies augurs well for the potential discovery of additional footwall lenses of massive sulphide in relation to the main mineralised horizon. Finally, a strong north-northeast trending soil anomaly situated 500m to the north of the East and West Lenses has seen minimal diamond drilling. The extension of this soil anomaly to the north-northeast is coincident with a prominent conductor defined by the ground TDEM survey (Target Zone D).

# 10.0 Drilling

## 10.1 Historic Drilling

Getty Mining and Chevron Resources completed historic diamond drilling programs at Pickett Mountain during the period of 1979 to 1985. The drilling was completed by Kennebec Drilling, based out of Bangor, Maine.

In all, a total of 113 drill holes were completed during this period, for a total meterage of 34,204m. All HQ-, NQ-, and BQ-sized equipment were utilised during these drilling programs. The drill holes were surveyed at the collar and down-the-hole using a Gyro instrument that measured the dip and azimuth every metre. In general, core recovery was averaging over 90%.

The drilling program was successful in that the first drill hole completed, intersected massive sulphide mineralisation. This result subsequently led to an extensive drilling campaign in efforts to determine the size and grade of the new discovery as well as the limits of mineralisation. Of the 113 historic drill holes completed by Getty Mining and Chevron Resources, 74 of them intersected massive sulphide mineralisation bearing significant Zn-Pb-Cu-Ag-Au values Table 7.1). Mineralisation from this drilling was traced over a 900m strike length and to a vertical depth of 750m.

The location, azimuth, and dip for all historic drill holes are summarised in Table 10.1, below. Additionally, the intersected widths and corresponding horizontal widths of all mineralised intercepts generated by the historic drilling, is documented on Table 7.1. It is notable that the general uniformity of grade for the mineral deposit is consistent, with no significant outliers in the assay results.

The data from most of these drill holes are utilised in the Mineral Resource estimate documented in this report. The historic drill core samples were cut in half using a diamond saw and sent to Skyline Laboratories in Tucson, Arizona for analyses. Copper, lead, and zinc were analysed by AA spectrometry while gold and silver were analysed utilising fire-assay techniques. High-grade copper, lead, and zinc assays, obtained by AA, were checked routinely using wet chemistry techniques.

The historical data includes most of the drill core in storage but does not include the original assay certificates. The historical results were compiled by Wolfden using original drill logs, drill sections, working files, reports, and databases prepared by the former owners of the Property at that time and subsequently acquired by Wolfden.

## TABLE 10.1
## SUMMARY OF HISTORIC DIAMOND DRILLING

| Hole Number | Easting (UTM m) | Northing (UTM m) | Elevation (m) | Azimuth | Dip | Total Depth (m) |
|---|---|---|---|---|---|---|
| 1 | 541370.81 | 5109305.38 | 353.02 | 330 | -45 | 91.89 |
| 2 | 541385.58 | 5109278.11 | 350.62 | 328 | -55 | 117.65 |
| 3 | 541836.67 | 5109092.73 | 324.88 | 344 | -50 | 100.58 |
| 4 | 540874.33 | 5109082.93 | 374.24 | 360 | -50 | 24.54 |
| 5 | 540873.19 | 5109147.93 | 374.33 | 150 | -45 | 140.36 |
| 6 | 541123.38 | 5109319.83 | 365.35 | 330 | -50 | 130.75 |
| 7 | 541122.99 | 5109201.08 | 365.47 | 330 | -48 | 112.16 |
| 8 | 541280.06 | 5109239.92 | 356.41 | 334 | -45 | 112.16 |
| 9 | 541341.19 | 5109263.01 | 353.34 | 340 | -60 | 113.68 |
| 10 | 541427.34 | 5109201.69 | 348.61 | 334 | -59 | 246.27 |
| 11 | 541495.30 | 5109268.47 | 345.16 | 329 | -48 | 182.57 |
| 12 | 541620.00 | 5109239.60 | 336.38 | 330 | -60 | 100.27 |
| 13 | 541370.76 | 5109203.18 | 350.17 | 330 | -70 | 213.65 |
| 14 | 541534.18 | 5109196.63 | 350.76 | 337 | -50 | 202.07 |
| 15 | 541567.89 | 5109388.96 | 347.31 | 330 | -50 | 91.44 |
| 16 | 542222.75 | 5109598.30 | 336.15 | 330 | -50 | 91.44 |
| 17 | 541372.95 | 5108988.45 | 339.67 | 330 | -60 | 152.40 |
| 18 | 541034.17 | 5108902.76 | 353.99 | 330 | -60 | 183.18 |
| 19 | 540731.63 | 5108990.83 | 385.09 | 330 | -50 | 213.36 |
| 20 | 540603.01 | 5108685.53 | 380.00 | 330 | -60 | 182.88 |
| 21 | 540018.86 | 5108738.69 | 381.62 | 0 | -45 | 101.80 |
| 22 | 540870.35 | 5108737.85 | 359.93 | 330 | -60 | 166.41 |
| 23 | 540776.62 | 5108911.88 | 377.16 | 329 | -60 | 279.49 |
| 24 | 540776.62 | 5108911.88 | 377.16 | 330 | -80 | 159.72 |
| 25 | 540841.22 | 5108797.24 | 364.85 | 330 | -60 | 361.78 |
| 26 | 540557.09 | 5108780.22 | 387.70 | 330 | -60 | 248.40 |
| 27 | 540241.63 | 5108459.88 | 394.85 | 330 | -60 | 309.05 |
| 28 | 540873.13 | 5108962.11 | 372.48 | 330 | -60 | 266.99 |
| 29 | 540690.59 | 5108808.31 | 378.70 | 330 | -60 | 358.73 |
| 30 | 540918.18 | 5108874.56 | 362.68 | 330 | -60 | 382.81 |
| 31 | 541173.09 | 5109126.88 | 363.27 | 330 | -60 | 228.59 |
| 32 | 540732.62 | 5108700.34 | 372.98 | 330 | -60 | 218.38 |
| 33 | 540947.81 | 5109035.96 | 365.70 | 330 | -60 | 233.78 |
| 34 | 541206.72 | 5109064.11 | 359.35 | 330 | -60 | 334.20 |
| 35 | 540984.57 | 5108970.01 | 360.09 | 330 | -60 | 334.35 |
| 36 | 541135.80 | 5108977.89 | 353.54 | 330 | -60 | 325.21 |
| 37 | 541234.91 | 5108994.81 | 351.16 | 330 | -66 | 386.16 |
| 38 | 541024.66 | 5108906.73 | 354.99 | 330 | -65 | 453.22 |
| 39 | 541283.48 | 5109135.14 | 355.68 | 330 | -65 | 328.25 |
| 40 | 541178.09 | 5108910.90 | 343.64 | 330 | -65 | 453.22 |
| 41 | 540877.61 | 5108731.32 | 359.81 | 330 | -65 | 322.16 |
| 42 | 540955.90 | 5108818.48 | 354.28 | 330 | -65 | 213.65 |
| 43 | 541669.01 | 5109158.94 | 335.36 | 330 | -65 | 288.63 |
| 44 | 541366.42 | 5109135.30 | 348.11 | 330 | -73 | 438.28 |
| 45 | 540771.49 | 5108671.72 | 370.71 | 330 | -70 | 495.89 |
| 46 | 541282.58 | 5109189.47 | 354.58 | 330 | -65 | 179.82 |
| 47 | 541220.87 | 5109162.47 | 360.45 | 330 | -70 | 232.55 |
| 48 | 540811.17 | 5108688.33 | 367.64 | 335 | -75 | 471.50 |
| 48A | 540811.17 | 5108688.33 | 367.64 | 335 | -75 | 806.77 |
| 49 | 541195.64 | 5109231.09 | 361.41 | 335 | -58 | 92.35 |
| 50 | 541376.35 | 5109077.55 | 344.37 | 335 | -77 | 524.23 |
| 51 | 541034.45 | 5109036.36 | 360.61 | 333 | -70 | 249.01 |
| 52 | 540818.36 | 5109031.73 | 380.03 | 333 | -62 | 151.78 |
| 53 | 540878.27 | 5109002.47 | 372.41 | 335 | -60 | 197.20 |
| 54 | 540783.22 | 5108970.38 | 381.00 | 333 | -50 | 161.54 |
| 55 | 540811.63 | 5108689.10 | 367.65 | 339 | -60 | 599.54 |
| 56 | 541266.56 | 5109011.47 | 350.37 | 334 | -73 | 453.83 |
| 57 | 540866.03 | 5109050.23 | 374.54 | 337 | -61 | 132.28 |

**TABLE 10.1**
**SUMMARY OF HISTORIC DIAMOND DRILLING**
***(CONTINUED)***

| Hole Number | Easting (UTM m) | Northing (UTM m) | Elevation (m) | Azimuth | Dip | Total Depth (m) |
|---|---|---|---|---|---|---|
| 58 | 540904.10 | 5108941.50 | 368.42 | 338 | -62 | 337.09 |
| 59 | 540776.92 | 5109003.32 | 382.87 | 335 | -80 | 237.12 |
| 60 | 541288.58 | 5109292.07 | 356.59 | 274 | -88.5 | 115.21 |
| 61 | 541031.16 | 5108973.11 | 358.11 | 335 | -73 | 334.04 |
| 62 | 540719.45 | 5108872.77 | 379.53 | 335 | -65 | 411.46 |
| 63 | 541245.53 | 5109266.18 | 358.90 | 336 | -80 | 119.17 |
| 64 | 541196.86 | 5109239.11 | 361.03 | 301 | -89 | 152.70 |
| 65 | 541060.01 | 5108911.26 | 352.35 | 335 | -73 | 510.21 |
| 66 | 541200.47 | 5108933.74 | 345.62 | 340 | -73 | 600.46 |
| 67 | 541234.24 | 5109240.72 | 358.78 | 207 | -90 | 257.24 |
| 68 | 540813.23 | 5109043.25 | 380.72 | 337 | -78 | 149.65 |
| 69 | 540813.30 | 5109042.80 | 380.59 | 335 | -83 | 164.89 |
| 70 | 541424.32 | 5109121.70 | 347.08 | 335 | -66 | 387.38 |
| 71 | 540672.74 | 5108944.46 | 389.61 | 334 | -64.5 | 160.93 |
| 72 | 540953.60 | 5108823.49 | 354.68 | 329 | -64.5 | 565.07 |
| 73 | 541013.59 | 5109081.09 | 365.29 | 301 | -66.5 | 184.40 |
| 74 | 540720.44 | 5108873.57 | 379.43 | 336.5 | -56.5 | 181.04 |
| 75 | 541560.37 | 5109094.72 | 344.30 | 339 | -66.5 | 295.34 |
| 76 | 540678.28 | 5108866.87 | 384.40 | 337 | -59 | 241.39 |
| 77 | 540636.86 | 5108835.05 | 386.43 | 337 | -62.5 | 242.32 |
| 78 | 541403.82 | 5109167.83 | 348.06 | 338.5 | -65 | 297.78 |
| 79 | 541508.48 | 5109073.72 | 341.26 | 334 | -65 | 455.20 |
| 80 | 540899.87 | 5108911.40 | 367.25 | 335 | -56 | 345.02 |
| 81 | 541347.38 | 5109138.78 | 349.80 | 333.5 | -59 | 273.39 |
| 82 | 540803.61 | 5108853.57 | 369.85 | 331 | -54 | 294.73 |
| 83 | 541348.29 | 5109139.39 | 349.71 | 339 | -46 | 261.20 |
| 84 | 541005.67 | 5108853.87 | 352.60 | 338 | -70 | 611.09 |
| 85 | 540859.54 | 5108862.82 | 367.14 | 331 | -67 | 450.47 |
| 86 | 540803.13 | 5108940.86 | 377.78 | 337 | -55 | 208.78 |
| 87 | 540895.03 | 5108965.40 | 370.21 | 338 | -59 | 254.80 |
| 88 | 541135.56 | 5109040.81 | 361.28 | 337.5 | -64 | 261.20 |
| 89 | 541226.32 | 5108802.15 | 338.03 | 336 | -73 | 492.84 |
| 90 | 540992.25 | 5108739.72 | 347.20 | 337 | -68 | 886.01 |
| 90A | 540992.25 | 5108739.72 | 347.20 | 337 | -68 | 791.53 |
| 91 | 540935.17 | 5108856.23 | 359.46 | 336 | -67 | 602.13 |
| 92 | 541228.45 | 5109100.87 | 358.56 | 339 | -65 | 260.59 |
| 93 | 541251.87 | 5109044.19 | 353.67 | 336.5 | -70 | 355.38 |
| 94 | 540743.10 | 5108817.77 | 372.77 | 338 | -67 | 373.97 |
| 95 | 540231.95 | 5108298.99 | 406.55 | 315 | -60 | 263.64 |
| 96 | 540588.38 | 5108870.09 | 393.63 | 334.5 | -50 | 138.07 |
| 97 | 541400.02 | 5108730.94 | 328.59 | 337 | -69 | 953.06 |
| 98 | 540863.16 | 5108594.94 | 382.21 | 330 | -75 | 749.16 |
| 98A | 540863.16 | 5108594.94 | 382.21 | 330 | -75 | 944.22 |
| 99 | 541145.16 | 5108737.09 | 336.66 | 325 | -80 | 762.30 |
| MCE-1 | 542683.15 | 5109593.93 | 337.60 | 330 | -55 | 214.57 |
| MCE-2 | 540842.26 | 5109411.65 | 376.68 | 315 | -45 | 158.79 |
| MCE-3 | 540747.18 | 5109510.09 | 383.26 | 315 | -50 | 199.63 |
| MCE-4 | 540656.83 | 5109340.40 | 394.31 | 310 | -50 | 184.40 |
| MCE-5 | 543334.79 | 5109910.38 | 339.53 | 150 | -55 | 159.77 |
| MCE-6 | 541863.34 | 5109282.79 | 331.46 | 340 | -55 | 130.75 |
| MCE-7 | 541967.88 | 5109344.40 | 328.85 | 340 | -55 | 227.06 |
| MCE-8 | 542055.06 | 5109477.16 | 331.40 | 335 | -55 | 224.02 |
| MCE-9 | 541963.69 | 5109234.86 | 324.62 | 338 | -62 | 321.85 |
| MCE-10 | 542146.93 | 5109419.86 | 327.16 | 340 | -65 | 306.61 |
| MCE-11 | 540469.52 | 5108651.52 | 383.52 | 335 | -60 | 398.05 |
| | | | | | Total | 19459.17 |

## 10.2 Wolfden Drilling

Wolfden completed a drilling program comprising 38 drill holes totaling 15,451m during the period of December 2017 to December 2018. The drilling was completed by Downing Drilling Inc., based out of Duluth, Minnesota. Drilling performed in 2019 and 2020 was not included in the Mineral Resource estimate.

Both NQ- and HQ-sized equipment was utilised in the Wolfden drilling program. Drill holes were surveyed at the collar and down-the-hole using a Gyro instrument, every 30m down-the-hole. Core recovery was greater than 95%.

Most of the holes were drilled in the locale of the known Pickett Mountain deposit, largely directed at confirming the nature, grade, and extent of the massive sulphide deposit. The holes were intended largely as fill-in holes and a few were twinned holes to validate the historical drill findings obtained by Getty and Chevron during their earlier drilling campaigns. Step-out holes, along trend and down-plunge from the known mineralisation, were also completed by Wolfden, in efforts to determine the limits of massive sulphide mineralisation and to explore for additional massive sulphide lenses.

In general, the Wolfden drilling program was successful in that it did confirm and verify the nature, grade, and extent of the massive sulphide deposit in relation to the historic work. The infill component of Wolfden's drilling program largely demonstrated continuity of massive sulphide mineralisation in locales where there were significant gaps along strike and at depth, in the historic drilling. In particular, deeper drilling below the 400m level at the site of the West Lens (W1) was successful in intersecting high-grade base and precious metal mineralisation and is an instrumental component in the new NI 43-101 compatible Mineral Resource estimate, documented in this report.

The step-out component of Wolfden's drilling program also generated success with the discovery of a potential new massive sulphide lens located in the footwall, 180m to the north of the known massive sulphide deposit (E1-E2 Lens). The New Footwall Lens yielded an intercept of 4.1m at 38.2% ZnEq, including 16.6% Zn, 8.4% Pb, 1.9% Cu, 612.0 g/t Ag, and 0.5 g/t Au in drill hole PM-18-031. Further drilling to test the continuity of this new lens is clearly warranted.

Drill hole locations, azimuth, and inclination for Wolfden drill holes are included in Table 10.2. The intersected widths and corresponding horizontal widths of all mineralised intercepts obtained in the Wolfden drilling program are documented in Table 7.1.

The location of the historic drill holes and Wolfden drill holes are illustrated on Figure 10.1. Total metreage for both the historical and Wolfden drilling campaigns is 49,665, comprising 151 drill holes.

## TABLE 10.2
## SUMMARY OF WOLFDEN DIAMOND DRILLING

| Hole Number | Easting (UTM m) | Northing (UTM m) | Elevation (m) | Azimuth | Dip | Total Depth (m) |
|---|---|---|---|---|---|---|
| PM-17-001 | 540881.9 | 5109037.7 | 372.7 | 327 | -46 | 168 |
| PM-17-002 | 540882.3 | 5109037.0 | 372.7 | 327 | -61 | 180 |
| PM-18-003 | 541278.9 | 5109158.7 | 356.4 | 327 | -64 | 234 |
| PM-18-004 | 541278.7 | 5109160.1 | 356.3 | 327 | -50 | 378 |
| PM-18-005 | 541262.7 | 5109084.4 | 355.2 | 327 | -68 | 354 |
| PM-18-006 | 541422.6 | 5109131.5 | 346.5 | 333 | -63 | 33 |
| PM-18-007 | 540843.9 | 5108911.0 | 372.3 | 327 | -62 | 465 |
| PM-18-008 | 540844.0 | 5108910.9 | 372.2 | 327 | -69 | 495.5 |
| PM-18-009 | 540867.7 | 5108865.1 | 366.5 | 316.5 | -60.5 | 447 |
| PM-18-010 | 540755.5 | 5108954.2 | 381.7 | 327 | -55 | 198 |
| PM-18-011 | 540778.5 | 5109012.0 | 382.9 | 327 | -45 | 106.5 |
| PM-18-012 | 540860.8 | 5109070.2 | 375.9 | 327 | -45 | 99 |
| PM-18-013 | 541431.9 | 5109286.8 | 349.1 | 327 | -45 | 120 |
| PM-18-014 | 541462.2 | 5109242.0 | 347.8 | 327 | -45 | 171 |
| PM-18-015 | 541463.6 | 5109158.1 | 350.3 | 327 | -55 | 312 |
| PM-18-016 | 541502.6 | 5109175.0 | 351.7 | 327 | -55 | 312 |
| PM-18-017 | 540905.1 | 5109095.1 | 369.8 | 327 | -69 | 120 |
| PM-18-018 | 540713.5 | 5108912.7 | 383.6 | 327 | -55 | 192 |
| PM-18-019 | 541113.1 | 5109018.3 | 358.8 | 327.0 | -55.0 | 298 |
| PM-18-020 | 541193.0 | 5109099.5 | 362.7 | 327.0 | -63.0 | 237 |
| PM-18-021 | 541241.3 | 5108996.6 | 351.0 | 327.0 | -63.0 | 420 |
| PM-18-022 | 540938.7 | 5108664.0 | 369.4 | 329.0 | -58.0 | 759 |
| PM-18-022A | 540938.7 | 5108664.0 | 369.4 | 329.0 | -58.0 | 699 |
| PM-18-023 | 541020.3 | 5108694.6 | 349.2 | 327.0 | -58.0 | 801 |
| PM-18-023A | 541020.3 | 5108694.6 | 349.2 | 327.0 | -58.0 | 750.0 |
| PM-18-024 | 540275.2 | 5108052.8 | 381.7 | 310.0 | -70.0 | 597 |
| PM-18-025 | 541304.7 | 5109393.7 | 357.9 | 329.5 | -50.0 | 258 |
| PM-18-026 | 540887.6 | 5108692.3 | 363.2 | 326.0 | -57.0 | 585 |
| PM-18-027 | 540762.4 | 5108868.5 | 374.3 | 321.5 | -65.0 | 336 |
| PM-18-028 | 541383.2 | 5108995.7 | 339.4 | 328.9 | -60.0 | 708 |
| PM-18-029 | 540940.9 | 5108662.1 | 369.3 | 325.5 | -62 | 771 |
| PM-18-029A | 540940.9 | 5108662.1 | 369.3 | 325.5 | -62 | 753 |
| PM-18-030 | 541383.5 | 5108995.3 | 339.4 | 325.5 | -74 | 651 |
| PM-18-031 | 541349.7 | 5108910.0 | 336.9 | 326.3 | -69.2 | 846 |
| PM-18-032 | 540887.7 | 5108692.4 | 363.2 | 335 | -60 | 705 |
| PM-18-033 | 540513.0 | 5113880.0 | 313.9 | 340 | -50 | 250 |
| PM-18-034 | 540312.0 | 5109030.0 | 402.7 | 140 | -55 | 522 |
| PM-18-035 | 541430.0 | 5109044.0 | 339.0 | 331 | -59 | 537 |

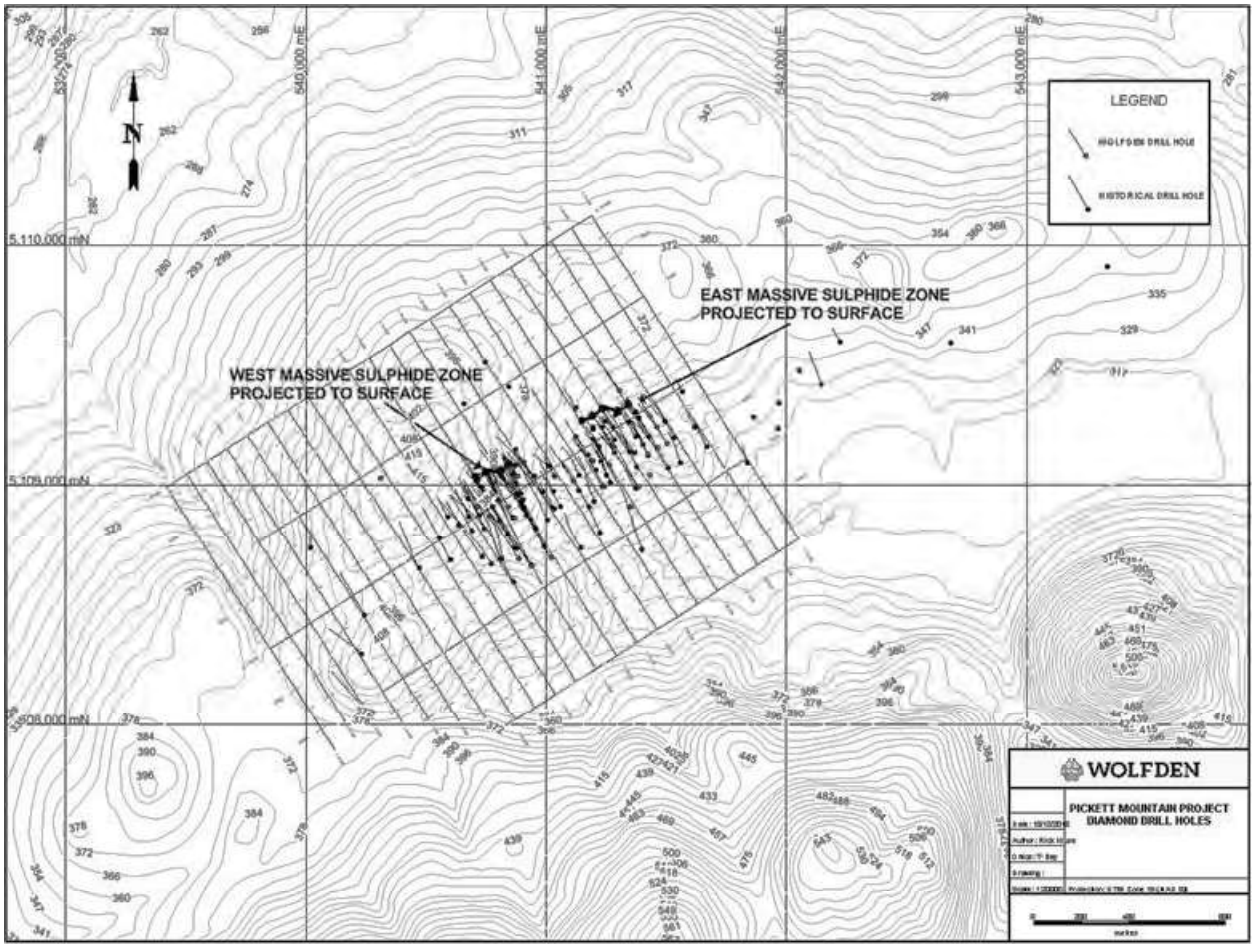



**Figure 10.1 Location of Historical and Wolfden Drill Holes**

### 10.2.1 Wolfden Drilling 2019

In 2019, Wolfden completed 3,530m of diamond drilling. Six holes were drilled from the surface and an additional 9 holes (both Wolfden and historic) were reamed out and/or extended for the purpose of completing down-hole EM surveys. The drilling was undertaken by Progressive Diamond Drilling Inc., based out of Sussex, New Brunswick and its United States subsidiary. Drill holes completed by Wolfden in 2019 are illustrated on the map below (Figure 10.2). One hole (PM-140) was drilled purely for the purposes of future metallurgical testing and as a result, has been placed in cold storage without assay until such time.

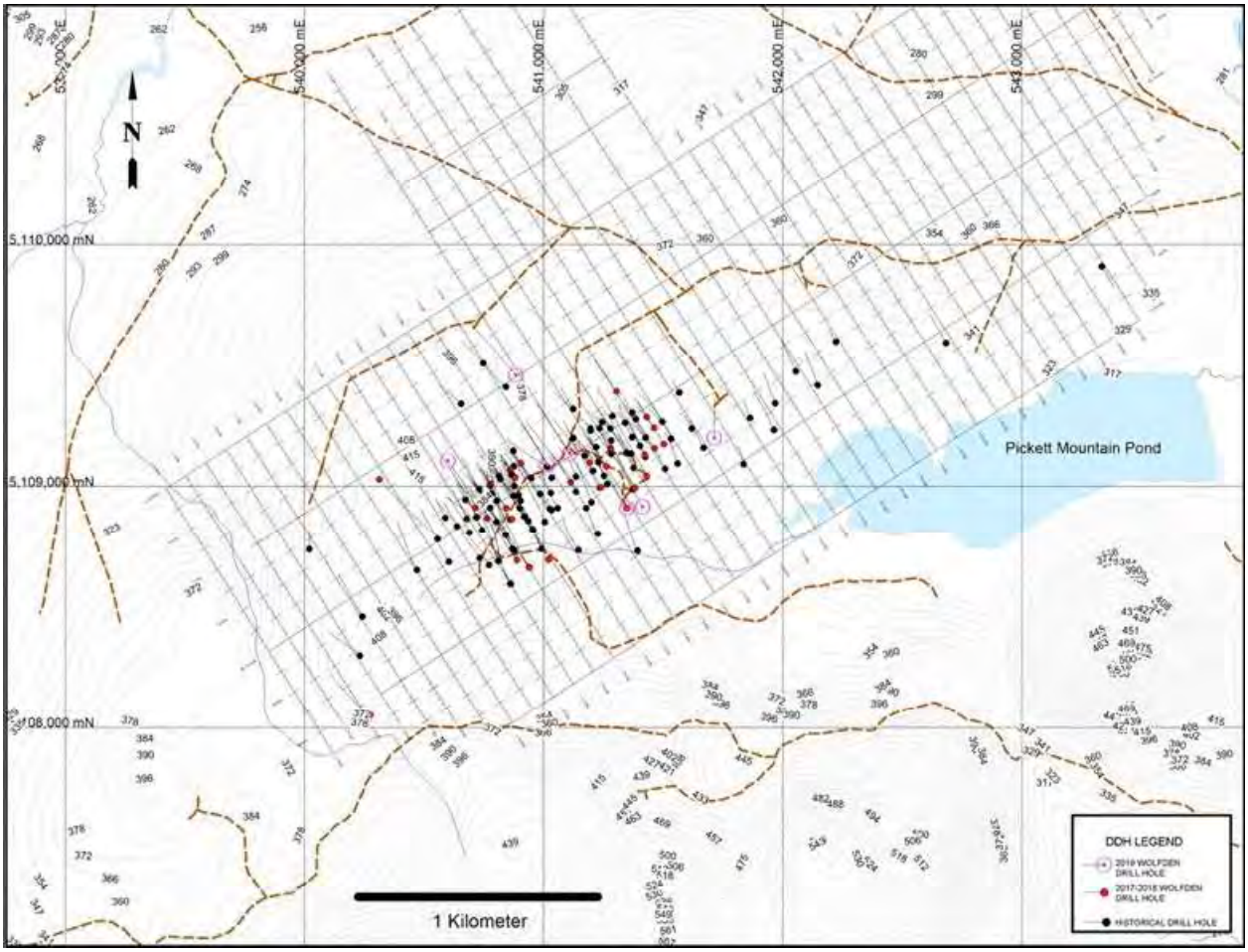



**Figure 10.2 Location of All Drill Holes and Wolfden 2019 Drill Holes**

As part of the 2019 drill program, 8 previous drill holes were reamed for down- hole geophysics (borehole electromagnetics – BHEM). All holes were successfully surveyed and the results confirmed this technique can be used to identify the East and West Lens extensions at depth that occur within a 100-200m distance of the hole. Although obvious depth potential exists with both lenses from 400m to 800m below surface and perhaps beyond, the next drill will prioritise near surface targets (conductors) with coincident soil and whole rock geochemical signatures. For more details on the 2019 drill results, please also refer to the Wolfden Resources Corporation Annual Information Form, filed on SEDAR April 28, 2020.

At depth on the East Lens, hole 137A, a wedge hole off of hole 137, targeting the deeper FWZ, unexpectedly intersected 9.6m of the East Lens at 6.7% ZnEq (3.0% Zn, 1.3% Pb, 0.5% Cu, 54.0 g/t Ag, and 0.3 g/t Au) in semi massive to massive sulphides that includes a higher-grade portion of 2.6m at 11.7% ZnEq (6.2% Zn, 2.7% Pb, 0.4% Cu, 109.4 g/t Ag, and 0.3 g/t Au). Hole 137 also intersected the East Lens yielding 3.5m at 2.3% ZnEq. A subsequent BHEM survey of hole 137A and another nearby historic hole, yielded strong build-up conductors, suggesting potential expansion of the East Lens at depths of 400 to 700 vertical metres.

Drill hole PX-001, the last hole completed in the 2019 exploration program, tested an historic drill hole with coincident gravity and soil anomalies, situated 500m to the north and parallel to the main horizon hosting the East Lens. The hole intersected a 207m felsic stringer zone with disseminated sulphide mineralisation and silica-sericite alteration. This rock type along with the sulphides and alteration is a typical marker for lithotypes underlying the East and West Lenses and could possibly be a significant indicator that another base metal rich sulphide lens is nearby. Unfortunately, the hole was stopped short

of the planned target depth with core barrel jammed at the bottom of the hole. This area and its trend have been followed up with a gravity survey and warrant additional drilling in the next program (Table 10.3).

**TABLE 10.3**
**SUMMARY TABLE OF WOLFDEN 2019 DRILL RESULTS**

| Hole No | From | To | Length (m) | Target | Results |
|---|---|---|---|---|---|
| PM-136 | 0 | 320 | 320 | Shallow gap area between East & West Lenses & Footwall Zone | No West Lens intercept; FW Zone: 2.5 m of 0.68% Zn, 0.38% Pb, 0.14% Cu, 89 g/t Ag, 0.12 (1.9 m TW) |
| PM-19-031A | 533 | 767 | 234 | Footwall Zone intercept above PM-18-031 | FW Zone: 4.2 m of 7.35%Zn, 3.65% Pb, 0.97% Cu, 105 g/t Ag, 0.59 g/t Au (2.1 m TW) |
| PM-137 | 0 | 882 | 882 | East Lens and also Footwall Zone | East Lens: 8.0 m of 0.44% Zn, 0.20% Pb, 0.18% Cu, 11.2 g/t Ag, 0.06 g/t Au (4.4 m TW)<br>FW Zone: 6.5 m of 1.36% Zn, 0.27% Pb, 0.04% Cu, 2 g/t Ag (2.8 m TW) |
| PM-137A | 501 | 612 | 111 | Footwall Zone - lost core barrel in bottom of hole - abandoned | East Lens: 9.6 m of 3.03% Zn, 1.34% Pb, 0.53% Cu, 54.0 g/t Ag, 0.30 g/t Au (5.1 m TW) |
| PM-18-028 ext | 708 | 828 | 120 | Footwall Zone | No significant mineralization |
| PM-18-029 | | | | West Lens, cleaned out to 753 m (EOH) | Not surveyed |
| PM-18-008 | 495 | 603 | 108 | West Lens & Footwall Zone; to test and/or better define PEM build-up anomaly | Stringer sulphide zone; FW Zone not intersected |
| PM-18-035 ext | 553 | 627 | 74 | Footwall Zone | Footwall Zone not intersected |
| PM-18-021 ext | 420 | 633 | 213 | Footwall Zone updip from PM-19-031A | FW Zone: 18.0 m of 1.25% Zn, 0.64% Pb, 0.15% Cu, 78 g/t Ag (14.9 m TW) |
| PM-18-019 ext | 298 | 496 | 198 | Footwall Zone | Possible FW Zone intersected at sediment contact - no significant mineralization |
| G-048 | 806 | 807 | 1 | Extension of West Lens to the southwest | BHEM picked up West Lens |
| PM-138 | 0 | 340 | 340 | Shallow gap area between East & West Lenses & Footwall Zone | 1.3 m of 1.81% Zn, 0.43% Pb, 0.81% Cu (0.82 m TW) |
| PM-139 | 0 | 250 | 250 | Step out east of East Lens | No significant mineralization |
| PM-140 | 0 | 269 | 269 | West Lens - hole for Met sample & infill | 9.0 m of massive sulphide, assays pending |
| PX-001 | 0 | 410 | 410 | Soil & gravity anomaly - rods dropped and hole abandoned with core barrel stuck | 207 m of altered Felsic FW with dissem/stringer sulphides |
| Total metres | | | 3530 | | |

# 11.0 Sample Preparation, Analyses, and Security

At the core shed, the core boxes are laid out in order on benches, which can support up to five boxes. A geological technician measures the core and labels the box ends with UV-resistant plastic dymo tape. A geologist then logs and samples the core. A technician then collects magnetic susceptibility and conductivity measurements at 0.5m to 3.0m intervals, as determined by the geologist. All drill core is photographed wet and dry, after which some core may be placed on pallets and moved to outdoor storage.

Where base and/or precious metal minerals have been observed or are suspected to occur – intervals immediately above and below are marked in red wax for assay sampling by the geologist. Assay samples are generally 0.3m to 1.0m long and where warranted, intervals up to 3m have been routinely sampled. The breaks between samples are marked at changes in rock type or metal content in mineralisation, although some wall rock must be included in shorter intervals.

The date, drill hole number, and interval are recorded on the computer and in a pre-numbered tag book provided by the assay lab. Two tags, one large and one small, are placed under the core at the end of the sample interval.

The core for the sample interval is cut, piece by piece, in a core saw using diamond-impregnated steel blades. The core is cut parallel to the core axis, if possible, along the long axis of the intersection between the dominant structural fabric and the core. One-half of the core is returned to the core box, if possible, with the structural fabric at a counter-clockwise angle to the core axis. The other half of the core is placed in a sturdy, plastic, sample bag. After the last piece of cut core has been cut, the small sample tag is stapled in the core box at the end of the sample. The large sample tag is inserted into the sample bag, and the bag is sealed with a zip tie. The sample bag is added to a labeled rice bag, which is also zip tied, once it contains up to 25 kg of samples.

For assay samples, several digestions and ICP packages have been used in the past. Currently, the assay techniques are:

1. 1E3 Aqua Regia ICP(AQUAGEO): digestion by aqua regia and ICP-OES analysis of 38 elements;

2. 8-Peroxide ICP Sodium Peroxide Fusion ICP: reanalysis of over-grade zinc, lead, or copper by peroxide digestion and ICP-OES;

3. 8-Ag Ag-Fire Assay Gravimetric: reanalysis of over-grade silver by 30 gram fire assay and atomic absorption analysis; and

4. <u>1A2 Au-Fire Assay AA</u>: analysis of gold by 30-gram fire assay with a gravimetric finish.

WRA samples are analysed by:

1. <u>ME-MS61</u>: 4-acid digestion and ICP-MS analysis of 43 elements.

Drill core is stored in 1.5 m-long wooden core boxes containing 3 rows of NQ core (4.76 cm diameter) or two rows of HQ core (6.35 cm diameter). A second core box is placed inverted on top, and the two are fiber-taped together for transportation. Usually, drill core is held at the drill until shift change, when it is taken to the driller's lay-down area and transferred to the drill foreman's truck. The foreman is met by the drill geologist at the core shed and the core is moved onto benches. In some circumstances, the core may be transported from the drill to the core shed by Wolfden employees.

The core remains in the locked core shed during core processing. Long intervals of unmineralised hanging wall rock are stacked on pallets, bundled with metal strapping and plastic wrapped, and moved to an unsecured outdoor core storage.

Mineralised core is sampled and with any other core of interest to the geologist, is moved to the locked indoor storage facility. Core samples are stored in the locked core shed until Wolfden's staff transports them to the assay laboratories sample prep lab. At present, the prep lab is Actlabs' facility in Fredericton, New Brunswick.

Actlabs is an independent, commercial assay laboratory that provides contract analytical services to Wolfden on the Pickett Mountain Project. They are ISO 17025 accredited and/or certified to 9001:2008.

It is the opinion of the authors of this technical report that sample preparation, security, and analytical procedures, currently employed, are adequate and meet industry standards.

# 12.0 Data Verification

## 12.1 Historical Data Verification

The Pickett Mountain Mineral Resource estimate documented in this technical report, in part, utilises historical drilling data generated between 1979 and 1989. Of the 111 historical drill holes on record, most of the cores from these holes are in two storage facilities owned and maintained by Huber Engineered Wood, at their production facility located in Easton, Maine. At the time of a site visit on September 26, 2017, it was observed that some core is on shelving and is easily accessible (see Figure 12.1).

**Figure 12.1 Core Storage Facilities Maintained by Huber Engineered Woods at Their Plant Located in Easton, Maine at "Remote Warehouse 1" Where a Majority of the Core is Stored Piled on Shelving Units**

Of the core in storage, most is stacked on pallets, wrapped in shrink wrap, and held together with binding straps. This prevented many of the holes being available for examination and re-sampling. However, some are stored on open shelves or racks. Subsequently, 4 holes (66-82-23, 66-82-28, 66-83-36, and 66-83-39) known to have massive sulphide were located, examined, and sampled (see Figure 12.2).

**Figure 12.2 Core Boxes with Mineralised Sections Located at the Core Storage Facility**

After the September 2017 visit to the Huber storage facility in Easton, Maine, the core has since been moved to a new secure storage facility located in Presque Isle, Maine. The new storage facility is operated and maintained by the Maine Geological Survey.

Data verification consisted of examining portions of these four holes. A random selection of medium- to high-grade intervals were selected and after cutting with a diamond saw, a total of 7 intervals of quartered core was sampled. Table 12.1 show the comparison of the re-assays with the original assays on record.

**TABLE 12.1**
**COMPARISON OF CHECK SAMPLE ASSAYS WITH HISTORICAL RECORD**
**SIX DIGIT SAMPLE NUMBERS ARE THE VALIDATION SAMPLES**
**(AU AND AG IN OZ/T, CU, PB, AND ZN IN %)**

| Sample | Au | Ag | Cu | Pb | Zn |
|---|---|---|---|---|---|
| 537556 | 0.007 | 0.875 | 0.41 | 0.27 | 2.93 |
| 13712 | 0.006 | 0.290 | 0.44 | 0.28 | 2.20 |
| 537557 | 0.005 | 0.758 | 0.31 | 0.21 | 0.48 |
| 13713 | 0.007 | 0.140 | 0.29 | 0.18 | 0.41 |
| 537558 | 0.025 | 3.238 | 3.82 | 3.76 | 8.23 |
| 13721 | 0.028 | 3.000 | 3.85 | 4.25 | 8.50 |
| 537559 | 0.016 | 2.392 | 1.06 | 2.02 | 5.60 |
| 4823 | 0.023 | 2.030 | 1.91 | 3.69 | 8.97 |
| 537560 | 0.040 | 11.435 | 1.11 | 14.00 | 31.00 |
| 2021 | 0.055 | 8.880 | 0.92 | 15.40 | 29.90 |
| 537561 | 0.020 | 2.975 | 1.18 | 4.98 | 12.70 |
| 13747 | 0.025 | 2.590 | 1.25 | 4.80 | 12.50 |
| 537562 | 0.024 | 3.676 | 1.33 | 6.48 | 14.70 |
| 2008 | 0.058 | 3.410 | 1.16 | 5.52 | 12.00 |

All validation sample values are in the same order of magnitude, as the historical values. While not the same, considering that less sample material was submitted due to the quartering of the core, all validation sample results are consistent with that of the historic numbers and confirm that they are a valid record of mineral grades.

In addition, the collars of 3 holes were located in the field where the casing had not been removed or destroyed. Figure 12.3 shows the collar of drill hole 66-46; the GPS coordinates (541190E, 5109225N) correspond within acceptable error with the calculated UTM equivalent to the original hole collar location (541195.6E, 5109231.1N) Maine State Plane coordinates. Two other collars were located (66-42 and 66-63) and similar correlations were found.

**Figure 12.3 The Casing Located in the Field and Identified as Being the Collar for Hole 66-46**

Based on the positive correlation of the assays obtained from check sampling of the historic drill core and for the hole collars found in the field, it is the opinion of authors, the QPs responsible for this report, that the information in the historical documents is reliable and is suitable for use for current and future studies, including Mineral Resource estimation.

## 12.2 Current Data Verification

Control charts showing standard, blank, duplicate, same-lab check, and outside-lab check sample results for each of Zn, Pb, Cu, Ag, and Au indicate good reliability for the assay data, except high blanks are common, indicating poor cleaning at the sample preparation lab.

### 12.2.1 Description of Control Charts

The standard, duplicate, same-lab check, and outside-lab check control charts plot the results of the control sample analysis against the reference values.

***Standard Charts:*** The reference values for standard samples are the certified values taken from certificates published on-line. For the base metals, the selected certified values and errors (1σ) are those appropriate to the digestion: 4 acid for standards with certified values below the upper detection limit and sodium peroxide for those above.

The standard results for each lab report were evaluated against the certificate values at ±2σ and ±3σ; however, to save space, +10% and -10% lines have been substituted on the standard charts.

***Blank Charts:*** The blank charts plot the blank sample results versus the results for the preceding sample (which assumes the samples were prepared in alphabetical order). Below-detection values were set to half of the detection limit.

Lines representing a US$2/t value for the metal are shown for reference and calculated as:

| Element | US$ Price | US$2/t | Conversion | Grade |
|---|---|---|---|---|
| Zn | $1.20/lb | 1.67 lb | 0.0454%/lb | 0.08% |
| Pb | $1.00/lb | 2.00 lb | 0.0454%/lb | 0.09% |
| Cu | $2.50/lb | 0.80 lb | 0.0454%/lb | 0.04% |
| Ag | $16/oz | 0.125 oz | 31.10 g/oz | 3.89 gpt |
| Au | $1,200/oz | 0.002 oz | 31.10 g/oz | 0.052 gpt |

Lines representing the blank values versus previous sample values of 0.2%, 0.5%, and 1.0% are also shown on the charts for reference.

***Duplicate Charts*:** The charts plot analyses of the duplicate versus the previous sample in the sample batch, with below-detection values were set to half of the detection limit. Quarter-core duplicates were replaced by pulp duplicates part way through the project to conserve material for later analytical or metallurgical work. The +10% and -10% lines are shown on the charts for reference.

***Same-Lab Check Charts*:** The charts plot check versus the original Actlabs analyses for a batch of pulps selected from the drilling to date and submitted to Actlabs. Below-detection values were set to half of the detection limit. Lines representing +10% and -10% are shown on the charts for reference.

***Outside-Lab Check Charts***: The charts plot check versus original Actlabs analyses for a batch of pulps selected from the drilling to date and submitted to AGAT. Below-detection values were set to half of the detection limit. Lines representing +10% and -10% are shown on the charts for reference.

### 12.2.2 Quality Assurance/Quality Control (QA/QC) Evaluation

***Zinc (Zn) (Figure 12.4):*** Most Zn standard analyses fall well within ±10% and ±3σ of the certified reference values. Two OREAS 623 (1.03 ± 0.04% Zn) samples returned -3.8σ and -3.3σ analyses, but the standard generally provides below certificate results.

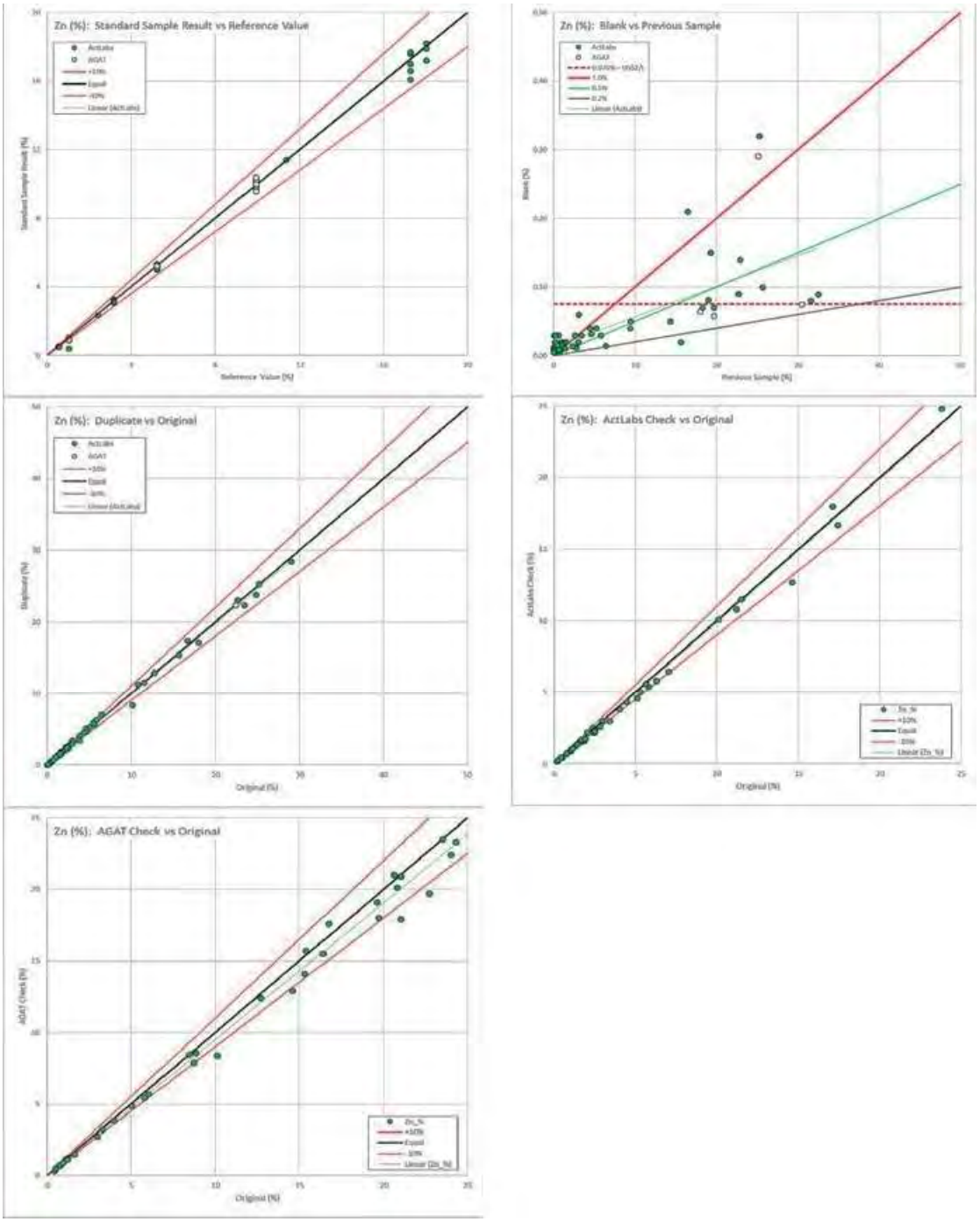



**Figure 12.4 Zn QA/QC Control Charts**

An OREAS 623 standard (E5407686, PM-18-031, Actlabs report A18-18236, finalised 2019-Jan-10) returned a value of 0.41% Zn, which is 60% or 15.4σ low. Neither this sample nor adjacent samples have values matching a standard and so a sample swap is unlikely.

Several blank samples returned significant Zn (up to 0.32%), several of which represent more than US$2/t. Three samples have results indicating >1% contamination from the preceding samples, indicating very poor cleaning practices at the samples preparation facility. A check analysis of the same pulp as one of these three samples reproduced the analysis at the outside lab.

The duplicate and check sample analyses suggest good reproducibility, although AGAT returned Zn values about 4% below those of Actlabs, on average.

***Lead (Pb) (*Figure 12.5*):*** The Pb control sample results share the problems of the Zn results, although less pronounced. Only one blank result corresponded to more than US$2/t in Pb values. AGAT returned Pb values about 5% below those of Actlabs, on average.

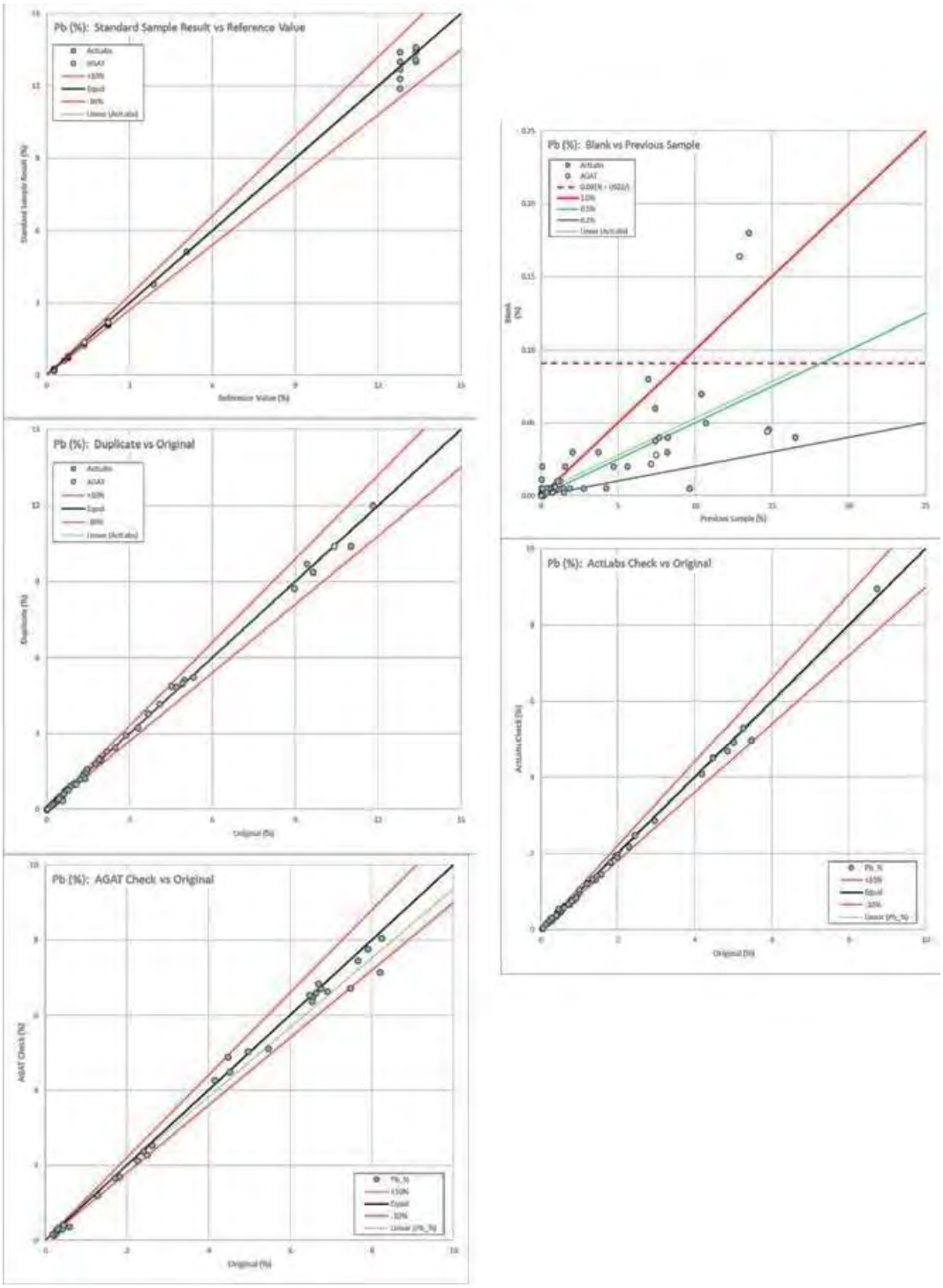



**Figure 12.5 Pb QA/QC Control Charts**

***Copper (Cu) (*Figure 12.6*):*** Again, the Cu control sample results share the problems of the Zn results, although less pronounced. No blank results corresponded to more than US$2/t in contained Cu, although a significant number of the blank sample results were above 1% of the previous sample results. AGAT returned Cu values similar to those of Actlabs.

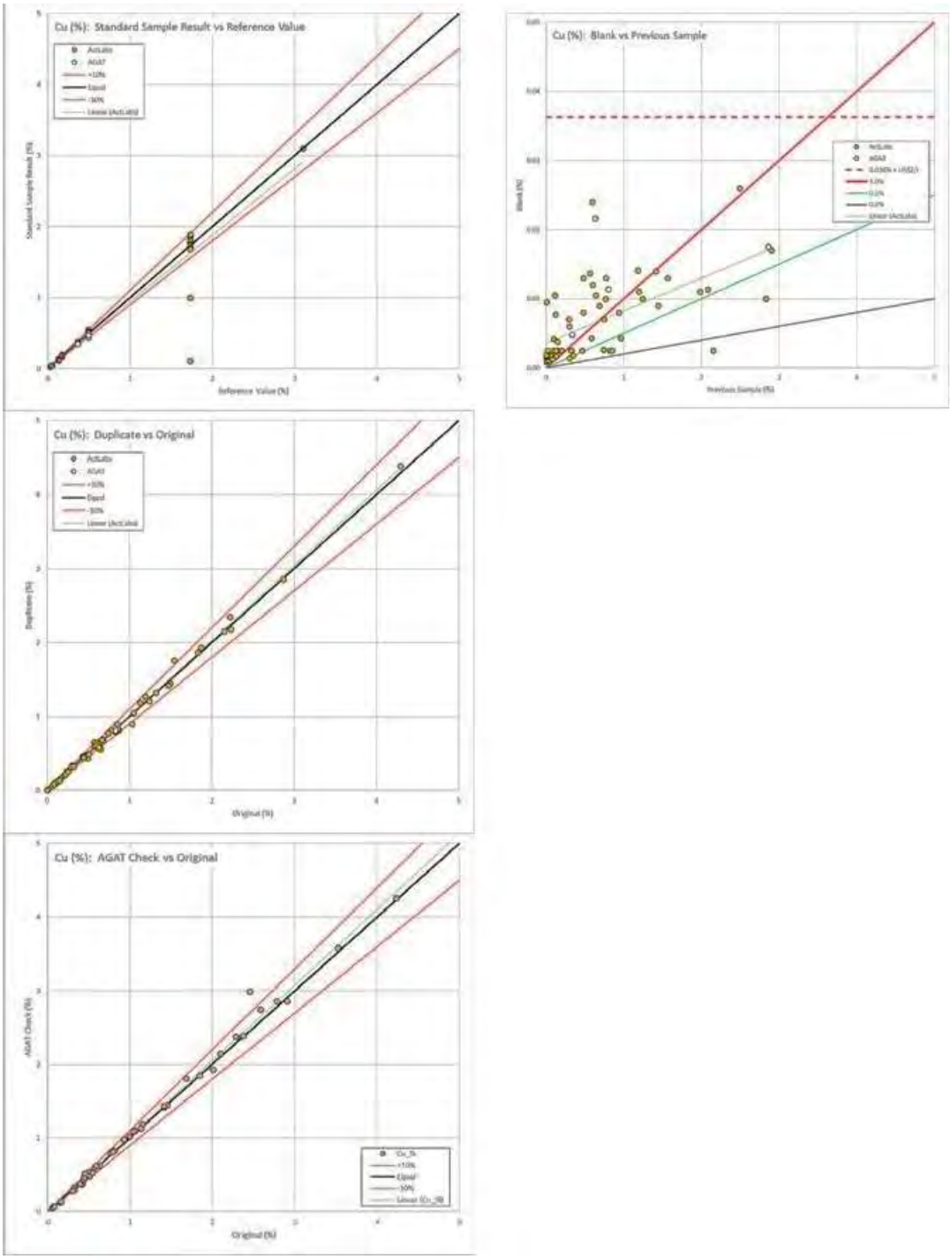



**Figure 12.6 Cu QA/QC Control Charts**

***Silver (Ag) (Figure 12.7):*** Nugget effects are likely responsible for the increased scatter of the precious metal control charts relative to the base metal charts.

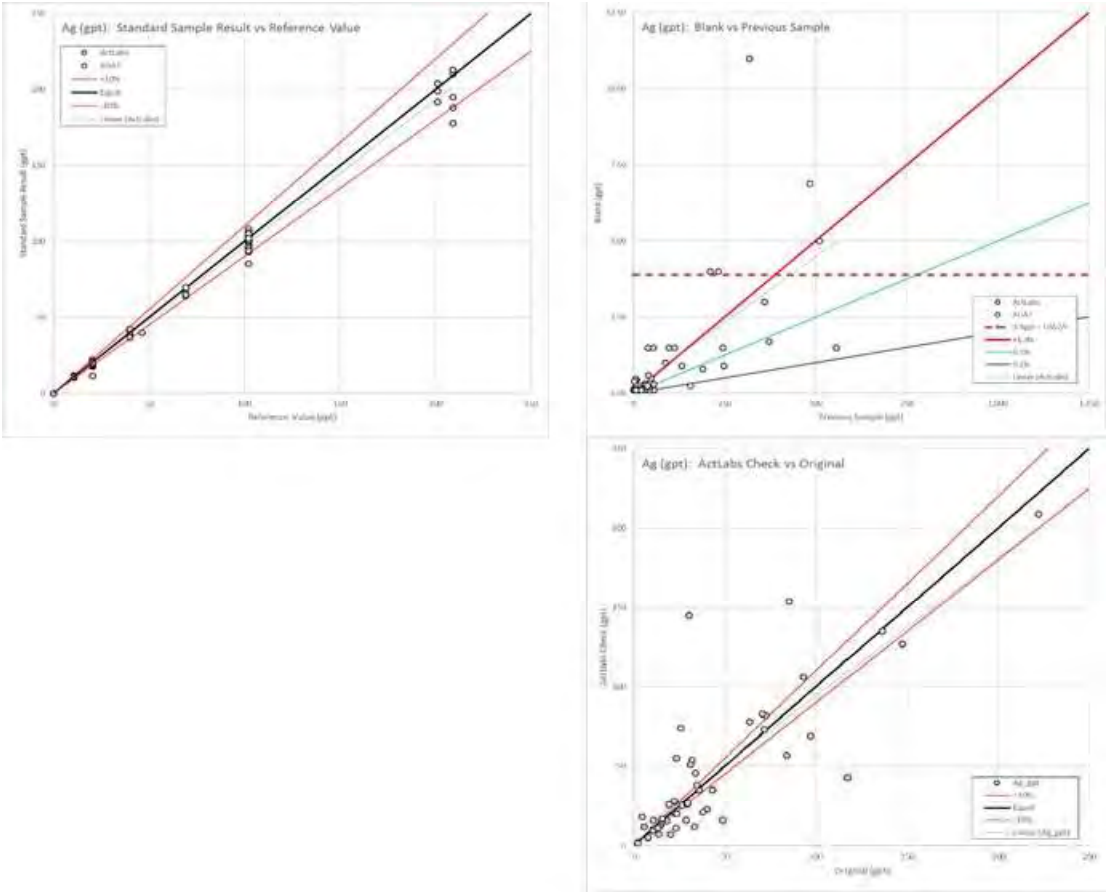



**Figure 12.7 Ag QA/QC Control Charts**

Both labs tend to be a bit low on high-grade Ag standards and a few blanks represent more than US$2/t in contained Ag. The duplicate Ag correlate fairly well, with the worst deviations from original values that are capped at the 100 gpt upper detection limit because no over-grade analyses were run. Oddly, the Actlabs check analyses show poorer correlation than those run at AGAT.

***Gold (Au) (Figure 12.8):*** As with Ag, the higher-grade Au standards ran a bit low, on average. Blanks, duplicates, and both sets of check analyses show considerable scatter.

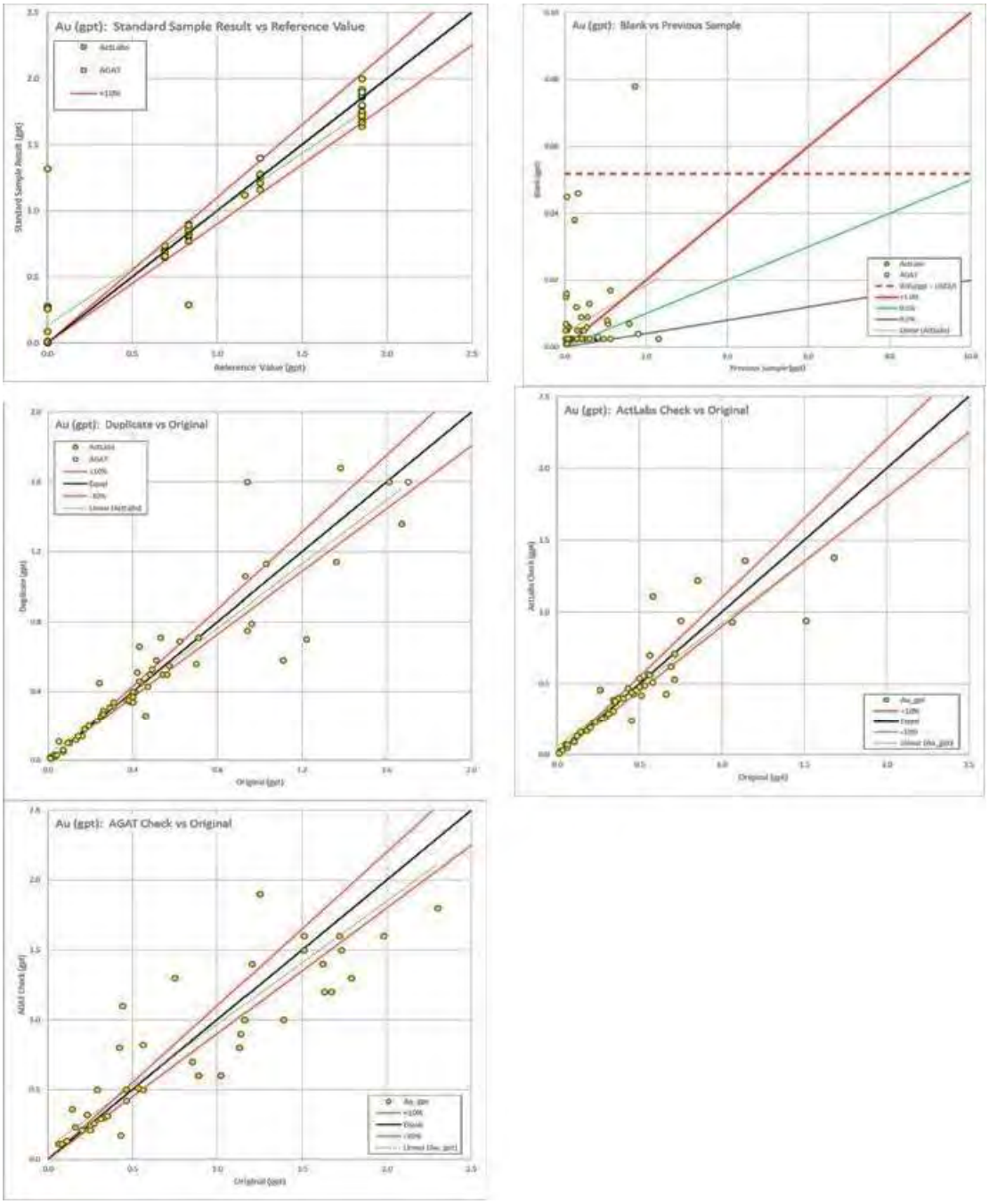



**Figure 12.8 Au QA/QC Control Charts**

The standards utilised in the drilling program include OREAS 133b, 134a, 134b, 630, 132b, 620, 621, 622, and 623.

### 12.2.3 Comparison of Original and AGAT Check Sample Composites

The check samples sent to AGAT include six mineralised intervals analysed at different times throughout the program. A comparison of the calculated composites for the original and check analyses (Table 12.2) indicates an about 5% lower ZnEq (and the related dollar value) for the check samples, with no trend through time.

## TABLE 12.2
## ORIGINAL VERSUS OUTSIDE-LAB CHECK COMPOSITES

| Hole-ID | From | To | Len | Samples | Lab | $/t | Zn eq | Zn % | Pb % | Cu % | Ag gpt | Au gpt | Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM-18-004 | 172.10 | 180.90 | 8.80 | 11 | ActLabs | $629 | 23.40 | 12.64 | 4.68 | 1.36 | 133.45 | 1.23 | 2018-Feb-28 |
| | | | | | AGAT | $596 | 22.16 | 11.85 | 4.67 | 1.41 | 123.82 | 0.98 | 2019-Jan-25 |
| | | | | | Change | -$33 | -1.24 | -0.79 | -0.01 | 0.05 | -9.63 | -0.25 | |
| | | | | | Percent | -3% | -5.3% | -6.3% | 0.2 | 3 | -7 | -.3 | |

In general, the quality control analyses are more accurate and reproducible for the base metals (Zn, Cu, and Pb) than for the precious metals (Au and Ag). This reflects the lower abundances of the precious metals and analytical difficulties, particularly for Ag.

The analyses for standard samples are acceptable with the exception of analyses of standard OREAS 623 that commonly returned lower values. The cause of this is not known.

Many of the blank sample analyses indicate more than 0.5% contamination from preceding samples with some in excess of 1% contamination. This suggests poor cleaning procedures at the preparation laboratory.

The duplicate and check analyses correlate adequately. It is the opinion of the authors that the quality control results are generally good, and therefore, the analytical data is reliable.

# 13.0 Mineral Processing and Metallurgical Testing

The test work was originally performed at Lakefield Research in 1984 and 1988 and recently a scoping study was completed at Resource Development Inc. (RDi).

The metallurgical reports were reviewed and a summary of the results are presented in this section.

## 13.1 Getty Mining Company, 1984

Lakefield Research undertook metallurgical test work for the recovery of copper, lead, and zinc from five composite samples. Approximately 3,350 kg of one-half core, one-quarter core, and slices of core was sent to Lakefield.

The metallurgical test work included sample preparation, preparation of five composites, rougher and cleaner flotation tests, Bond's Work Index determination, settling tests, mineralogical examination of test products, gold and silver recovery from tailings and determination of acid producing potential of tailings.

### 13.1.1 Sample Characterisation

Five master composite (MC) samples were prepared from the fresh drill core splits. The head analyses of the composite samples are given in Table 13.1. The assays indicated some variation in copper (1.01% to 4.03%), lead (2.84% to 5.29%), zinc (7.23% to 17.1%), gold (0.52 g/t to 1.26 g/t) and silver (57.5 g/t to 142 g/t). Samples 2-5 were not assayed for arsenic.

**TABLE 13.1**
**HEAD ANALYSES OF COMPOSITE SAMPLES**

| Sample | Assay | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Master Composite | % Cu | % Pb | % Zn | % Fe | % S | % As | Au, (g/t) | Ag, (g/t) |
| 1 | 1.32 | 4.29 | 9.72 | 26.9 | 33.4 | 0.16 | 0.75 | 91.4 |
| 2 | 4.03 | 5.29 | 11.8 | 25.7 | 34.6 | - | 1.26 | 142.0 |
| 3 | 1.11 | 6.58 | 17.1 | 21.1 | 30.0 | - | 0.95 | 139.0 |
| 4 | 1.13 | 2.84 | 7.23 | 23.7 | 28.4 | - | 0.52 | 57.5 |
| 5 | 1.01 | 4.93 | 9.07 | 19.6 | 24.4 | - | 0.78 | 116.0 |

The iron and sulfur analyses of the composites indicated that the deposit is massive sulfide. The specific gravity of MC-1 of 4.19 confirmed it.

### 13.1.2 Bond's Ball Mill Work Index

Bond's ball mill work index was determined for master composite 1 at 200 mesh. It was determined to be 8.79.

### 13.1.3 Flotation Testing

Most of the flotation test work was performed on Master Composite 1. The other composites were tested at the end of the program to evaluate their response to the developed flowsheet.

Two alternative flowsheets were evaluated:

1. Copper-lead bulk flotation followed by Cu-Pb separation.

2. Selective copper and lead flotation.

The highlights of the test work are presented in the following sub-sections.

#### 13.1.3.1 Cu-Pb Bulk Flotation

Tests were conducted to evaluate the response of the ore to the circuit involving flotation of a bulk Cu-Pb rougher concentrate followed by regrinding and cleaning and subsequently Cu-Pb separation.

Four different depressant schemes were evaluated to depress zinc and float copper and lead. Other variables investigated included fineness of grind, flotation time, and reagent amounts. The best overall results in the rougher flotation was approximately 90% Cu and Pb recovery with 25% Zn recovery. These results were obtained with $Na_2SO_3$ – NaCN – $Na_2CO_3$ and Ca $(OH)_2$ – $ZnSO_4$/NaCN and $SO_2$ depressant systems at a grind size of ±75% minus 400 mesh. The test data are given in Table 13.2 and Table 13.3.

**TABLE 13.2**
**METALLURGICAL RESULTS FOR $NA_2SO_3$ – NACN – $NA_2CO_3$ DEPRESSANT SYSTEM**

| Test No. | Grind % -400 Mesh | Reagents, g/t | | | | Flotation Time, Min | Cu-Pb Rougher Concentrate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Assay, % | | | Distribution, % | | | |
| | | $Na_2SO_3$ | NaCN | $Na_2CO_3$ | A325 | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| 1 | 84.3 | 2000 | 50 | 250 | 200 | 18 | 6.26 | 18.6 | 8.15 | 18.81 | 89.1 | 81.7 | 15.4 |
| 3 | 76.7 | 1000 | 50 | 250 | 40 | 8 | 3.23 | 10.7 | 7.02 | 37.45 | 90.4 | 90.8 | 25.9 |
| 8 | 42.0 | 1500 | 50 | 250 | 55 | 20 | 2.56 | 12.0 | 18.0 | 30.35 | 63.8 | 86.4 | 55.3 |

**TABLE 13.3**
**METALLURGICAL RESULTS FOR $CA(OH)_2$– $ZNSO_4$/NACN – $SO_2$ DEPRESSANT SYSTEM**

| Test No. | Grind % -400 Mesh | Reagents, g/t | | | | Flotation Time, Min | Cu-Pb Rougher Concentrate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Assay, % | | | Distribution, % | | | |
| | | $Ca(OH)_2$ | $ZnSO_4$/ NaCN | $SO_2$ | A325 | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| 2 | 70.2 | 1000 | 500 | 450 | 70 | 9 | 4.32 | 14.2 | 9.35 | 26.93 | 90.2 | 89.8 | 24.9 |
| 5 | 58.9 | 1000 | 500 | 500 | 55 | 9 | 4.31 | 14.7 | 10.3 | 25.20 | 84.7 | 87.9 | 25.6 |

Based on these results, the latter depressant system was selected for further testing, which included the effect of grind and reagent levels in the rougher flotation and to investigate the cleaner flotation response. The best Cu-Pb rougher flotation results were obtained at primary grind of 78.9% minus 400 mesh with 1,000 g/t lime, 500 g/t $ZnSO_4$/NaCN, 500 g/t $SO_2$, and 80 g/t A325. The rougher concentrate recovered 32.67% of weight, 91.6% of copper, 90.6% of lead, and 29.9% of zinc at a grade of 3.37% Cu, 11.5% Pb, and 8.83% Zn.

Upgrading of Cu and Pb in the cleaner flotation was poor with problems in depression of the pyrite and sphalerite. The Cu-Pb cleaner concentrate could be recovered in the ranges of:

| Assays, % | | | Distribution, % | | |
|---|---|---|---|---|---|
| Cu | Pb | Zn | Cu | Pb | Zn |
| 9 | 30 | 7.5 | 62 | 61 | 7 |
| 7 | 28.5 | 7.8 | 64 | 75 | 9 |
| 6 | 26 | 8.0 | 73 | 85 | 12 |

The lower grade concentrates had reasonable recoveries but were contaminated with pyrite and sphalerite. The high-grade concentrates had low recoveries.

Cu-Pb separation was performed on the Cu-Pb cleaner concentrate from two different tests, namely test 38 and 41. The Cu-Pb concentrate was conditioned with activated carbon, dextrin, and $SO_2$ and a copper rougher concentrate was recovered. The concentrate was cleaned once.

The Cu-Pb concentrate was conditioned with activated carbon and $SO_2$. A copper concentrate was collected and cleaned once. The copper flotation tailing was conditioned with lime and $ZnSO_4$/NaCN and a Pb concentrate was recovered and cleaned. The test results, summarised in Table 13.4, indicated that copper was upgraded reasonably well but lead upgrading and recovery were poor.

**TABLE 13.4**
**RESULTS OF CU-PB BULK FLOTATION AND SEPARATION**

| Test No. | Product | Assay, % | | | Distribution, % | | | |
|---|---|---|---|---|---|---|---|---|
| | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| 38 | Cu Cleaner Conc. | 23.9 | 5.38 | 3.46 | 3.31 | 63.3 | 4.3 | 1.2 |
| | Cu Flotation Conc. | 16.3 | 16.4 | 5.04 | 5.09 | 66.3 | 20.0 | 2.7 |
| | Cu-Pb Separation Tailing (Pb Conc.) | 0.70 | 25.6 | 9.42 | 10.50 | 5.9 | 64.2 | 10.3 |
| | Cu-Pb Cleaner-Conc. (Separation Feed) | 5.79 | 22.6 | 7.99 | 15.59 | 72.2 | 84.2 | 13.0 |
| | Cu-Pb Rougher Conc. | 2.79 | 9.55 | 9.87 | 41.45 | 92.5 | 94.5 | 42.6 |
| 41 | Cu Cleaner Conc. | 28.3 | 4.32 | 2.48 | 2.29 | 52.8 | 2.4 | 0.6 |
| | Cu Flotation Conc. | 21.8 | 13.3 | 3.52 | 3.31 | 58.1 | 10.8 | 1.2 |
| | Pb Cleaner Conc. | 0.22 | 47.1 | 9.53 | 3.40 | 0.6 | 39.3 | 3.4 |
| | Pb Flotation Conc. | 0.35 | 42.5 | 9.53 | 4.19 | 1.2 | 43.7 | 4.2 |
| | Cu-Pb Sepn. Tail | 0.97 | 21.0 | 8.48 | 5.25 | 4.1 | 27.0 | 4.6 |
| | Cu-Pb Cleaner Conc. (Separation Feed) | 6.17 | 26.1 | 7.54 | 12.75 | 63.4 | 81.5 | 10.0 |
| | Cu-Pb Rougher Conc. | 3.57 | 12.0 | 9.79 | 31.32 | 90.1 | 92.4 | 31.9 |

### 13.1.3.2 Selective Cu, Pb, and Zn Flotation

Based on the visual observation of the Cu-Pb bulk flotation, it was noted that Cu floated ahead of the Pb. Hence, a decision was made to investigate sequential Cu and Pb flotation. The addition of $SO_2$ to the grind resulted in production of a fairly selective copper rougher concentrate, which could be upgraded following regrind of rougher concentrate. Preliminary testing results are given in Table 13.5.

**TABLE 13.5**
**PRELIMINARY SELECTIVE COPPER FLOTATION RESULTS**

| Test No. | Procedure | Product | Assay % | | | Distribution % | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| 26 | Cu-$SO_2$ to Grind<br>M200 Collector<br>Regrind Ro. Conc.<br>Pb-$Na_2CO_3$, NaCN, A325 Collector<br>Regrind Ro. Conc. | Cu Cl. Conc. | 23.3 | 2.90 | 3.07 | 3.28 | 63.0 | 2.4 | 1.1 |
| | | Cu Ro. Conc. | 6.64 | 3.90 | 7.78 | 15.29 | 83.7 | 12.8 | 12.6 |
| | | Pb Cl. Conc. | 0.13 | 45.3 | 9.41 | 5.21 | 0.6 | 60.0 | 5.2 |
| | | Pb Ro. Conc. | 0.22 | 14.2 | 11.2 | 20.82 | 3.8 | 75.2 | 24.7 |

Optimisation of the copper flotation resulted in primary grind of 60% to 80% minus 400 mesh, M203 as primary collector and reduction in dosage of A325. This improved selectivity toward lead and higher copper recovery. Overall, from the batch tests, a copper concentrate assaying 22% to 24% Cu with a recovery of 55% to 65% copper was obtained.

Copper rougher tailing and first-cleaner tailing were combined as feed to the lead circuit. The test results, given in Table 13.6, indicated that lead concentrate can be upgraded to 45% to 48% Pb, but after that lead losses were higher. Overall lead recovery for a 45% to 48% Pb concentrate was about 65% and zinc loss to the concentrate was about 5%.

**TABLE 13.6**
**LEAD FLOTATION RESULTS**

| Test No. | Grind % -400M | Lime g/t | | $ZnSO_4$ NaCN, g/t | | A325 g/t | Pb Cl. Conc. Pb Ro. Conc. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Assay, % | | | Distribution, % | | | |
| | | Ro. | Cl. | Ro. | Cl. | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| 44 | 70.2 | 1800 | 450 | 500 | 550 | 83 | 0.19 | 56.9 | 6.67 | 2.58 | 0.4 | 40.5 | 2.0 |
| | | | | | | | 0.51 | 14.1 | 11.20 | 22.76 | 9.3 | 79.5 | 26.5 |
| 45 | 78.9 | 2400 | 450 | 500 | 375 | 87 | 0.28 | 58.1 | 6.20 | 2.02 | 0.5 | 29.1 | 1.2 |
| | | | | | | | 0.38 | 17.2 | 10.80 | 18.37 | 5.8 | 78.4 | 20.3 |
| 47 | 78.9 | 2000 | 265 | 600 | 625 | 83 | 0.15 | 46.6 | 8.11 | 5.55 | 0.7 | 63.1 | 4.6 |
| | | | | | | | 0.24 | 14.7 | 11.5 | 21.54 | 4.4 | 77.3 | 25.6 |
| 48 | 58.9 | 1600 | 270 | 600 | 625 | 93 | 0.19 | 45.1 | 9.93 | 5.81 | 0.9 | 64.2 | 6.0 |
| | | | | | | | 0.22 | 14.7 | 13.50 | 20.27 | 3.7 | 74.9 | 29.1 |

A few batch tests were performed for zinc recovery because the feed for the zinc circuit could only be produced in locked cycle tests involving recirculation of Cu and Pb cleaner tailing. The tests indicated that a final zinc concentrate of 55% Zn at 62% recovery could be obtained in a batch test.

### 13.1.4 Locked Cycle Flotation Tests

Locked cycle tests were performed using the selective flotation procedure to determine the effect of recirculation of cleaner products on the grades and recoveries of Cu, Pb, and Zn.

Several LCT tests were performed using slight variations of the flowsheet given in Figure 13.1. The test conditions are given in Table 13.7 and the best results are presented in Table 13.8. The impurity analyses are given in Table 13.9. The results indicate the following:

- Copper concentrate, assaying 23.1% Cu, 3.64% Pb, 2.85% Zn, 1.90 g/t Au, and 493 g/t Ag, recovered 77.4% of copper in the feed.
- The lead concentrate, assaying 50.9% Pb, 7.85% Zn, 0.34% Cu, 2.02 g/t Au, and 494 g/t Ag, recovered 77.5% of lead in the feed.
- The zinc concentrate, assaying 53% Zn, 1.57% Pb, 0.86% Cu, 0.46% g/t Au, and 51.6 g/t Ag recovered 87.7% of the zinc in the feed.
- The concentrate did not contain detrimental elements to trigger penalties.

**TABLE 13.7**
**LOCKED-CYCLE TEST CONDITIONS**

| Process Parameters | Reagents, g/t | | | Grind $P_{80'}$ µm | Flotation Time, min | pH |
|---|---|---|---|---|---|---|
| | $SO_2$ | M200 | A325 | | | |
| **COPPER CIRCUIT** | | | | | | |
| Primary Grind | 1000 | - | - | 37 | - | - |
| Conditioner | - | 25 | 10 | - | 1 | 6.3 |
| Rougher Float | - | - | - | - | 9 | - |
| Regrind | 340 | - | - | 21 | - | - |
| 1st Cleaner | - | 12.5 | 5.0 | - | 6 | 5.5 |
| 2nd Cleaner | - | - | - | - | 4 | 5.0 |
| 3rd Cleaner | - | - | - | - | 3 | 4.5 |
| 4th Cleaner | - | - | - | - | 2 | 4.0 |

### TABLE 13.7
### LOCKED-CYCLE TEST CONDITIONS
### *(CONTINUED)*

| Process Parameters | Reagents, g/t | | | | Flotation Time, min | pH |
|---|---|---|---|---|---|---|
| | Lime | $ZnSO_4$/NaCN (ratio) | A 325 | MIBC | | |
| **LEAD CIRCUIT** | | | | | | |
| Conditioner | 2125 | 600 (2:1) | 45 | - | 1 | 9.5 |
| Rougher Float | - | - | - | - | 9 | 9.5 |
| Regrind | 235 | 525 | - | 14 | - | - |
| 1st Cleaner | - | - | 33 | - | 6 | 9.5 |
| 2nd Cleaner | - | - | - | - | 5 | 9.5 |
| 3rd Cleaner | - | - | - | - | 4 | 9.6 |
| 4th Cleaner | - | - | - | - | 3 | 9.5 |

### TABLE 13.7
### LOCKED-CYCLE TEST CONDITIONS
### *(CONTINUED)*

| Process Parameters | Reagents, g/t | | | | Grind $P_{80'}$ µm | Flotation Time, min | pH |
|---|---|---|---|---|---|---|---|
| | Lime | $CuSO_4$ | A343 | M200 | | | |
| **ZINC CIRCUIT** | | | | | | | |
| Conditioner | 1750 | 1000 | 40 | 10 | - | - | 11.9 |
| Rougher Float | - | - | - | - | - | 9 | 12.0 |
| Regrind | 1250 | 150 | - | - | 22 | - | 12.0 |
| 1st Cleaner | - | - | 10 | 5 | | 10 | |
| 2nd Cleaner | - | - | - | - | - | 6 | 12.1 |
| 3rd Cleaner | - | - | - | - | - | 5 | 12.3 |
| 4th Cleaner | - | - | - | - | - | 4 | 12.4 |
| Final Tailing | - | - | - | - | 29 | - | - |

### TABLE 13.8
### LOCKED-CYCLE TEST RESULTS (TEST 49)

| Product | Assay %, g/t | | | | | Distribution, % | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cu | Pb | Zn | Au | Ag | Wt. | Cu | Pb | Zn | Au | Ag |
| Cu Cl. Conc. | 23.1 | 3.64 | 2.85 | 1.90 | 493 | 4.26 | 77.4 | 3.8 | 1.2 | 13.3 | 27.3 |
| Pb Cl. Conc. | 0.34 | 50.9 | 7.85 | 2.02 | 494 | 6.16 | 1.6 | 77.5 | 4.8 | 20.4 | 39.6 |
| Zn Cl. Conc. | 0.86 | 1.57 | 53.0 | 0.46 | 51.6 | 16.63 | 11.2 | 6.5 | 87.7 | 12.5 | 11.1 |
| Zn Comb. Tail | 0.17 | 0.68 | 0.87 | 0.45 | 23.2 | 72.95 | 9.8 | 12.2 | 6.3 | 53.8 | 22.0 |
| Cal. Head | 1.27 | 4.05 | 10.05 | 0.61 | 76.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

### TABLE 13.9
### IMPURITY ANALYSES OF CONCENTRATES

| Element, % | Cu Conc. | Pb Conc. | Zn Conc. |
|---|---|---|---|
| Fe | 30.6 | 13.7 | 9.04 |
| S | 36.8 | 26.4 | 33.4 |
| As | 0.85 | 0.13 | 0.038 |
| Sb | 0.47 | 0.076 | 0.013 |
| Bi | 0.014 | 0.096 | 0.007 |
| Cd | 0.01 | 0.024 | 0.015 |
| Hg | 0.0011 | 0.0018 | 0.0029 |
| $SiO_2$ | 0.40 | 0.09 | 0.77 |
| $Al_2O_3$ | 0.15 | 0.029 | 0.24 |
| MgO | 0.036 | 0.007 | 0.049 |
| CaO | 0.004 | 0.034 | 0.11 |

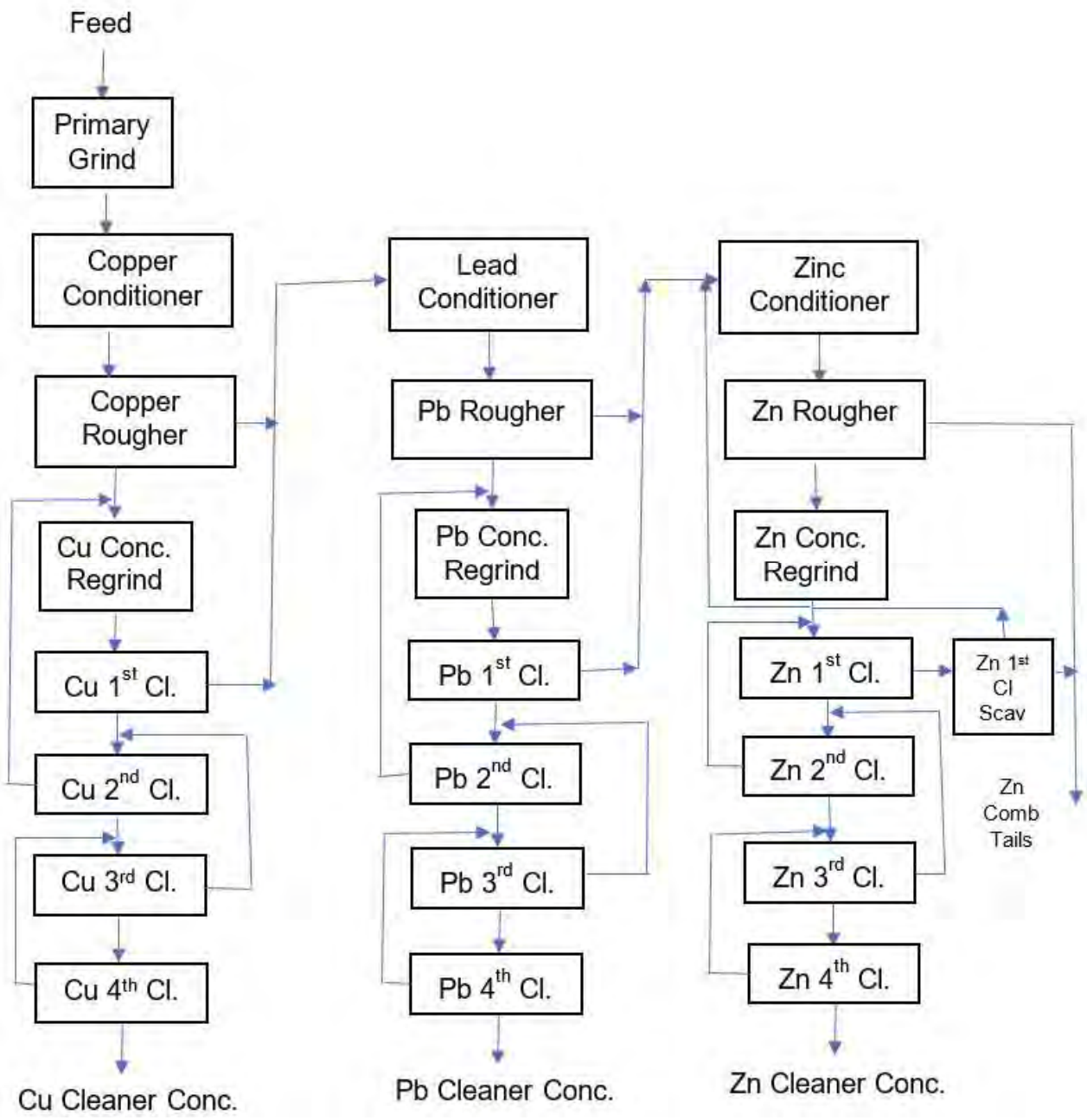



**Figure 13.1 Locked-cycle Test Flowsheet**

### 13.1.5 Miscellaneous Tests

Open-circuit sequential flotation tests were performed on Composites 2 to 5. The results were similar to those obtained for Composite 1 except for Composite 5 which gave inferior copper recovery and copper concentrate from Composite 3 assayed over 1% As which will have to be blended with other concentrates to avoid penalty for impurities.

The aging of samples at ambient atmosphere resulted in poor copper and lead recovery as compared to samples stored in the freezer.

The tailing settled to ±63% solids and was characterised to be strong acid producer.

## 13.2 Chevron Resources, 1988

Lakefield Research undertook scoping level metallurgical test work for Chevron Resources using Composite 1 stored in the freezer from 1984 studies.

The primary objective of the study was to determine if bulk flotation flowsheet for treatment of the ore could be utilised for recovery of Cu, Pb and Zn products. Two flowsheets were examined in the test work:

1. Cu-Pb bulk flotation flowsheet followed by Cu-Pb cleaning, Cu-Pb separation, and zinc flotation and upgrading.

2. A Cu-Pb-Zn bulk flotation followed by Cu-Pb and zinc separation, Cu-Pb upgrading, and separation and zinc upgrading.

Only open-circuit flotation tests were performed. The projected metallurgical results for the two flowsheets using batch test data are given in Table 13.10.

**TABLE 13.10**
**PROJECTED METALLURGICAL RESULTS FROM BATCH TESTS USING DIFFERENT FLOWSHEETS**

| Flowsheet | Product | Assay % | | | Distribution, % | | | |
|---|---|---|---|---|---|---|---|---|
| | | Cu | Pb | Zn | Wt. | Cu | Pb | Zn |
| Cu-Pb Bulk Flotation | Cu Cl. Conc. | 28.10 | 2.5 | 3.0 | 3.53 | 80.0 | 2.3 | 1.1 |
| | Pb Cl. Conc. | 1.64 | 53.2 | 10.5 | 5.49 | 7.2 | 75.0 | 5.8 |
| | Zn Cl. Conc. | 0.42 | 1.0 | 56.0 | 15.71 | 5.4 | 3.9 | 88.0 |
| | Zn Comb. Tailing | 0.12 | 0.97 | 0.68 | 75.27 | 7.4 | 18.8 | 5.1 |
| | Cal. Head | 1.24 | 3.90 | 10.00 | 100 | 100 | 100 | 100 |
| Cu-Pb-Zn Bulk Flotation | Cu Cl. Conc. | 29.00 | 2.0 | 2.5 | 3.21 | 75.0 | 1.6 | 0.8 |
| | Pb Cl. Conc. | 1.50 | 55.0 | 10.1 | 5.53 | 6.7 | 78.0 | 5.6 |
| | Zn Cl. Conc. | 0.50 | 1.6 | 55.5 | 16.10 | 6.5 | 6.6 | 88.5 |
| | Zn Comb. Tailing | 0.19 | 0.71 | 0.57 | 75.16 | 11.8 | 13.8 | 5.1 |
| | Cal. Head | 1.24 | 3.90 | 10.10 | 100 | 100 | 100 | 100 |

The conclusions of this study were as follows:

1. The Mount Chase (Pickett Mountain) material belongs to a group of refractory finely disseminated Cu-Pb-Zn massive sulfide ores from which the separation of the individual minerals and production of separate Cu, Pb, and Zn concentrates represents significant mineral processing problems.

2. Irrespective of the process flowsheet selected, large quantities of depressants would be needed to produce marketable-grade concentrates of Cu, Pb, and Zn.

3. The rate of Cu-Pb flotation in either of the two flotation schemes evaluated was relatively low and significant losses of copper and lead occurred in the cleaner tailings.

## 13.3 Wolfden Resource Corporation, 2019

Resource Development Inc. (RDi) undertook scoping level metallurgical test work for Wolfden Resource Corp. in 2019 with the primary objective of determining metal recoveries and flotation concentrate grades for the mineralised material from the Pickett Mountain deposit. The program investigated both sequential and differential flotation schemes to separate Cu, Pb, and Zn from the polymetallic ore and produce final

concentrates. The concentrates were analysed for impurities. In addition, flotation tailings were characterised for environmental purposes.

### 13.3.1 Sample Preparation and Characterisation

RDi received 37 samples weighing approximately 0.6 to 2 kg each for the test work. A master composite sample was created utilising each individual sample. The head analyses of the master composite are given in Table 13.11. The master composite assayed 1.2% Cu, 3.4% Pb, 8.6% Zn, 27.4% $S_{Total}$, 0.7 g/mt Au, and 95 g/mt Ag. The sample was a massive sulfide but approximately 21% of the sulfur was present as sulfate sulfur. Hence, **the sample may have been oxidised**.

**TABLE 13.11**
**HEAD ANALYSES OF COMPOSITE SAMPLES INCLUDING ICP**

| Element | Master Composite |
|---|---|
| Au, g/mt | 0.704 |
| Ag, g/mt | 95 |
| Sulfide S % | 21.7 |
| Sulfate S % | 5.69 |
| Total S % | 27.4 |
| **%** | |
| Al | 3.00 |
| Ca | 0.41 |
| Cu | 1.21 |
| Fe | 21.1 |
| K | 1.00 |
| Mg | 0.97 |
| Na | 0.27 |
| Pb | 3.37 |
| Ti | 0.05 |
| Zn | 8.56 |
| **ppm** | |
| As | 953 |
| Ba | 1060 |
| Bi | 81 |
| Cd | 246 |
| Co | 33 |
| Cr | 141 |
| Mn | 365 |
| Mo | <1 |
| Ni | 26 |
| Sr | 17 |
| V | 25 |
| W | 518 |

### 13.3.2 Bond's Ball Mill Work Index

Bond's ball mill work index was determined for the master composite sample at a closed size of 100 mesh (150 microns). The $BW_i$ of 10.96 kwh/st indicated that the sample will be considered soft to medium hardness.

### 13.3.3 Rougher Flotation Testing

The rougher flotation test for both schemes, namely bulk-flotation of Pb/Cu and sequential flotation utilised similar promotors and depressants but different pulp pHs. Aero 5100 promoter was used to collect

the copper due to a good selectively against iron sulfides and SIPX/Aero 3418A was used to recover lead. After the copper/lead flotation, both approaches utilised the same process to collect the zinc and remaining sulfides. The zinc was activated with copper sulfate and then collected with SIPX. The remaining sulfides left in the sample were then floated with a combination of PAX/AP404 to attempt to create a benign tail. The primary grind was varied between $P_{80}$ 200 mesh and $P_{80}$ 325 mesh and various amounts of depressants were added to determine if the separation was more sensitive to liberation size or reagent dosages. The differential flotation data is summarised in Table 13.12, while the sequential flotation data is summarised in Table 13.13.

**TABLE 13.12**
**DIFFERENTIAL FLOTATION RESULTS**

| Product | Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-1 (200 mesh, Standard Depressants)** | | | | | | | | | | | |
| Cu/Pb Ro Conc | 36.0 | 76.0 | 84.2 | 89.0 | 55.9 | 89.0 | 1.7 | 215 | 7.8 | 13.3 | 3.1 |
| Zn Ro Conc | 27.8 | 20.6 | 12.4 | 8.5 | 42.7 | 7.4 | 0.6 | 40.8 | 1.0 | 13.2 | 0.3 |
| Pyrite Ro Conc | 2.7 | 1.3 | 1.1 | 0.7 | 0.5 | 1.1 | 0.4 | 37.5 | 0.8 | 1.6 | 0.5 |
| Combined Ro Conc | 66.5 | 98.0 | 97.7 | 98.2 | 99.1 | 97.6 | 1.2 | 135 | 4.6 | 12.8 | 1.8 |
| Ro Tail | 33.5 | 2.0 | 2.3 | 1.8 | 0.9 | 2.4 | <0.10 | 6.2 | 0.17 | 0.22 | 0.09 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.82 | 92 | 3.14 | 8.58 | 1.25 |
| **FT-4 (200 mesh, 2X Depressants)** | | | | | | | | | | | |
| Cu/Pb Ro Conc | 24.9 | 80.5 | 81.8 | 81.0 | 38.7 | 90.1 | 2.4 | 339 | 5.9 | 11.0 | 4.6 |
| Zn Ro Conc | 17.9 | 13.1 | 9.4 | 9.9 | 59.3 | 4.7 | 0.5 | 54.2 | 1.0 | 23.3 | 0.3 |
| Pyrite Ro Conc | 2.2 | 2.7 | 1.2 | 1.1 | 0.4 | 0.9 | 0.9 | 53.4 | 0.9 | 1.3 | 0.5 |
| Combined Ro Conc | 45.0 | 96.3 | 92.4 | 92.1 | 98.4 | 95.6 | 1.6 | 212 | 3.7 | 15.4 | 2.7 |
| Ro Tail | 55.0 | 3.7 | 7.6 | 7.9 | 1.6 | 4.4 | <0.10 | 14.2 | 0.26 | 0.2 | 0.10 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.74 | 103 | 1.80 | 7.03 | 1.26 |

**TABLE 13.13**
**SEQUENTIAL FLOTATION RESULTS**

| Product | Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-2 (200 mesh, Standard Depressants)** | | | | | | | | | | | |
| Cu Ro Conc | 9.5 | 42.9 | 44.7 | 13.9 | 6.4 | 78.8 | 3.0 | 427 | 4.1 | 5.7 | 9.8 |
| Pb Ro Conc | 10.8 | 16.3 | 29.9 | 63.0 | 18.8 | 8.0 | 1.0 | 251 | 16.3 | 14.7 | 0.9 |
| Zn Ro Conc | 32.2 | 30.5 | 18.7 | 17.4 | 73.2 | 8.0 | 0.6 | 52.5 | 1.5 | 19.2 | 0.3 |
| Pyrite Ro Conc | 8.0 | 7.3 | 2.8 | 2.0 | 0.6 | 1.9 | 0.6 | 31.8 | 0.7 | 0.6 | 0.3 |
| Combined Ro Conc | 60.4 | 97.0 | 96.1 | 96.2 | 98.9 | 96.7 | 1.1 | 144 | 4.4 | 13.8 | 1.9 |
| Ro Tail | 39.6 | 3.0 | 3.9 | 3.8 | 1.1 | 3.3 | <0.10 | 8.8 | 0.27 | 0.22 | 0.10 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.66 | 90 | 2.79 | 8.43 | 1.18 |
| **FT-3 (200 mesh, 1.5X Depressants)** | | | | | | | | | | | |
| Cu Ro Conc | 10.4 | 47.3 | 48.6 | 24.4 | 9.0 | 81.5 | 3.2 | 486 | 4.3 | 6.5 | 9.5 |
| Pb Ro Conc | 12.2 | 17.7 | 25.6 | 40.6 | 19.2 | 5.4 | 1.0 | 219 | 6.1 | 11.8 | 0.5 |
| Zn Ro Conc | 34.2 | 29.6 | 21.0 | 26.4 | 69.8 | 8.7 | 0.6 | 64.3 | 1.4 | 15.3 | 0.3 |
| Pyrite Ro Conc | 4.7 | 2.7 | 2.6 | 2.8 | 0.6 | 1.5 | 0.4 | 58.2 | 1.1 | 1.0 | 0.4 |
| Combined Ro Conc | 61.5 | 97.3 | 97.8 | 94.1 | 98.7 | 97.2 | 1.1 | 166 | 2.8 | 12.0 | 1.9 |
| Ro Tail | 38.5 | 2.7 | 2.2 | 5.9 | 1.3 | 2.8 | <0.10 | 6.0 | 0.28 | 0.26 | 0.09 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.71 | 104 | 1.83 | 7.50 | 1.22 |
| **FT-5 (325 mesh, 1.5X Depressants)** | | | | | | | | | | | |
| Cu Ro Conc | 10.6 | 41.4 | 52.0 | 19.0 | 6.9 | 85.7 | 4.5 | 492 | 3.1 | 5.2 | 9.9 |
| Pb Ro Conc | 12.6 | 24.5 | 30.6 | 48.8 | 19.2 | 5.3 | 2.3 | 244 | 6.7 | 12.1 | 0.5 |
| Zn Ro Conc | 33.0 | 30.4 | 12.8 | 22.3 | 71.8 | 5.3 | 1.1 | 39.0 | 1.2 | 17.4 | 0.2 |
| Pyrite Ro Conc | 2.9 | 1.9 | 1.0 | 1.6 | 0.4 | 0.7 | 0.8 | 35.1 | 1.0 | 1.2 | 0.3 |
| Combined Ro Conc | 59.2 | 98.2 | 96.4 | 91.8 | 98.4 | 97.0 | 1.9 | 164 | 2.7 | 13.3 | 2.0 |
| Ro Tail | 40.8 | 1.8 | 3.6 | 8.2 | 1.6 | 3.0 | 0.41 | 9.0 | 0.35 | 0.31 | 0.09 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 1.16 | 101 | 1.74 | 7.97 | 1.23 |

The scoping level rougher flotation test results indicate the following:

- The differential and sequential approaches floated nearly all of the metals contained in the sample. Each individual metal recovery ranged from approximately 91% to 99% once all concentrates were combined.

- Differential flotation testing recovered 81% to 90% of the lead and copper into the first rougher concentrate, but 39% to 56% of the zinc was also recovered during this stage that decreased the zinc recovery to the zinc concentrate to below 60%. Additional depressants decreased the amount of zinc reporting to the copper/lead concentrate, but not to an acceptable level.

- Sequential flotation testing recovered as much as 86% of the copper, 63% of the lead, and 73% of the zinc into their respective concentrates. Approximately 14% to 24% of the lead reported to the copper concentrate and 19% of the zinc reported to the lead concentrate.

- A finer grind to 325 mesh improved copper recovery to the copper concentrate. Increased depressant additions had a negative effect on lead recovery and little effect on zinc recovery.

- The majority of the gold and silver present in the sample reported to the copper concentrate during sequential flotation (41% to 52%). Approximately 20% of the gold and 30% of the silver reported to the lead concentrate, while the rest of the precious metals were collected in the zinc concentrate.

- The rougher flotation tailings still contain approximately 2.5% sulfide sulfur after the pyrite flotation stage.

### 13.3.4 Cleaner Flotation Testing

Based on the scoping level rougher flotation test results, the sequential flotation scheme was selected for cleaner flotation testing.

A series of rougher flotation tests were completed with the composite sample to produce rougher copper, lead, and zinc concentrates for cleaner flotation testing. A sequential flotation process was utilised at a primary grind of $P_{80}$ 325 mesh with standard depressant additions. A summary of the flotation results is given in Table 13.14.

**TABLE 13.14**
**ROUGHER FLOTATION RESULTS - CONCENTRATE PRODUCTION**

| Product | Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-Production (325 mesh, Standard Depressants)** | | | | | | | | | | | |
| Cu Ro Conc | 9.6 | 29.0 | 49.6 | 18.2 | 6.0 | 84.7 | 2.8 | 505 | 3.01 | 5.35 | 11.6 |
| Pb Ro Conc | 14.5 | 34.3 | 33.4 | 55.0 | 29.3 | 8.1 | 2.2 | 225 | 6.03 | 17.3 | 0.73 |
| Zn Ro Conc | 23.9 | 23.2 | 11.3 | 17.4 | 62.7 | 4.0 | 0.9 | 46 | 1.16 | 22.4 | 0.22 |
| Pyrite Ro Conc | 11.7 | 11.3 | 2.9 | 3.6 | 0.9 | 1.4 | 0.9 | 24 | 0.49 | 0.63 | 0.16 |
| Combined Ro Conc | 59.8 | 97.8 | 97.1 | 94.2 | 98.9 | 98.2 | 1.52 | 159 | 2.51 | 14.2 | 2.16 |
| Ro Tail | 40.2 | 2.2 | 2.9 | 5.8 | 1.1 | 1.8 | 0.3 | 7 | 0.23 | 0.24 | 0.06 |
| Calc. Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.93 | 98 | 1.59 | 8.86 | 1.32 |

The rougher flotation results were similar to the previous results observed in test FT2 with more lead reporting to the copper concentrate and more zinc reporting to the lead concentrate. Cleaner flotation tails from the copper circuit would be sent to the lead circuit and the lead cleaner tails would be sent to the zinc circuit in commercial operations. This can be simulated in locked-cycle tests, which should be undertaken with freshly drilled samples in the next phase of the study.

Representative splits of the rougher concentrates were then used for the subsequent cleaner testing. Testing was completed with and without regrind of the rougher concentrates. The cleaner flotation data are summarised in Table 13.15 to Table 13.17.

### TABLE 13.15
### COPPER CLEANER RESULTS

| Product | Cumulative Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-6 (No Regrind)** | | | | | | | | | | | |
| Cu CL3 Conc | 24.8 | 27.2 | 42.9 | 35.1 | 24.2 | 52.9 | 8.78 | 851 | 4.28 | 5.43 | 23.6 |
| Cu CL2 Conc | 36.1 | 48.1 | 55.6 | 49.8 | 32.8 | 65.8 | 10.66 | 757 | 4.16 | 5.05 | 20.2 |
| Cu CL1 Conc | 53.8 | 69.1 | 73.6 | 71.1 | 50.0 | 81.3 | 10.24 | 670 | 3.98 | 5.15 | 16.7 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 7.98 | 491 | 3.02 | 5.55 | 11.0 |
| **FT-7 (7.5 minute Regrind)** | | | | | | | | | | | |
| Cu CL3 Conc | 16.1 | 22.1 | 38.9 | 8.2 | 6.7 | 41.0 | 5.62 | 1170 | 1.49 | 2.21 | 27.1 |
| Cu CL2 Conc | 23.5 | 35.3 | 51.2 | 14.3 | 11.6 | 54.6 | 6.19 | 1059 | 1.79 | 2.63 | 24.8 |
| Cu CL1 Conc | 33.0 | 49.6 | 63.0 | 25.5 | 21.6 | 65.5 | 6.19 | 927 | 2.28 | 3.48 | 21.2 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 4.11 | 485 | 2.94 | 5.32 | 10.6 |

### TABLE 13.16
### LEAD CLEANER RESULTS

| Product | Cumulative Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-6 (No Regrind)** | | | | | | | | | | | |
| Pb CL3 Conc | 18.0 | 35.5 | 39.3 | 19.3 | 15.0 | 21.1 | 2.95 | 500 | 6.63 | 14.8 | 0.82 |
| Pb CL2 Conc | 28.1 | 54.1 | 52.9 | 29.4 | 25.1 | 32.0 | 2.87 | 430 | 6.48 | 15.8 | 0.79 |
| Pb CL1 Conc | 41.5 | 73.0 | 67.2 | 45.1 | 37.8 | 47.2 | 2.64 | 371 | 6.73 | 16.1 | 0.79 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 1.50 | 229 | 6.19 | 17.7 | 0.70 |
| **FT-7 (5 minutes Regrind)** | | | | | | | | | | | |
| Pb CL3 Conc | 7.3 | 15.1 | 21.9 | 9.8 | 3.3 | 10.0 | 2.76 | 677 | 9.08 | 8.00 | 1.01 |
| Pb CL2 Conc | 14.7 | 26.8 | 36.8 | 16.2 | 9.1 | 18.6 | 2.45 | 575 | 7.56 | 11.1 | 0.94 |
| Pb CL1 Conc | 28.7 | 49.0 | 54.9 | 30.1 | 21.1 | 33.8 | 2.29 | 439 | 7.17 | 13.2 | 0.88 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 1.34 | 229 | 6.83 | 17.9 | 0.74 |

### TABLE 13.17
### ZINC CLEANER RESULTS

| Product | Cumulative Recovery % | | | | | | Product Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Au | Ag | Pb | Zn | Cu | Au (g/mt) | Ag (g/mt) | Pb (%) | Zn (%) | Cu (%) |
| **FT-6 (No Regrind)** | | | | | | | | | | | |
| Zn CL3 Conc | 27.2 | 39.5 | 23.8 | 17.6 | 73.7 | 14.7 | 1.44 | 39 | 0.70 | 56.1 | 0.13 |
| Zn CL2 Conc | 34.1 | 42.9 | 33.1 | 27.6 | 83.6 | 21.1 | 1.25 | 43 | 0.87 | 50.7 | 0.15 |
| Zn CL1 Conc | 43.9 | 49.7 | 47.1 | 43.5 | 90.8 | 34.5 | 1.12 | 48 | 1.07 | 42.8 | 0.19 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.99 | 45 | 1.08 | 20.7 | 0.24 |
| **FT-7 (10 minutes Regrind)** | | | | | | | | | | | |
| Zn CL3 Conc | 20.7 | 10.0 | 17.2 | 10.7 | 60.6 | 15.4 | 0.27 | 35 | 0.61 | 62.3 | 0.18 |
| Zn CL2 Conc | 26.1 | 14.9 | 22.6 | 16.0 | 68.2 | 19.9 | 0.32 | 36 | 0.72 | 55.7 | 0.18 |
| Zn CL1 Conc | 39.5 | 32.9 | 38.2 | 32.8 | 79.2 | 34.8 | 0.47 | 41 | 0.98 | 42.8 | 0.21 |
| Calc Feed | 100 | 100 | 100 | 100 | 100 | 100 | 0.56 | 42 | 1.18 | 21.3 | 0.24 |

The open-circuit cleaner flotation results indicate the following:

- The copper cleaner circuit achieved a grade of 27.1% Cu after three stages of cleaners with one stage of regrind. Copper recovery was low at 41.0% in the open-circuit test. The recovery increased to 52.9% without regrind, but the concentrate grade was reduced to 23.6% Cu. The regrind stage also helped to reduce the lead and zinc grades to 1.49% Pb and 2.21% Zn as opposed to 4.28% Pb and 5.43% Zn without regrind.

- The lead cleaner circuit did not recover a significant amount of the lead or upgrade the concentrate. The maximum lead grade was 9.08% Pb with only 9.8% recovery. In addition, the zinc grade was high at 8.00% Zn. The poor metallurgical performance could potentially be due to aging of the samples. Additional tests are needed to optimise the lead circuit with fresh drill core.

- The zinc cleaner circuit achieved a grade of 62.3% Zn and recovery or 60.6% after three stages of cleaners with one stage of regrind. The recovery increased to 73.7% without regrind, while the concentrate grade was reduced to 56.1% Zn. The regrind stage had little effect on the copper and lead grades. The copper grade was 0.18% Cu while the lead grade was 0.61% Pb with regrind.

### 13.3.5 Vacuum Filtration Test

Vacuum filtration testing was completed with the rougher flotation tails generated during flotation testing at $P_{80}$ 200 mesh and $P_{80}$ 325 mesh. Portions of each flotation tail sample were slurried to approximately 40% solids and placed in a vacuum filtration apparatus. The vacuum was initiated, and the slurry was allowed to filter until a cake was formed with no visible moisture on the top of the cake. Data was collected to determine the form time and cake moisture and thickness to determine the filtration rate. Additional tests were completed that included multiple dry times and varied cake thicknesses. The dry time is the additional time that the vacuum is engaged after the cake has been formed to determine if additional moisture can be removed from the cake. The filter data is summarised in Table 13.18.

**TABLE 13.18**
**VACUUM FILTRATION DATA OF ROUGHER FLOTATION TAILS**

| Sample | Dry Time (min) | Cake Thickness (mm) | % Solids of Filter Cake | Filtration Rate (Dry lb./ft$^2$/hr.) |
|---|---|---|---|---|
| FT-4 Tails (200 mesh) | 0 | 6.4 | 74.4 | 190.7 |
| FT-4 Tails (200 mesh) | 1 | 6.4 | 75.6 | 81.8 |
| FT-4 Tails (200 mesh) | 1 | 3.2 | 74.9 | 54.7 |
| FT-5 Tails (325 mesh) | 0 | 7.9 | 66.9 | 157.5 |
| FT-5 Tails (325 mesh) | 1 | 7.9 | 68.6 | 80.8 |
| FT-5 Tails (325 mesh) | 1 | 4.0 | 67.9 | 57.4 |

The flotation tails filtration results indicate the following:

- A maximum percent solid of 75.6% was achieved during testing with the 200-mesh sample, while a percent solid of 68.6% was achieved with the 325-mesh sample.

- A filtration rate of approximately 190 dry lb./ft$^2$/hr. was achieved with vacuum filtration at 200 mesh and approximately 160 dry lb./ft$^2$/hr. at 325 mesh.

### 13.3.6 Smelter Penalty Analyses

The copper and zinc concentrates were analysed for smelter penalty elements. The analyses, given in Table 13.19, indicate that the copper concentrate could be penalised for arsenic and antimony.

**TABLE 13.19**
**METAL ANALYSIS OF CLEANED CONCENTRATE SAMPLES**

| Element | Third Stage Cleaner Cu Concentrate (FT6) | Third Stage Cleaner Zn Concentrate (FT7) |
|---|---|---|
| Au, g/mt | 8.78 | 0.27 |
| Ag, g/mt | 851 | 35 |
| **%** | | |
| Al | 7.80 | 3.25 |
| Ca | 0.04 | 0.07 |
| Cu | 23.6 | 0.18 |
| Fe | 26.6 | 2.48 |
| K | <0.01 | <0.01 |
| Mg | 0.05 | 0.04 |
| Na | <0.01 | <0.01 |
| Pb | 4.27 | 0.61 |
| Ti | <0.01 | <0.01 |
| Zn | 5.43 | 62.3 |
| **ppm** | | |
| As | 9340 | 90 |
| Ba | 71 | 48 |
| Bi | <2 | <2 |
| Cd | 159 | 1740 |
| Co | 23 | 3 |
| Cr | <1 | <1 |
| Hg | 10.2 | 25.2 |
| Mn | 37 | 63 |
| Mo | 15 | 3 |
| Ni | <5 | <5 |
| Sb | 5190 | 30 |
| Se | 6 | <5 |
| Sr | 4 | 3 |
| Te | 88 | 39 |
| V | <1 | <1 |
| W | <10 | <10 |

In 1984, Getty contracted A.H. Ross & Associates to complete a metallurgical test work program at Lakefield Research of Canada Limited (Lakefield). Lakefield developed an ore treatment process and established information on likely product composition, plant tailings, and water characteristics. Based on the Lakefield work, a process flowsheet and material balance were determined (Bosch and Grimes, 1984).

A composite sample was submitted for study based on three locked-cycle flotation tests. It is not known how representative this sample was to the various types and styles of mineralisation and the mineral deposit as a whole. The grade of the composite sample, the head grade for the study, was (Bosch and Grimes, 1984):

Copper – 1.32%
Lead – 4.29%
Zinc – 9.72%
Gold – 0.022 opt
Silver – 2.66 opt

The sample was subjected to conventional grinding involving primary crushing, followed by grinding with a rod mill, followed by further grinding in a ball mill, with final output being 80% minus 400 mesh. The output was reclassified using a cyclone with oversize going back to the grinding circuit. The cyclone slurry, with about 33% solids, was passed directly to the flotation circuit. It was found that a sequential flotation of the Cu, Pb, and Zn minerals was better than a bulk Cu-Pb flotation (Bosch and Grimes, 1984). It is not

known to what extent there are any processing factors or deleterious elements that could have a significant effect on potential economic extraction.

The flotation test resulted in the following recoveries (Bosch and Grimes, 1984):

| | Cu Con. | Pb Con. | Zn Con. |
|---|---|---|---|
| Copper | **77.4%** | 1.6% | 11.2% |
| Lead | 3.8% | **77.5%** | 6.5% |
| Zinc | 1.2% | 4.8% | **87.7%** |
| Gold | 13.3% | 20.4% | 12.5% |
| Silver | 27.3% | 39.6% | 11.1% |

It should be noted that the above mineral processing and metallurgical test work comprises historical work and requires verification and updating, given that technology in this field has improved in the last 35 years.

## 13.4 Conclusions

The scoping level test work has indicated that a sequential flotation process will produce marketable-grade copper, lead, and zinc concentrates. Arsenic and antimony levels were high in copper concentrates produced in open-cycle and locked-cycle tests. **Additional geo-metallurgical test work will provide additional information on the impurities in the marketable-grade copper concentrate to determine if penalties needs to be paid**. In addition, blending of ores from different areas in the mine will keep impurities (As/Sb) below penalty levels.

# 14.0 Mineral Resource Estimate

## 14.1 Introduction

The authors were retained by AMPL to update the Pickett Mountain Project Deposit Resources in accordance with the guidelines of NI 43-101 and CIM standards. This resource estimate was undertaken by Mr. Finley Bakker, P. Geo. of Campbell River, British Columbia. The Mineral Resource used in this Preliminary Economic Assessment is an update from the A-Z Mining Professionals Ltd. report titled "National Instrument 43-101 Technical Report, Pickett Mountain Project Resource Estimation Report," Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude and effective January 7, 2019 and is based on the drill results received during the 2018 drilling program as well as the historical drill results.

The resource estimate, as used in this study and reported in a press release on September 14, 2020, utilises the 7% cut-off grade (or an NSR value of $139/t) rather than the previous 9% cut-off grade ($178/t NSR) portion as reported in the base case of the January 7, 2019 statement. No other changes were made. The exploration and drilling results completed on the property in 2019 were limited and, therefore, were considered to have no material impact on the updated mineral resource statement.

## 14.2 Database

The database used data initially verified in "National Instrument 43-101 Technical Report – Pickett Mountain Project," Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude – Prepared for Wolfden Resources Corporation, by Mr. Alan Aubut, P.Geo., April 02, 2018.

The database was updated and verified by Mr. Jerry Grant, P.Geo. and included the results from 2018 diamond drill program, a total of 34 holes or intersections. Only a few holes drilled after November 15, 2018 (after hole PM-18-029A) were not included in the resource estimate.

A total of 148 diamond drill holes made up the database and included 2,550 samples. Of these samples, approximately 940 samples were used in the resource calculation. These samples constituted 104 intervals over 4 lens codes (wireframes).

## 14.3 Data Verification

As due diligence had been undertaken in a previous NI 43-101 Technical Report, titled "National Instrument 43-101 Technical Report Pickett Mountain Project," Penobscot County Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude – Prepared for Wolfden Resources Corporation by Mr. Alan Aubut, P.Geo., April 02, 2018, its data was assumed correct. The authors had no reason not to rely on the information that they may have referenced. However, spot checks of historical data were still undertaken. No serious errors or omissions were found.

Information added to the database was verified by Mr. Don Hoy, P.Geo., Mr. Andre Labonte, and Mr. Jerry Grant, P.Geo., and was further confirmed by the authors.

Sample analyses were undertaken by ACTIVATION LABORATORIES LTD., 41 Bittern Street, Ancaster, Ontario, Canada, L9G 4V5 Telephone: +1.905.648-9611 or +1.888.228.5227; Fax: +1.905.648.9613; Activation Laboratories Ltd. (Act labs) is ISO 17025 accredited and/or certified to 9001: 2008.

- Code 1A2-Au – Fire Assay AA
- Code 1E-Ag Aqua Regia ICP (AQUAGEO)
- Code 8-Peroxide ICP Sodium Peroxide Fusion ICP
- Check assays were undertaken at Act Labs in Kamloops.
- Code 1A2-Kamloops Au – Fire Assay AA
- Code 1A3-Ag-Kamloops Au – Ag-Fire Assay Gravimetric (QOP Fire Assay Thunder Bay)
- Code 1E3-Kamloops Aqua Regia ICP (AQUAGEO)
- Code 8-Peroxide ICP-Kamloops Sodium Peroxide Fusion ICP

| Analyte Symbol | Au | Ag | Cu | Pb | Zn | Au | Ag |
|---|---|---|---|---|---|---|---|
| Unit Symbol | ppb | ppm | % | % | % | g/tonne | g/tonne |
| Lower Limit | 5 | 0.2 | 0.005 | 0.01 | 0.01 | 0.03 | 3 |
| Method Code | FA-AA | AR-ICP | FUS-Na2O2 | FUS-Na2O2 | FUS-Na2O2 | FA-GRA | FA-GRA |

The location of the recent diamond drill holes was verified by Jerry Grant, as he was on site during the drill program. All data was collected in NAD-83 format.

## 14.4 Domain Interpolation

The various domains were interpreted based on mineralogy, lithology, and grade. It was felt by the authors that the 3D Block Model would resolve any grade continuity issues as part of the interpolation.

Wireframe models were created by Andre Labonte using Gems™ 3D modeling software. These wireframes were then imported into Hexagon™/MineSight™ and validated.

It was ensured that there was no overlapping of lenses. Any overlaps, based on block size, were trimmed using MineSight™ software to negate any double reporting of tonnes (Figure 14.1, Figure 14.2, and Figure 14.3).

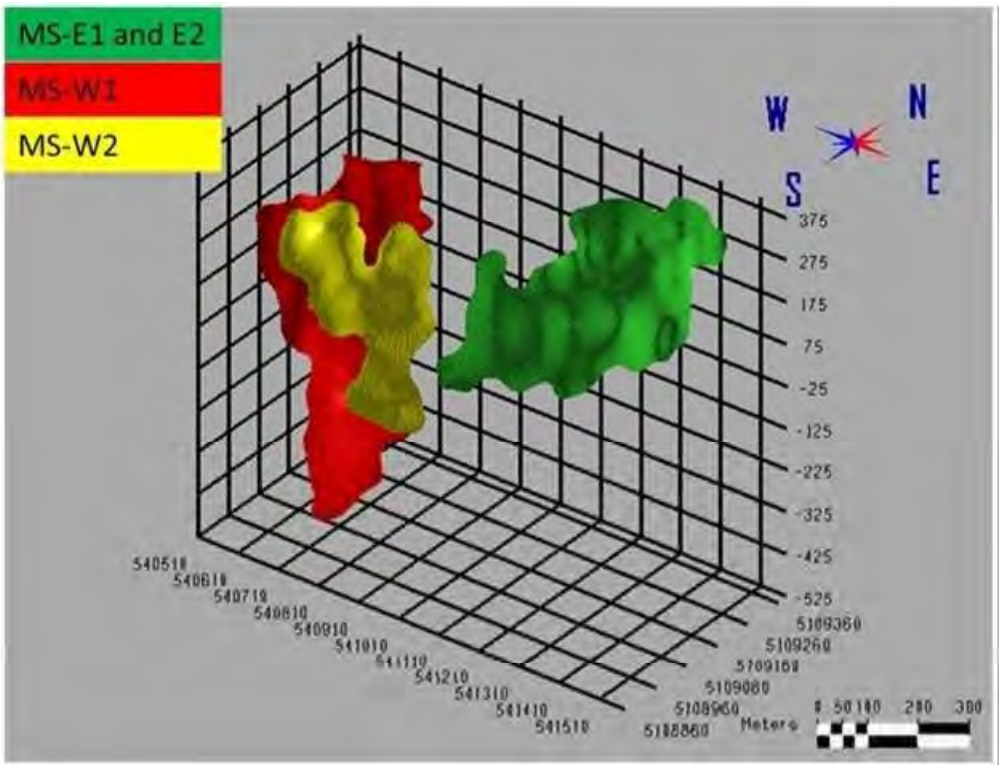



**Figure 14.1 Wireframes**

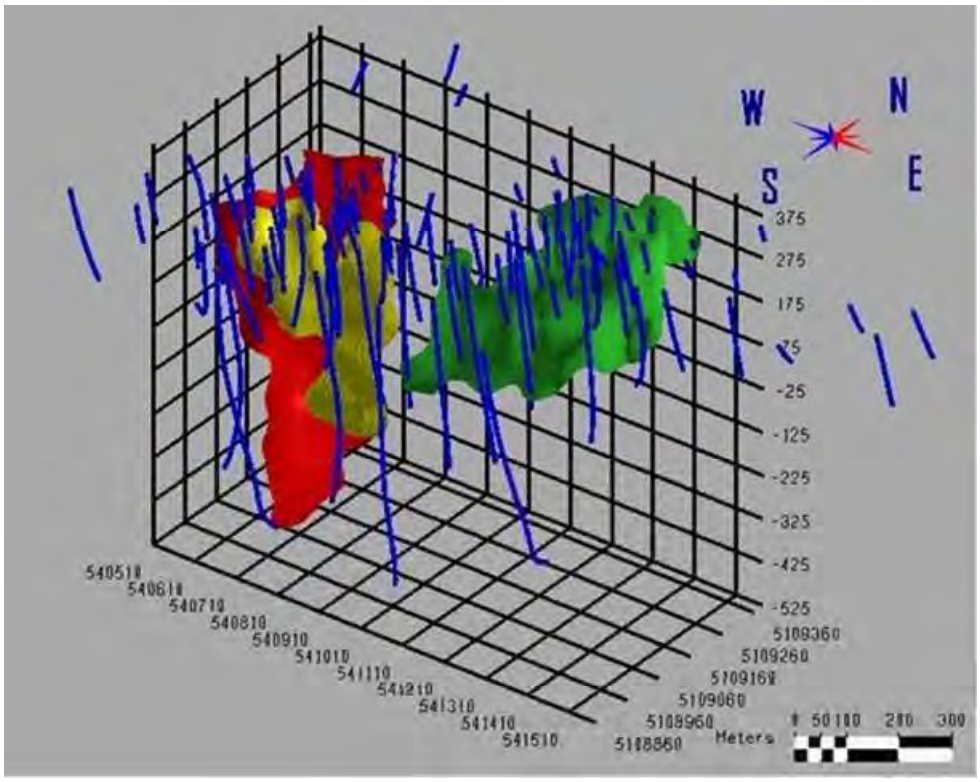



**Figure 14.2 Pre-2018 Diamond Drilling**

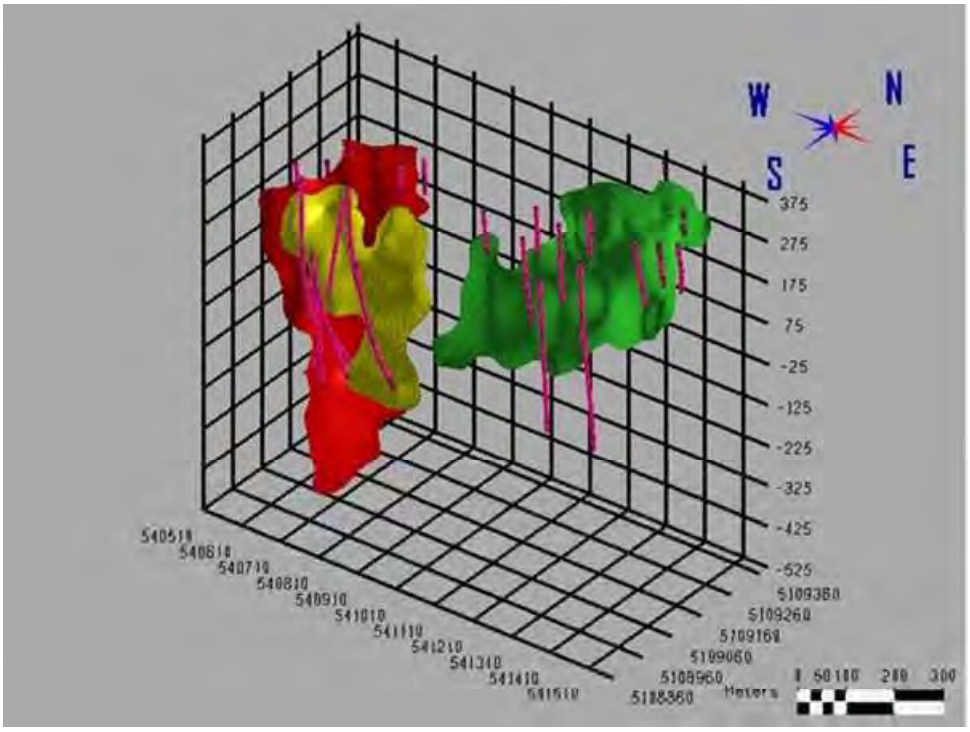



**Figure 14.3 2017/2018 Showing 2018 Diamond Drilling**

## 14.5 Lens/Rock Code

The original work centered on 4 lens codes. However, two of these were combined after density was applied, such that only three wireframe lenses were used in the estimate.

- MS-E1 and MS-E2
- MS-W1
- MS-W2

## 14.6 Composites

Two sets of composites were created for calculating purposes.

1. **Composite 1** – Composited metal grades over the entire lens code. This was done to ensure that the entire interval used in the calculation could be put into an Excel™ spreadsheet and compared to the block model. Calculations were limited by lens code (LENS). These intervals are reported in Table 14.5, below.

2. **Composite 2** – Composited metal grades were limited to lens code but assigned a maximum of 1m. Calculations were limited by lens code (LENS). These composites were used in the grade interpolation.

## 14.7 Grade Capping

Grade-capping was not performed based on histograms and the QP's experience. As well, observations by Wolfden and J. Grant, during a review of the massive sulphide intercepts, note that no obvious secondary enrichment was observed, with massive sulphide grades generally correlating with the strength of the

footwall alteration, or, local structural sub-basins where more focused hydrothermal activity would be expected. Overall, it was noted that the uniformity of grade was reasonably consistent and well correlated with geological controls and without any significant outliers in the assay results.

## 14.8 Variography

A series of variograms were created using Hexagon™ program, MSDA; this allowed a series of 3D variograms to be created based on lens code.

These 3D variograms were imported into MineSight™.

Surprisingly, the zinc variogram shows the weakest continuity with the weakest orientation of only 21m. As such, 25m was chosen as the distance from the diamond drill hole for the Indicated Resource (Figure 14.4 , Figure 14.5, and Figure 14.6).

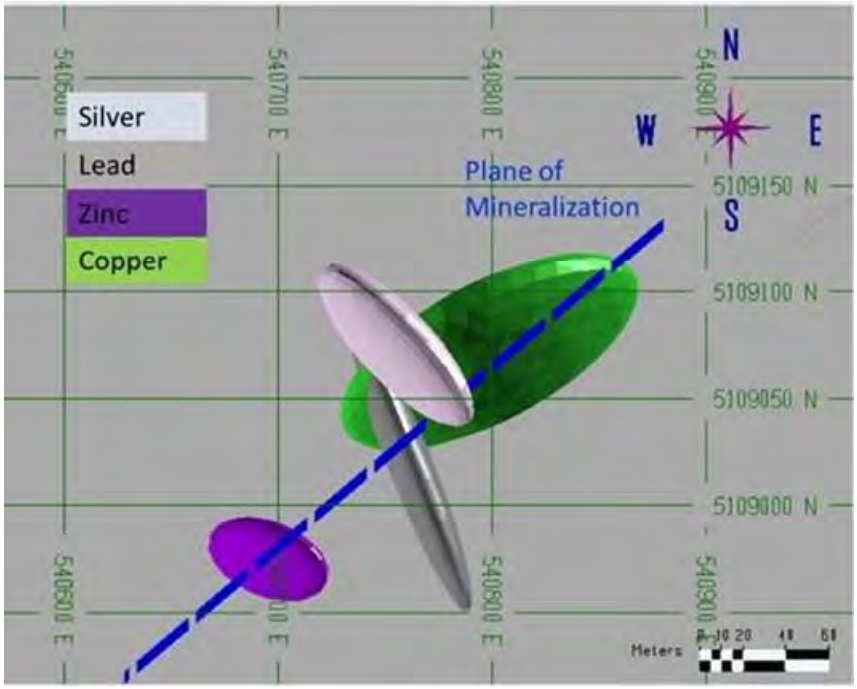



**Figure 14.4 3D Variogram of Metals Looking Down**

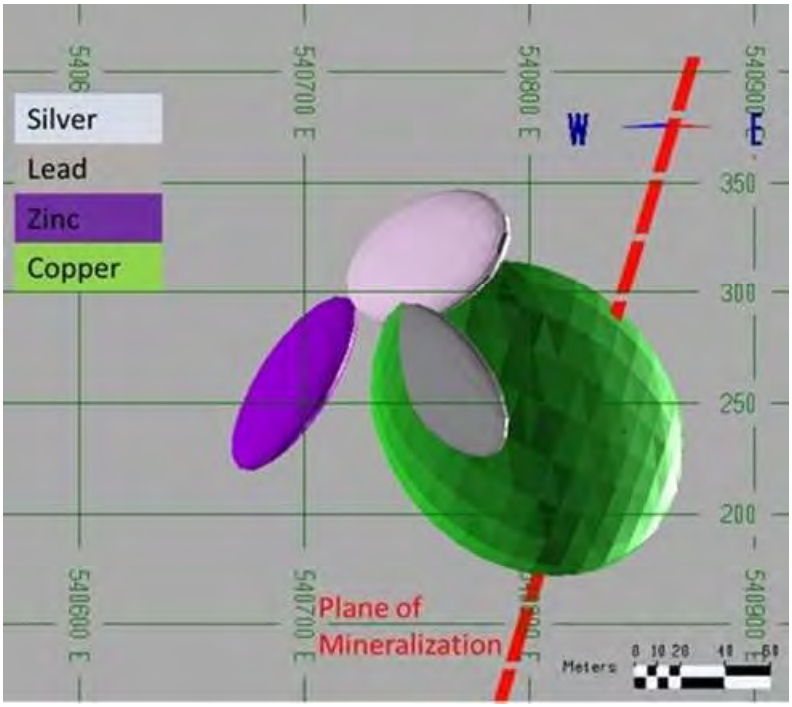



**Figure 14.5 3D Variogram of Metals Looking North**

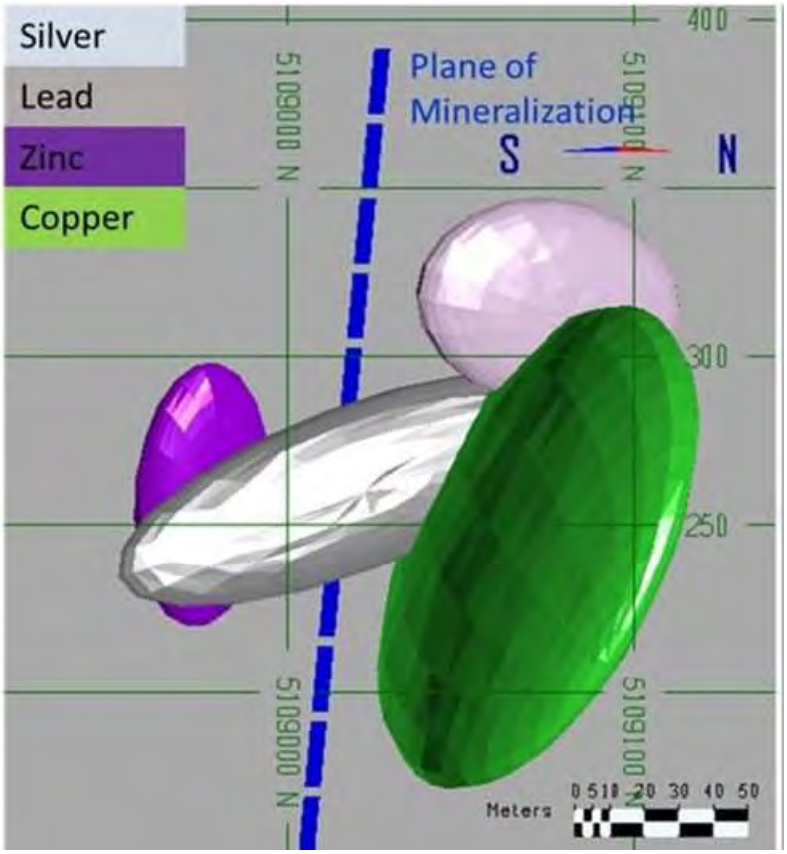



**Figure 14.6 3D Variogram of Metals Looking West**

### 14.8.1 Discussion of Variograms

Several discrete populations are evident. Pb and Ag seem to have a strong correlation. Cu has the greatest continuity and Zn shows a somewhat strange orientation. The apparent weakest correlation of zinc may be due to it having the greatest extremes in grade.

It should be noted that variograms are used to predict that the grade will continue over a certain length. The continuity of the lens is predicted by geological modeling. Hence, Zn, which has the greatest fluctuations in grade, shows the smallest continuity over distance.

However, it was noted that while composites of 1m were used in the model, sample intervals were often as much as 3m, meaning that when composites were created, there were now 3 identical composites down the length of the diamond drill core. This would/could obviously create variograms that, in reality, were only mimicking diamond drill holes and had less to do with the integrity of the data.

As a result, not much credence was given to the variograms and the authors were, therefore, more comfortable with an $IDW^2$ model.

It should be noted that the geologists working on the 2018 drill program were very confident in intersecting the lenses at distances of 50m to 70m when targeting an intersection within the model envelope. This was, in itself, a practical assessment of the variography, as opposed to interpretation of the data.

## 14.9 Bulk Density

The specific gravities used in the model were updated based on a total of 253 measured specific gravities within the mineralised lenses. These densities were loaded into the model based on sample ID. Averages were then calculated for each of the 4 mineralised zones. Where no information was present, average densities were loaded. The average for the 4 zones and waste was:

- Waste = 2.95
- MS-E1 = 4.06
- MS-E2 = 4.14
- MS-W1 = 3.89
- MS-W2 = 4.04

In the case of MS-E1 and MS-E2, the average densities per lens type was still applied in the assay file, in spite of the geometry being combined.

## 14.10 Block Model

A 3D block model was built with the following parameters.

```
(452)   3 = TYPE OF COORDINATES= Metric

(455)   1 = TYPE OF MINE MODEL = "3-D"

(476)     = TYPE OF  PROJECT   = METL

(21) XMIN = EASTING AT WEST MATRIX LIMIT    540510.00
(22) XMAX = EASTING AT EAST MATRIX LIMIT    541575.00
(23)  DX  = MATRIX BLOCK WIDTH ON EASTING        5.00
(24)  NX  = NO. OF MINE MODEL COLUMNS E-W      213.00


(25) YMIN = NORTHING AT SOUTH MATRIX LIMIT 5108860.00
(26) YMAX = NORTHING AT NORTH MATRIX LIMIT 5109398.00
(27)  DY  = MATRIX BLOCK WIDTH ON NORTHING       5.00
(28)  NY  = NO. OF MINE MODEL  ROWS  N-S       106.00


(29) ZMIN = TOE ELEVATION OF  LOWEST LEVEL    -525.00
(30) ZMAX = CREST  ELEV.  OF HIGHEST LEVEL     380.00
(31)  DZ  = MATRIX ELEVATION BLOCK HEIGHT        5.00
(32)  NZ  = NO. OF MINE MODEL BENCHES          181.00
```

## 14.11 Resources Classification

The resources were based on the distance from a diamond drill hole and by a ZnEq cut-off. The mineralised wireframes were created based on mineralogy. The Indicated Resource was based on a cut-off of 9% ZnEq and a maximum distance of 25m to a drill hole. The 25m was based on maximum continuity indicated by the variograms. Because of the relatively small distance used to calculate Indicated, a simple on- hole minimum was used. Using a two-hole minimum was not recommended. Visual inspection of the wireframes suggests a much stronger correlation between assays than the variograms suggest.

For the Inferred Resource, a minimum of 25 metres and a maximum of 200m were used (Figure 14.7, Figure 14.8, and Figure 14.9).

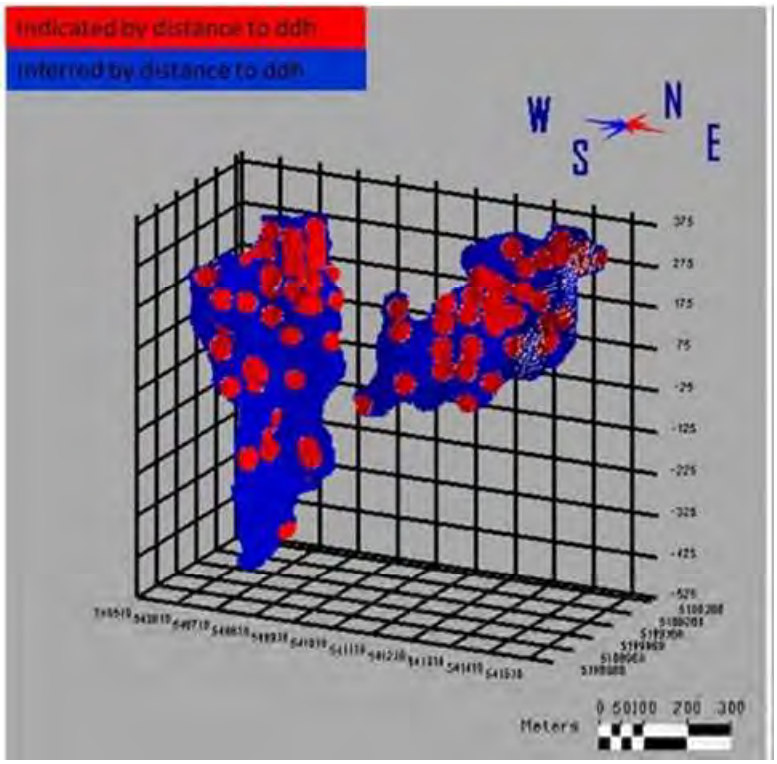



**Figure 14.7 Mineralisation, as Defined from Distance to Diamond Drill Hole**

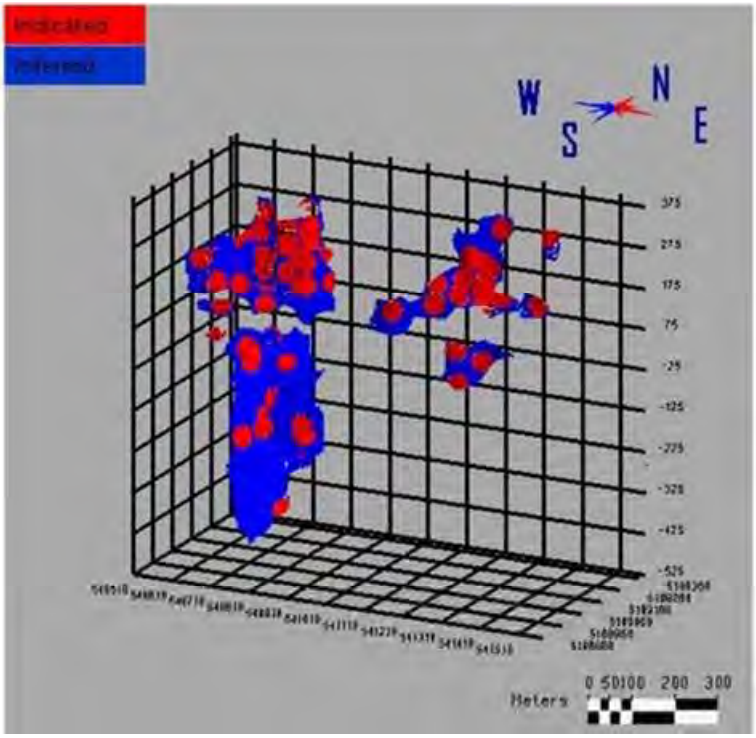



**Figure 14.8 Area in Blue Shows Inferred Resource, Red Shows Indicated Resource; Both Categories Trimmed to 9% ZnEq**

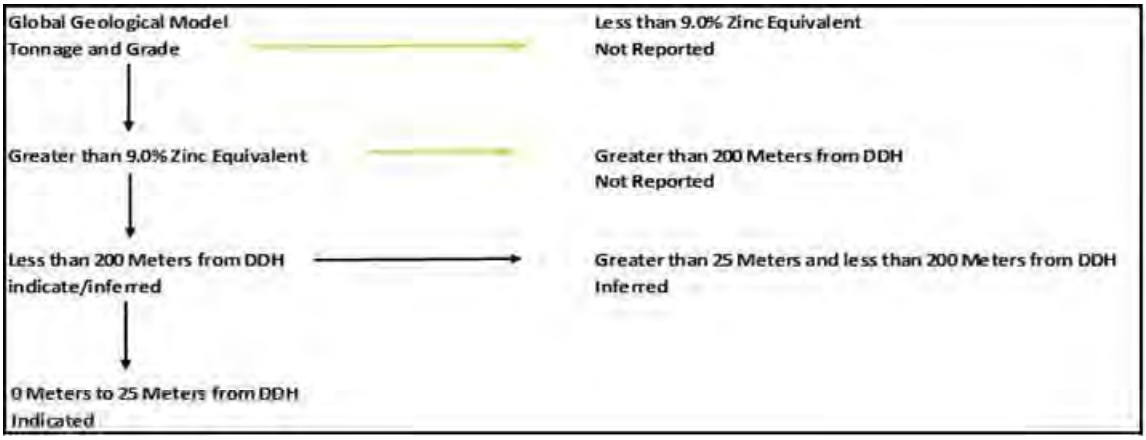



**Figure 14.9 Flow Chart of Resource Classification**

The Indicated material was calculated as being a maximum of 25m from a diamond drill hole and meeting a single hole minimum. In addition, it had to meet a minimum grade of 9% ZnEq.

A no hole minimum and a minimum of 25m and a maximum distance of 200m were used for Inferred. In addition, it had to meet a minimum grade of 9% ZnEq.

## 14.12 Resources Estimate

A number of potential cut-off grades in ZnEq were calculated. Results are given in Table 14.1, Table 14.2, Table 14.3 and Table 14.4. The tonnage and grade are robust over the intervals chosen. However, in January 2019, a 9% ZnEq was chosen as the cut-off grade for the resources in order to be able to compare the updated resource to the historical estimates performed by Getty and Chevron in the 1980s (Figure 14.10 and Figure 14.11). For the purposes of this PEA, the cut-off grade was reduced to 7% ZnEq. This, in the opinion of the authors, was deemed acceptable and did not require an entire recalculation of the resource for the following reasons:

1. An indicated and inferred resource had already been calculated at 7% Zinc Equivalent although a 9% cut-off was ultimately used. It was felt that by lowering the cut-off, the only impact on grade shells would be to make them more robust, not less

2. Different metal prices were used in the PEA as well as different recoveries. None the less these metal prices were still robust and similar enough that the resource did not need to be recalculated

3. The resource reported and used in the PEA at a 7% cut-off was slightly lower than that reported in the January 2019 report. This resulted in a slightly more conservative tonnage with the contained metal seeing an overall reduction of approximately 5% contained metal. This is due to removing some of the outliers from the blocks used for the PEA.

**TABLE 14.1**
**MINERAL RESOURCE SUMMARY JANUARY 2019 WITH 9% ZNEQ CUT-OFF**

| Category | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| Indicated | 2,050,000 | 9.88 | 3.93 | 1.38 | 101.58 | 0.92 | 3.99 | 19.32 |
| Inferred | 2,030,000 | 10.98 | 4.35 | 1.2 | 111.45 | 0.92 | 4 | 20.61 |

**TABLE 14.2**
**MINERAL RESOURCE STATEMENT – UPDATED SEPTEMBER 2020 WITH 7% ZNEQ CUT-OFF**

| Category | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| Indicated | 2,177,000 | 9.25 | 3.68 | 1.32 | 96.4 | 0.9 | 3.98 | 18.23 |
| Inferred | 2,294,000 | 9.79 | 3.88 | 1.15 | 101.1 | 0.9 | 3.99 | 18.62 |

**TABLE 14.3**
**SENSITIVITY OF INDICATED RESOURCE TO CUT-OFF GRADES – JANUARY 7, 2019**
**(BASED ON < 25M FROM DIAMOND DRILL HOLES)**

| % ZnEq Cut-off Grade | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| 3% ZnEq | 3,970,000 | 6.03 | 2.38 | 1.02 | 65.39 | 0.68 | 4.02 | 12.39 |
| 5% ZnEq | 2,820,000 | 7.89 | 3.12 | 1.21 | 83.61 | 0.81 | 4 | 15.79 |
| 7% ZnEq | 2,320,000 | 9.11 | 3.62 | 1.32 | 95.04 | 0.88 | 3.98 | 17.99 |
| 9% ZnEq | 2,050,000 | 9.88 | 3.93 | 1.38 | 101.58 | 0.92 | 3.99 | 19.32 |
| 11% ZnEq | 1,770,000 | 10.77 | 4.29 | 1.41 | 109.32 | 0.96 | 4 | 20.79 |

**TABLE 14.4**
**SENSITIVITY OF INFERRED RESOURCE TO CUT-OFF GRADES – JANUARY 7, 2019**
**(BASED ON > 25M AND < 200M FROM DIAMOND DRILL HOLES)**

| % ZnEq Cut-off Grade | Tonnes | % Zn | % Pb | % Cu | g/t Ag | g/t Au | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| 3% ZnEq | 4,020,000 | 6.59 | 2.58 | 0.94 | 69.91 | 0.68 | 4.03 | 13.03 |
| 5% ZnEq | 2,980,000 | 8.35 | 3.29 | 1.06 | 87.12 | 0.79 | 4.01 | 16.14 |
| 7% ZnEq | 2,450,000 | 9.67 | 3.83 | 1.15 | 99.99 | 0.86 | 4 | 18.43 |
| 9% ZnEq | 2,030,000 | 10.98 | 4.35 | 1.2 | 111.45 | 0.92 | 4 | 20.61 |
| 11% ZnEq | 1,740,000 | 12.06 | 4.77 | 1.24 | 121.42 | 0.97 | 4 | 22.39 |

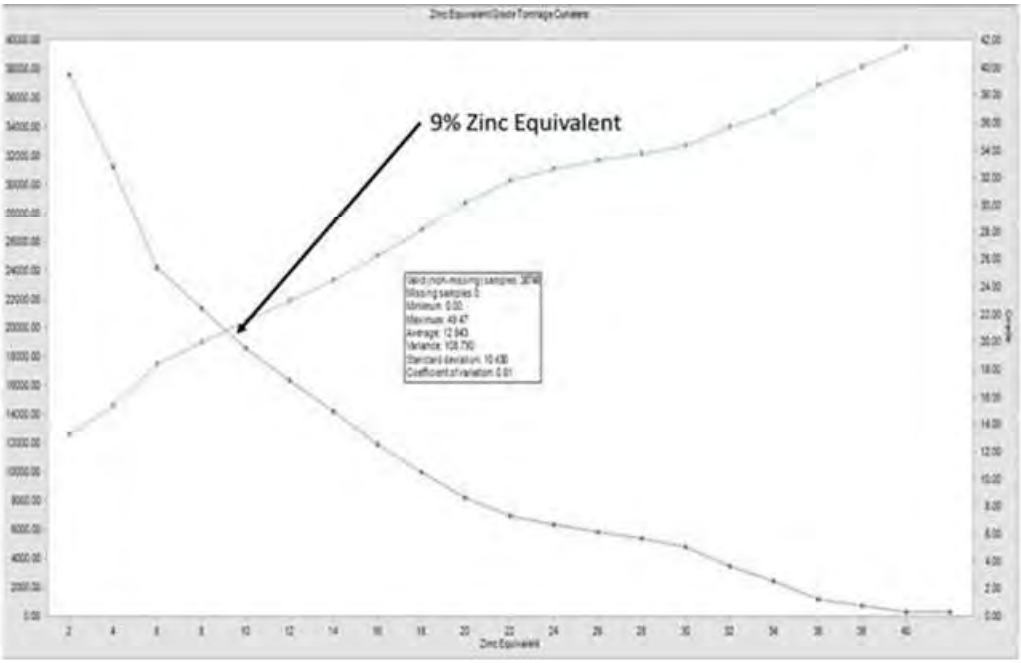



**Figure 14.10 ZnEq Tonnage Curve Limited to Mineralised Lenses**

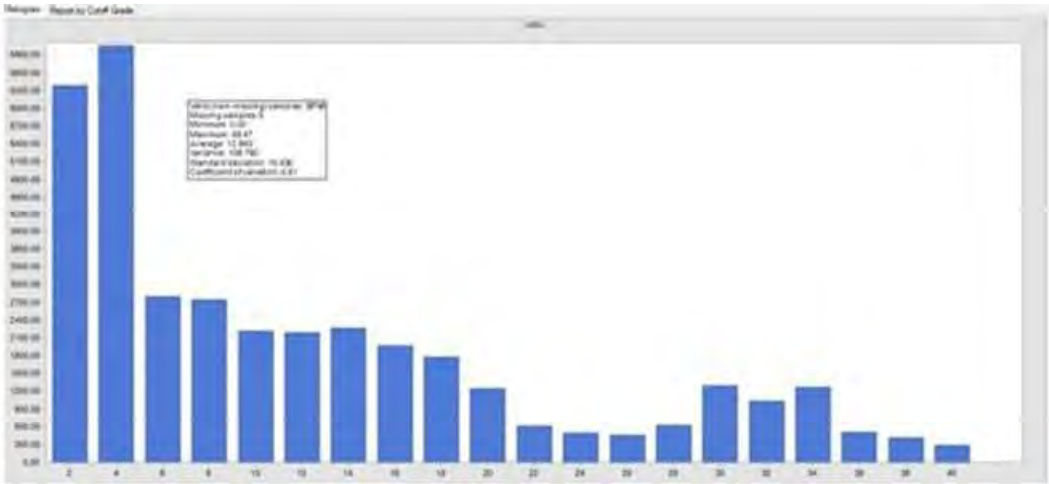


**Figure 14.11 ZnEq Histogram Limited to Mineralised Lenses**

The histogram above also indicates that a cut-off between 6% to 9% ZnEq would ensure that a bell curve would capture the bulk of the tonnes. It does not, however, show a sharp inflection point, which would ease the determination of a cut-off (Table 14.5).

**TABLE 14.5**
**ZNEQ CUT-OFFS LIMITED TO MINERALISED LENSES**

| Zinc Equivalent Cutoffs | | | | | | |
|---|---|---|---|---|---|---|
| Class | Cutoff >= | Cutoff < | Samples | Average | Metal (units) | %Total |
| 1 | 0.0 | 5.12 | 382 | 2.634 | 1006.2 | 9.1179 |
| 2 | 5.12 | 9.65 | 148 | 6.7652 | 1001.2 | 9.0732 |
| 3 | 9.65 | 13.7 | 86 | 11.712 | 1007.2 | 9.1273 |
| 4 | 13.7 | 16.98 | 66 | 15.209 | 1003.8 | 9.0963 |
| 5 | 16.98 | 20.6 | 54 | 18.82 | 1016.3 | 9.2094 |
| 6 | 20.6 | 24.65 | 44 | 22.732 | 1000.2 | 9.0638 |
| 7 | 24.65 | 28.5 | 38 | 26.574 | 1009.8 | 9.1508 |
| 8 | 28.5 | 33.04 | 33 | 30.773 | 1015.5 | 9.2025 |
| 9 | 33.04 | 36.71 | 29 | 34.451 | 999.09 | 9.0536 |
| 10 | 36.71 | 42.5 | 27 | 38.663 | 1043.9 | 9.4596 |
| 11 | 42.5 | 51.91 | 20 | 46.6 | 932.0 | 8.4457 |
| | | | | | | |
| Total: | | | 927 | 11.904 | 11035.1 | 100.0 |

Table 14.5 also shows that while there are a considerable number of assays that fall below the 9% ZnEq, the total contained metal units do not exhibit much variation between cut-offs. Nonetheless, based on visual examination of the model, it was the opinion of the authors that a 9% ZnEq cut-off was appropriate until such time that detailed mining options become available and additional infill diamond drilling and associated geological interpretations are carried out. As noted above, more detailed mining options became available and using data available for the PEA, the ZnEq cut-off was revised to 7%.

It is apparent that there appears to be a natural break in ZnEq grades at approximately 9% (Figure 14.12 and Figure 14.13).

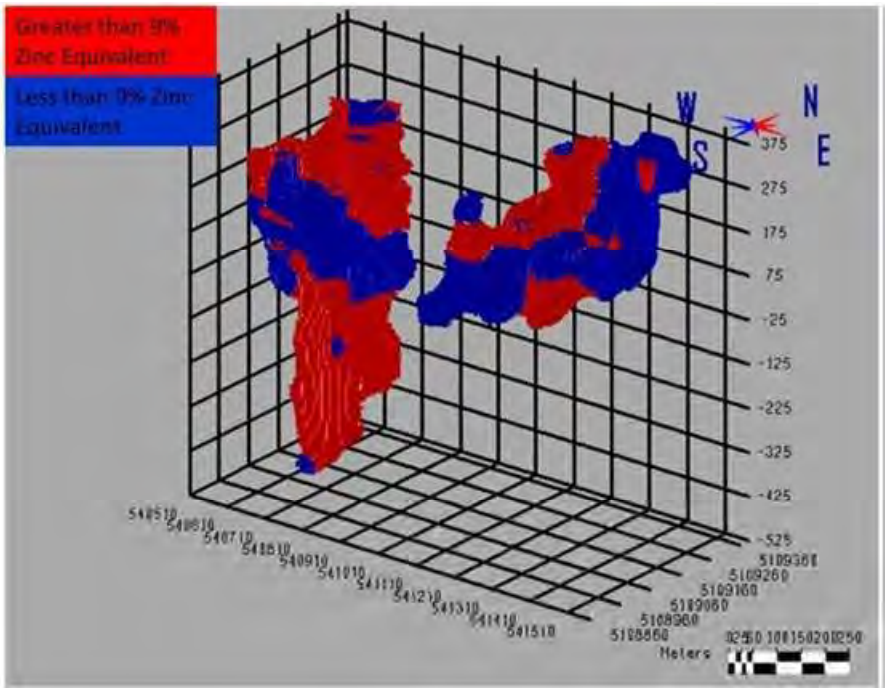



**Figure 14.12 Indicated (Red) and Inferred (Blue) Domains Superimposed on the Entire Geological Model**

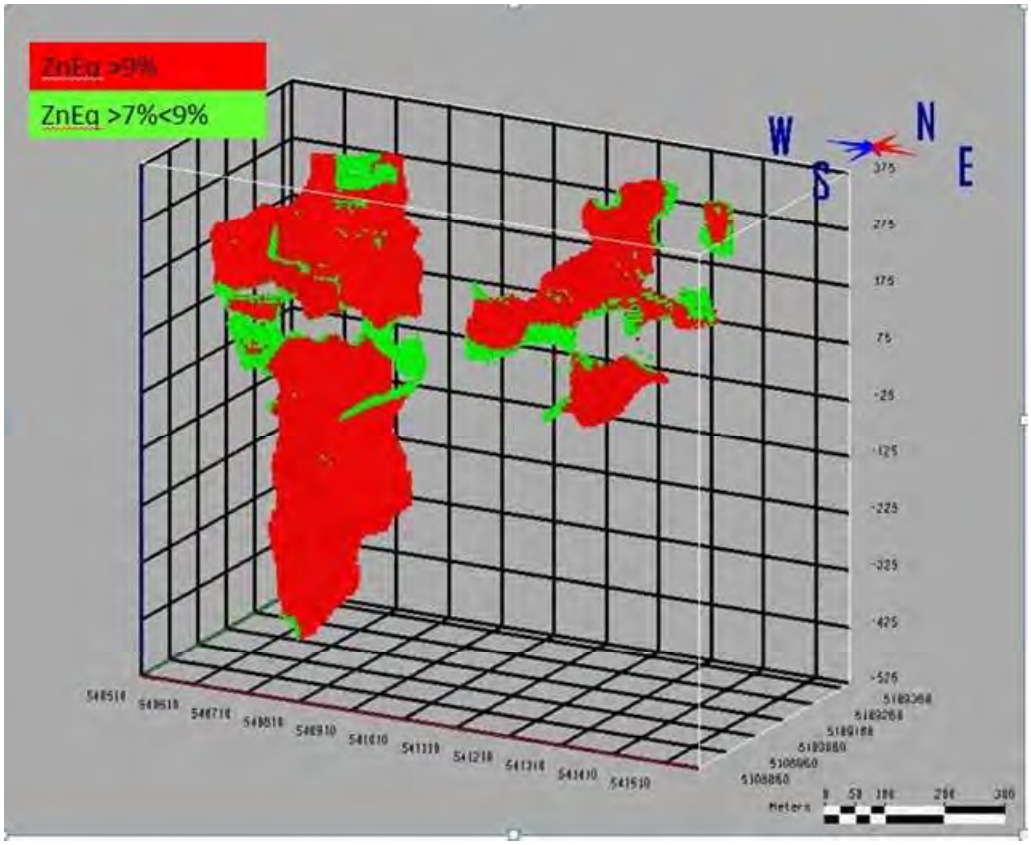



**Figure 14.13 Showing Location of Material > 7% ZnEq < 9% ZnEq**

## 14.13 Calculation of Cut-off

Both a Gross ZnEq cut-off and an NSR were calculated. A generic NSR was calculated using the parameters in Table 14.6.

**TABLE 14.6**
**MINERAL RESOURCE METAL PRICES**

| Assumptions | $US/pound/oz | |
|---|---|---|
| Zn | $ 1.20 | /pound |
| Cu | $ 2.50 | /pound |
| Pb | $ 1.00 | /pound |
| Ag | $ 16.00 | /troy ounce |
| Au | $ 1,200.00 | /troy ounce |

A 9% ZnEq was then calculated based on values in Table 14.6 and lacking any recent metallurgical testing, an assumed conservative similar recovery of all metals (75%) was used. Historical metallurgical testing indicated 88% for Zn, 78% for Pb, and 77% for Cu.

Assuming an overall recovery (milling and smelting) of 75%, a 9% ZnEq equates to a $178 NSR cut-off. This is not meant as a precise number but more as an aid in determining cut-off (Table 14.7).

**TABLE 14.7**
**CALCULATION OF NSR/ZNEQ CUT-OFF**

| | |
|---|---|
| US$/Pound | $ 1.20 |
| 9 % zinc = pounds/tonne | 198 |
| 75 % recovery = pounds zinc | 149 |
| value in US$ | $ 178 |

The 9% ZnEq was based on both economics as well as a tonnage grade curve and indicated that a significant portion of the tonnes and grade would be captured at this cut-off (Table 14.8, Table 14.9, Table 14.10, and Table 14.11).

This same calculation using a 7% ZnEq resulted in a $139 NSR.

**TABLE 14.8**
**INDICATED RESOURCES**

| Indicated Mineral Resources | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ZnEq Cutoff | Tonnes | %Zn | %Cu | %Pb | g/t Au | g/t Ag | Den | %ZnEq |
| LENS E1 + E2 | 9% | 890,000 | 8.27 | 1.10 | 3.24 | 0.87 | 75.64 | 4.07 | 16.00 |
| LENS WEST 1 | 9% | 990,000 | 11.60 | 1.60 | 4.60 | 0.99 | 128.39 | 3.92 | 22.68 |
| LENS WEST 2 | 9% | 170,000 | 8.30 | 1.51 | 3.59 | 0.75 | 81.41 | 4.03 | 17.11 |
| 9% Zinc Equiva | 9% | 2,050,000 | 9.88 | 1.38 | 3.93 | 0.92 | 101.58 | 3.99 | 19.32 |

*Tonnes may not add due to rounding*
*The resource for the Pickett Mountain Project zinc deposit was estimated based on metal prices of US$1.20/lb Zn, $2.50/lb Cu, $1.00/lb Pb, $16.00/oz Ag, and $1,200/oz/Au, and equates to an NSR cut-off of $178/tonne or a 9% ZnEq cut-off based on the above metal prices. An average recovery of 75% for all metals for underground mining and milling was utilised to report the resource*

### TABLE 14.9
### INFERRED RESOURCES

| Inferred Mineral Resources | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ZnEq Cutoff | Tonnes | %Zn | %Cu | %Pb | g/t Au | g/t Ag | Den | %ZnEq |
| LENS E1 + E2 | 9% | 670,000 | 6.87 | 1.00 | 2.69 | 0.82 | 67.44 | 4.07 | 13.68 |
| LENS WEST 1 | 9% | 1,120,000 | 14.23 | 1.28 | 5.58 | 1.04 | 146.32 | 3.95 | 25.87 |
| LENS WEST 2 | 9% | 240,000 | 7.26 | 1.42 | 3.20 | 0.68 | 71.05 | 4.01 | 15.27 |
| 9% Zinc Equiva>= | 9% | 2,030,000 | 10.98 | 1.20 | 4.35 | 0.92 | 111.45 | 4.00 | 20.61 |

*Tonnes may not add due to rounding*

*The resource for the Pickett Mountain Project zinc deposit was estimated based on metal prices of US $1.20/lb Zn, $2.50/lb Cu, $1.00/lb Pb, $16.00/oz Ag, and $1,200/oz/Au, this equates to an NSR cut-off of $178/tonne or a 9% ZnEq cut-off based on the above metal prices. An average recovery of 75% for all metals for underground mining and milling was utilised to report the resource.*

### TABLE 14.10
### SHOWING REPRESENTATIVE RECOVERED VALUE OF INDICATED RESOURCE

| Indicated Mineral Resource | | | | | | |
|---|---|---|---|---|---|---|
| | Price Assumption | | | | $US/tonne | Approx.NSR |
| | $US/Pound | $US/gm | %US/% | input file | metal | % payable |
| Zn | 1.2 | | 26.45 | 9.88 | 196 | 51% |
| Cu | 2.5 | | 55.12 | 1.38 | 57 | 15% |
| Pb | 1 | | 22.05 | 3.93 | 65 | 17% |
| Ag | 16 | 0.51 | | 101.59 | 39 | 10% |
| Au | 1200 | 38.58 | | 0.92 | 27 | 7% |
| | | | | | 383 | 100% |

### TABLE 14.11
### SHOWING REPRESENTATIVE RECOVERED VALUE OF INFERRED RESOURCE

| Inferred Mineral Resource | | | | | | |
|---|---|---|---|---|---|---|
| | Price Assumption | | | | $US/tonne | Approx.NSR |
| | $US/Pound | $US/gm | %US/% | input file | metal | % payable |
| Zn | 1.2 | | 26.45 | 10.98 | 218 | 53% |
| Cu | 2.5 | | 55.12 | 1.20 | 50 | 12% |
| Pb | 1 | | 22.05 | 4.35 | 72 | 18% |
| Ag | 16 | 0.51 | | 111.45 | 43 | 11% |
| Au | 1200 | 38.58 | | 0.92 | 27 | 7% |
| | | | | | 409 | 100% |

NSR values given are only an estimate using an overall 75% recovery of all metals. This is less than the historical metallurgical work undertaken in 1984 and is considered to be conservative. While a recovery of 75% for gold may be optimistic, on average it only contributes 7% to the value of the Mineral Resource, so any discrepancies would be minor (Table 14.12).

**TABLE 14.12**
**METALLURGICAL RECOVERIES (1984 BY GETTY AT LAKEFIELD)**
The flotation test resulted in the following recoveries (Bosch and Grimes, 1984):

| | | Cu Con. | Pb Con. | Zn Con |
|---|---|---|---|---|
| Copper | - | **77.4%** | 1.6% | 11.2% |
| Lead | - | 3.8% | **77.5%** | 6.5% |
| Zinc | - | 1.2% | 4.8% | **87.7%** |
| Gold | - | 13.3% | 20.4% | 12.5% |
| Silver | - | 27.3% | 39.6% | 11.1% |

## 14.14 Confirmation of Estimate

The accuracy of the model reporting was verified in four ways:

1. Pitres (Hexagon™/MineSight™) was used to calculate the resource tonnage and grade.

2. UG1res (Hexagon™/MineSight™) was then used to compare the resource estimate to the Pitres resource tonnage and grade. As expected, the numbers were identical.

3. The 3D block model data was exported into Excel™ and the resource tonnage and grade results independently verified the data, as reported by Hexagon™/MineSight™, was correct. The global tonnage was within 3 tonnes.

4. Andre Labonte calculated a gross tonnage and grade in Gems™ and this was compared to MineSight™. Using a 0.5% Zn cut-off, his global tonnage was within 1% of MineSight™ and the variance for global contained metals ranged from 3% for base metals to a maximum of 5% for precious metals.

## 14.15 Discussion of Results

A historical resource estimate was undertaken using the "Contour Plotting System" for Getty in 1983. This historical resource does not use the classification terms "Inferred Mineral Resource," "Indicated Mineral Resource," and "Measured Mineral Resource" that have the meanings ascribed to them by the Canadian Institute of Mining, Metallurgy and Petroleum, as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council, as amended. The authors have not done sufficient work to classify this historical estimate as a current Mineral Resource and Wolfden is not treating this historical estimate as a current Mineral Resource and they are included in this section for illustrative purposes only and should not be disclosed out of context. Using an average density factor of 8.25 cubic feet per ton, the estimated resource was 3.15 million tons with an average grade of 9.66% Zn, 4.30% Pb, 1.24% Cu, 0.029 opt Au, and 2.96 opt Ag (Laverty, 1983; Riddell, 1983). The conversion from imperial to metric is given below in Table 14.13.

**TABLE 14.13**
**HISTORICAL 1983 RESOURCE**

| Historical Resource Estimate | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Tons | %Zn | %Cu | %Pb | oz/t Au | oz/t Ag | Tonnage Factor |
| Getty 1983 Imperial | 3,150,000 | 9.66 | 1.24 | 4.30 | 0.03 | 2.96 | 8.25 |
| | | | | | | | |
| | Tonnes | %Zn | %Cu | %Pb | g/t ?Au | g/t Ag | Density |
| Getty 1983 Metric | 2,857,050 | 9.66 | 1.24 | 4.30 | 0.99 | 102.16 | 3.89 |

This historical resource does not use the classification terms “Inferred Mineral Resource,” “Indicated Mineral Resource,” and “Measured Mineral Resource” that have the meanings ascribed to them by the Canadian Institute of Mining, Metallurgy and Petroleum, as the CIM Definition Standards on Mineral Resources and Mineral Reserves adopted by CIM Council, as amended (Table 14.14).

**TABLE 14.14**
**MINERAL RESOURCE SUMMARY – JANUARY 7, 2019**

| Total Resources | Tonnes | % Zn | % Cu | % Pb | g/t Au | g/t Ag | Density | % ZnEq |
|---|---|---|---|---|---|---|---|---|
| Indicated Mineral Resource | 2,050,000 | 9.88 | 1.38 | 3.93 | 0.92 | 101.58 | 3.99 | 19.32 |
| Inferred Mineral Resource | 2,030,000 | 10.98 | 1.20 | 4.35 | 0.92 | 111.45 | 4.00 | 20.61 |

While a direct comparison of tonnage and grade is not possible, it is apparent that regardless of the methodology employed to calculate the resource, the system is robust enough to support multiple methods of calculating resources. The apparent increase in tonnage is at least partially due to the 2018 diamond drill program that extended the deposits to depth. The historical resource was noted to occur only to a depth of 400 metres. The updated estimate goes to a vertical depth of +800m in the West Lens (Table 14.15 and Table 14.16).

## TABLE 14.15

## LIST OF SIGNIFICANT INTERSECTIONS USED TO CALCULATE THE MINERAL RESOURCE

| HOLE-ID | EAST | NORTH | ELEV. | LNGTH | ZN | CU | PB | AU | AG | DEN |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 541,355 | 5,109,333 | 322 | 6.71 | 2.04 | 0.71 | 0.72 | 0.19 | 28.80 | 4.14 |
| 2 | 541,362 | 5,109,314 | 295 | 12.80 | 4.96 | 0.90 | 1.85 | 0.62 | 49.02 | 4.14 |
| 8 | 541,246 | 5,109,299 | 299 | 3.65 | 5.46 | 1.22 | 1.97 | 1.10 | 45.49 | 4.06 |
| 9 | 541,326 | 5,109,306 | 286 | 7.92 | 2.00 | 0.29 | 0.27 | 0.73 | 19.39 | 4.14 |
| 10 | 541,373 | 5,109,289 | 218 | 1.22 | 2.18 | 0.81 | 0.59 | 0.17 | 42.51 | 4.14 |
| 11 | 541,476 | 5,109,300 | 305 | 4.41 | 2.14 | 0.42 | 0.56 | 0.41 | 30.38 | 4.14 |
| 13 | 541,327 | 5,109,280 | 189 | 2.90 | 2.49 | 0.68 | 0.52 | 0.54 | 54.86 | 4.14 |
| 23 | 540,719 | 5,109,002 | 218 | 1.30 | 8.07 | 1.58 | 5.00 | 0.86 | 101.95 | 4.04 |
| 23 | 540,716 | 5,109,006 | 212 | 3.40 | 6.31 | 2.12 | 3.22 | 0.71 | 65.29 | 3.89 |
| 25 | 540,745 | 5,108,964 | 127 | 0.61 | 0.60 | 0.50 | 0.23 | 0.33 | 14.09 | 4.04 |
| 25 | 540,742 | 5,108,970 | 122 | 6.92 | 1.35 | 0.72 | 0.33 | 0.23 | 10.75 | 3.89 |
| 28 | 540,813 | 5,109,059 | 202 | 10.07 | 15.89 | 1.42 | 7.40 | 1.84 | 180.93 | 3.89 |
| 29 | 540,623 | 5,108,925 | 135 | 0.61 | 2.58 | 0.19 | 0.96 | 0.25 | 6.32 | 3.89 |
| 30 | 540,809 | 5,109,035 | 81 | 1.65 | 0.89 | 0.35 | 0.40 | 0.27 | 21.60 | 3.89 |
| 33 | 540,892 | 5,109,111 | 241 | 1.56 | 6.66 | 0.44 | 4.77 | 0.50 | 90.77 | 3.89 |
| 34 | 541,138 | 5,109,166 | 140 | 14.06 | 8.67 | 0.82 | 3.27 | 0.99 | 78.52 | 4.06 |
| 35 | 540,920 | 5,109,074 | 187 | 4.45 | 12.65 | 0.85 | 5.58 | 0.82 | 86.61 | 4.04 |
| 36 | 541,054 | 5,109,112 | 125 | 6.33 | 6.11 | 1.07 | 2.46 | 0.72 | 63.58 | 4.06 |
| 37 | 541,140 | 5,109,154 | 78 | 21.96 | 1.64 | 0.72 | 0.69 | 0.74 | 51.27 | 4.06 |
| 38 | 540,911 | 5,109,057 | 90 | 3.98 | 2.26 | 0.73 | 0.88 | 0.44 | 32.34 | 4.04 |
| 39 | 541,235 | 5,109,229 | 126 | 32.18 | 2.31 | 0.85 | 0.89 | 0.41 | 22.43 | 4.06 |
| 40 | 541,082 | 5,109,080 | 11 | 3.24 | 1.52 | 0.76 | 0.58 | - | - | 4.06 |
| 44 | 541,282 | 5,109,238 | 79 | 25.75 | 0.94 | 0.53 | 0.51 | 0.22 | 8.49 | 4.06 |
| 46 | 541,236 | 5,109,259 | 212 | 10.06 | 8.85 | 0.73 | 3.38 | 0.66 | 79.71 | 4.06 |
| 47 | 541,184 | 5,109,221 | 190 | 6.41 | 17.08 | 1.02 | 6.42 | 1.40 | 128.89 | 4.06 |
| 49 | 541,178 | 5,109,263 | 305 | 0.36 | 0.18 | 0.10 | 0.14 | 0.11 | 0.14 | 4.06 |
| 52 | 540,805 | 5,109,058 | 327 | 13.97 | 3.97 | 0.91 | 1.69 | 0.49 | 33.27 | 3.89 |
| 53 | 540,841 | 5,109,078 | 231 | 13.90 | 18.60 | 1.63 | 10.21 | 1.62 | 229.78 | 3.89 |
| 54 | 540,748 | 5,109,040 | 294 | 8.37 | 7.76 | 1.23 | 2.27 | 0.71 | 44.23 | 3.89 |
| 55 | 540,714 | 5,108,931 | - 9 | 5.17 | 0.99 | 0.56 | 0.33 | 0.18 | 8.97 | 3.89 |
| 56 | 541,222 | 5,109,117 | - 30 | 1.95 | 12.00 | 0.67 | 4.08 | 1.30 | 96.41 | 4.06 |
| 57 | 540,848 | 5,109,091 | 298 | 14.58 | 11.05 | 1.54 | 5.91 | 0.92 | 145.72 | 3.89 |
| 58 | 540,868 | 5,109,041 | 181 | 5.82 | 8.09 | 2.40 | 3.31 | 1.12 | 123.63 | 4.04 |
| 58 | 540,855 | 5,109,075 | 122 | 14.54 | 2.97 | 0.94 | 1.30 | 0.44 | 78.28 | 3.89 |
| 59 | 540,766 | 5,109,034 | 212 | 14.47 | 6.16 | 1.58 | 2.75 | 0.62 | 88.43 | 4.04 |
| 59 | 540,764 | 5,109,039 | 184 | 17.71 | 14.99 | 3.14 | 7.80 | 1.19 | 150.73 | 3.89 |
| 60 | 541,285 | 5,109,293 | 262 | 1.82 | 0.79 | 0.75 | 0.28 | 0.17 | 5.14 | 4.06 |
| 62 | 540,682 | 5,108,947 | 195 | 5.80 | 1.47 | 0.94 | 0.50 | 0.72 | 20.52 | 4.04 |
| 62 | 540,680 | 5,108,952 | 183 | 7.32 | 8.59 | 1.09 | 4.55 | 0.87 | 76.67 | 3.89 |
| 63 | 541,237 | 5,109,282 | 265 | 0.19 | 5.30 | 0.54 | 2.40 | 0.45 | 30.17 | 4.06 |
| 64 | 541,193 | 5,109,240 | 238 | 12.76 | 8.24 | 1.36 | 3.71 | 0.78 | 83.84 | 4.06 |
| 65 | 540,996 | 5,109,027 | - 40 | 3.29 | 0.77 | 0.32 | 0.26 | 0.53 | 4.86 | 4.06 |
| 67 | 541,230 | 5,109,234 | 146 | 81.46 | 5.68 | 1.00 | 2.55 | 0.54 | 42.09 | 4.06 |
| 68 | 540,807 | 5,109,058 | 308 | 20.87 | 7.79 | 1.13 | 2.59 | 0.52 | 44.74 | 3.89 |
| 69 | 540,808 | 5,109,056 | 276 | 30.32 | 8.40 | 1.16 | 3.55 | 0.95 | 107.33 | 3.89 |
| 70 | 541,368 | 5,109,231 | 92 | 41.75 | 1.49 | 0.58 | 0.49 | 0.41 | 17.27 | 4.14 |
| 72 | 540,793 | 5,109,031 | - 101 | 3.92 | 18.08 | 0.56 | 8.53 | 1.13 | 209.86 | 3.89 |
| 74 | 540,680 | 5,108,954 | 248 | 3.34 | 13.55 | 1.95 | 5.12 | 0.98 | 167.98 | 3.89 |
| 76 | 540,643 | 5,108,945 | 243 | 5.41 | 1.66 | 2.88 | 0.57 | 0.36 | 38.22 | 3.89 |

## TABLE 14.15
## LIST OF SIGNIFICANT INTERSECTIONS USED TO CALCULATE THE MINERAL RESOURCE
## *(CONTINUED)*

| HOLE-ID | EAST | NORTH | ELEV. | LNGTH | ZN | CU | PB | AU | AG | DEN |
|---|---|---|---|---|---|---|---|---|---|---|
| 78 | 541,356 | 5,109,270 | 136 | 23.05 | 5.01 | 1.10 | 2.00 | 0.62 | 48.85 | 4.14 |
| 80 | 540,845 | 5,109,024 | 186 | 6.24 | 8.15 | 1.64 | 3.90 | 1.00 | 110.32 | 4.04 |
| 80 | 540,826 | 5,109,060 | 132 | 9.60 | 1.61 | 0.58 | 1.09 | 0.44 | 14.74 | 3.89 |
| 81 | 541,272 | 5,109,252 | 150 | 25.48 | 3.10 | 0.77 | 1.20 | 0.51 | 31.53 | 4.06 |
| 82 | 540,724 | 5,108,986 | 182 | 3.14 | 0.94 | 0.91 | 0.32 | 0.46 | 26.51 | 4.04 |
| 82 | 540,719 | 5,108,994 | 173 | 4.90 | 7.23 | 2.64 | 2.85 | 0.95 | 115.16 | 3.89 |
| 83 | 541,285 | 5,109,275 | 208 | 5.48 | 3.13 | 0.43 | 1.24 | 0.33 | 29.39 | 4.06 |
| 85 | 540,759 | 5,108,978 | 18 | 1.66 | 1.42 | 0.19 | 0.69 | 0.20 | 6.13 | 4.04 |
| 85 | 540,752 | 5,108,984 | - 2 | 12.71 | 8.81 | 1.88 | 4.04 | 1.02 | 92.78 | 3.89 |
| 86 | 540,765 | 5,109,031 | 247 | 2.59 | 11.19 | 1.28 | 3.86 | 1.03 | 85.12 | 4.04 |
| 86 | 540,761 | 5,109,039 | 237 | 8.00 | 3.04 | 2.24 | 1.11 | 0.57 | 35.79 | 3.89 |
| 87 | 540,865 | 5,109,042 | 236 | 12.10 | 5.53 | 1.28 | 2.35 | 0.56 | 56.91 | 4.04 |
| 87 | 540,852 | 5,109,074 | 187 | 5.73 | 15.50 | 2.25 | 6.00 | 0.87 | 191.16 | 3.89 |
| 90 | 540,805 | 5,109,047 | - 377 | 1.91 | 25.27 | 0.88 | 10.21 | 0.86 | 140.84 | 3.89 |
| 91 | 540,832 | 5,109,023 | - 1 | 2.10 | 1.00 | 1.65 | 0.37 | 0.38 | 9.26 | 4.04 |
| 91 | 540,823 | 5,109,033 | - 15 | 2.61 | 8.28 | 1.46 | 3.00 | 1.45 | 70.80 | 3.89 |
| 92 | 541,187 | 5,109,196 | 158 | 4.19 | 8.40 | 0.87 | 3.29 | 0.81 | 76.59 | 4.06 |
| 93 | 541,201 | 5,109,157 | 41 | 13.66 | 3.94 | 0.85 | 1.46 | 1.11 | 72.91 | 4.06 |
| 94 | 540,683 | 5,108,941 | 79 | 15.82 | 2.72 | 1.09 | 1.09 | 0.73 | 44.61 | 3.89 |
| 90A | 540,808 | 5,109,049 | - 312 | 1.37 | 12.50 | 0.77 | 4.75 | 0.79 | 93.24 | 3.89 |
| 98A | 540,733 | 5,108,954 | - 446 | 1.40 | 1.58 | 0.10 | 0.01 | 0.10 | 1.30 | 3.89 |
| PM-17-001 | 540,853 | 5,109,090 | 309 | 7.95 | 8.06 | 1.56 | 3.92 | 0.87 | 105.89 | 3.56 |
| PM-17-002 | 540,854 | 5,109,086 | 273 | 9.89 | 16.31 | 1.73 | 7.09 | 1.42 | 185.64 | 3.89 |
| PM-18-003 | 541,229 | 5,109,235 | 180 | 9.71 | 9.51 | 1.06 | 3.45 | 0.77 | 60.82 | 4.07 |
| PM-18-004 | 541,218 | 5,109,257 | 223 | 10.28 | 11.40 | 1.28 | 4.20 | 1.00 | 120.25 | 4.06 |
| PM-18-005 | 541,203 | 5,109,178 | 76 | 45.80 | 1.30 | 0.59 | 0.51 | 0.43 | 24.03 | 4.06 |
| PM-18-006A | 541,368 | 5,109,244 | 96 | 52.40 | 1.33 | 0.50 | 0.48 | 0.30 | 18.63 | 4.14 |
| PM-18-007 | 540,778 | 5,109,011 | 149 | 1.79 | 0.63 | 0.34 | 0.15 | 0.14 | 9.00 | 4.04 |
| PM-18-007 | 540,767 | 5,109,028 | 112 | 31.49 | 4.62 | 1.01 | 1.73 | 0.63 | 63.50 | 4.15 |
| PM-18-008 | 540,794 | 5,109,012 | 60 | 1.00 | 0.94 | 0.72 | 0.35 | 0.17 | 17.25 | 4.04 |
| PM-18-008 | 540,792 | 5,109,016 | 49 | 2.41 | 16.79 | 0.37 | 3.99 | 0.53 | 68.43 | 3.89 |
| PM-18-009 | 540,747 | 5,108,975 | 32 | 6.80 | 0.79 | 0.54 | 0.25 | 0.24 | 16.99 | 4.35 |
| PM-18-009 | 540,744 | 5,108,978 | 24 | 3.50 | 10.38 | 1.28 | 4.07 | 0.59 | 84.28 | 4.32 |
| PM-18-010 | 540,720 | 5,109,012 | 279 | 3.29 | 5.35 | 0.51 | 1.74 | 0.31 | 41.77 | 3.42 |
| PM-18-011 | 540,756 | 5,109,047 | 342 | 3.00 | 4.22 | 2.60 | 1.42 | 0.54 | 34.26 | 3.89 |
| PM-18-012 | 540,844 | 5,109,097 | 345 | 11.40 | 3.84 | 0.87 | 1.51 | 0.31 | 36.35 | 3.27 |
| PM-18-013 | 541,406 | 5,109,325 | 305 | 9.40 | 2.41 | 0.76 | 0.84 | 0.42 | 32.21 | 4.16 |
| PM-18-014 | 541,430 | 5,109,295 | 285 | 5.00 | 1.70 | 0.47 | 0.55 | 0.28 | 24.65 | 4.14 |
| PM-18-015 | 541,391 | 5,109,274 | 155 | 16.50 | 1.10 | 0.53 | 0.42 | 0.27 | 18.59 | 4.14 |
| PM-18-018 | 540,679 | 5,108,961 | 293 | 0.50 | 11.70 | 2.25 | 8.31 | 0.46 | 100.00 | 3.89 |
| PM-18-019 | 541,038 | 5,109,137 | 168 | 2.90 | 0.40 | 0.28 | 0.08 | 0.05 | 3.88 | 4.06 |
| PM-18-020 | 541,141 | 5,109,173 | 188 | 3.20 | 13.32 | 1.75 | 5.37 | 1.14 | 126.36 | 3.94 |
| PM-18-021 | 541,149 | 5,109,142 | 32 | 21.00 | 2.09 | 0.35 | 0.72 | 0.31 | 15.47 | 4.22 |
| PM-18-022 | 540,770 | 5,109,011 | - 171 | 1.50 | - | 0.54 | - | 0.58 | 29.00 | 3.47 |
| PM-18-022 | 540,768 | 5,109,015 | - 176 | 4.71 | 23.85 | 0.88 | 9.86 | 1.53 | 262.52 | 4.44 |
| PM-18-022A | 540,775 | 5,109,023 | - 143 | 5.90 | 23.95 | 0.95 | 10.21 | 1.35 | 324.08 | 3.89 |
| PM-18-023 | 540,855 | 5,109,057 | - 193 | 5.92 | 7.41 | 1.38 | 3.20 | 0.74 | 63.39 | 3.97 |
| PM-18-023 | 540,841 | 5,109,094 | - 238 | 2.40 | 20.76 | 1.37 | 3.83 | 1.07 | 108.07 | 4.13 |
| PM-18-023A | 540,846 | 5,109,058 | - 171 | 6.00 | 10.20 | 1.28 | 4.69 | 0.49 | 52.95 | 4.04 |
| PM-18-023A | 540,836 | 5,109,084 | - 197 | 3.29 | 15.83 | 0.70 | 7.78 | 0.93 | 167.93 | 3.89 |
| PM-18-027 | 540,691 | 5,108,958 | 139 | 24.41 | 3.50 | 0.76 | 1.47 | 0.30 | 52.41 | 3.89 |
| PM-18-028 | 541,259 | 5,109,171 | 14 | 3.41 | 19.15 | 0.60 | 7.37 | 1.16 | 151.11 | 4.06 |
| PM-18-029 | 540,739 | 5,108,969 | - 186 | 10.55 | 19.32 | 1.24 | 7.24 | 1.28 | 206.37 | 3.89 |

**TABLE 14.16**
**LIST OF DIAMOND DRILL COLLARS FROM 2018 DIAMOND DRILLING**

| HOLE-ID | EAST | NORTH | ELEV | AZ | DIP | DEPTH |
|---|---|---|---|---|---|---|
| PM-17-001 | 540,887 | 5,109,039 | 372 | 327 | -46 | 168 |
| PM-17-002 | 540,887 | 5,109,039 | 372 | 327 | -61 | 180 |
| PM-18-003 | 541,280 | 5,109,160 | 356 | 327 | -64 | 234 |
| PM-18-004 | 541,280 | 5,109,160 | 356 | 327 | -50 | 204 |
| PM-18-005 | 541,264 | 5,109,082 | 355 | 327 | -68 | 354 |
| PM-18-006 | 541,424 | 5,109,130 | 348 | 333 | -63 | 33 |
| PM-18-006A | 541,424 | 5,109,130 | 348 | 333 | -63 | 336 |
| PM-18-007 | 540,845 | 5,108,913 | 372 | 327 | -62 | 465 |
| PM-18-008 | 540,845 | 5,108,913 | 372 | 327 | -69 | 496 |
| PM-18-009 | 540,869 | 5,108,866 | 367 | 313 | -61 | 447 |
| PM-18-010 | 540,760 | 5,108,953 | 382 | 327 | -55 | 198 |
| PM-18-011 | 540,778 | 5,109,012 | 383 | 327 | -45 | 107 |
| PM-18-012 | 540,861 | 5,109,071 | 375 | 327 | -45 | 99 |
| PM-18-013 | 541,431 | 5,109,287 | 349 | 327 | -45 | 120 |
| PM-18-014 | 541,464 | 5,109,241 | 348 | 327 | -45 | 171 |
| PM-18-015 | 541,465 | 5,109,157 | 348 | 327 | -55 | 312 |
| PM-18-016 | 541,501 | 5,109,176 | 349 | 327 | -55 | 312 |
| PM-18-017 | 540,906 | 5,109,092 | 372 | 327 | -69 | 120 |
| PM-18-018 | 540,714 | 5,108,908 | 383 | 327 | -55 | 192 |
| PM-18-019 | 541,114 | 5,109,021 | 360 | 327 | -55 | 298 |
| PM-18-020 | 541,193 | 5,109,097 | 361 | 327 | -63 | 237 |
| PM-18-021 | 541,233 | 5,108,999 | 352 | 327 | -63 | 420 |
| PM-18-022 | 540,939 | 5,108,666 | 362 | 329 | -58 | 759 |
| PM-18-022A | 540,939 | 5,108,666 | 362 | 329 | -58 | 699 |
| PM-18-023 | 541,020 | 5,108,714 | 350 | 327 | -58 | 801 |
| PM-18-023A | 541,020 | 5,108,714 | 350 | 327 | -58 | 750 |
| PM-18-025 | 541,304 | 5,109,390 | 365 | 327 | -50 | 258 |
| PM-18-027 | 540,759 | 5,108,870 | 382 | 322 | -65 | 336 |
| PM-18-028 | 541,380 | 5,109,002 | 346 | 326 | -60 | 498 |
| PM-18-029 | 540,939 | 5,108,668 | 370 | 326 | -62 | 771 |
| PM-18-006 | 541,424 | 5,109,130 | 348 | 333 | -62 | 33 |
| PM-18-026 | 540,889 | 5,108,694 | 370 | 326 | -57 | 585 |
| PM-18-029A | 540,939 | 5,108,668 | 370 | 326 | -62 | 714 |
| PM-18-030 | 541,380 | 5,109,002 | 346 | 326 | -74 | 651 |
| PM-18-031 | 541,348 | 5,108,907 | 340 | 326 | -70 | 537 |

It is the opinion of the authors that continued expansion and infill diamond drilling will have significant potential to expand and certainly upgrade the resource.

Figure 14.14 and Figure 14.15 show the ZnEq grade shells for the lenses of the deposits. Additional drilling and modeling may allow material that is less than 9% ZnEq to be upgraded. In addition, metallurgical work and developing mining costs for the deposit may allow the inclusion of lower grade material in the resource. This was undertaken as part of the PEA.

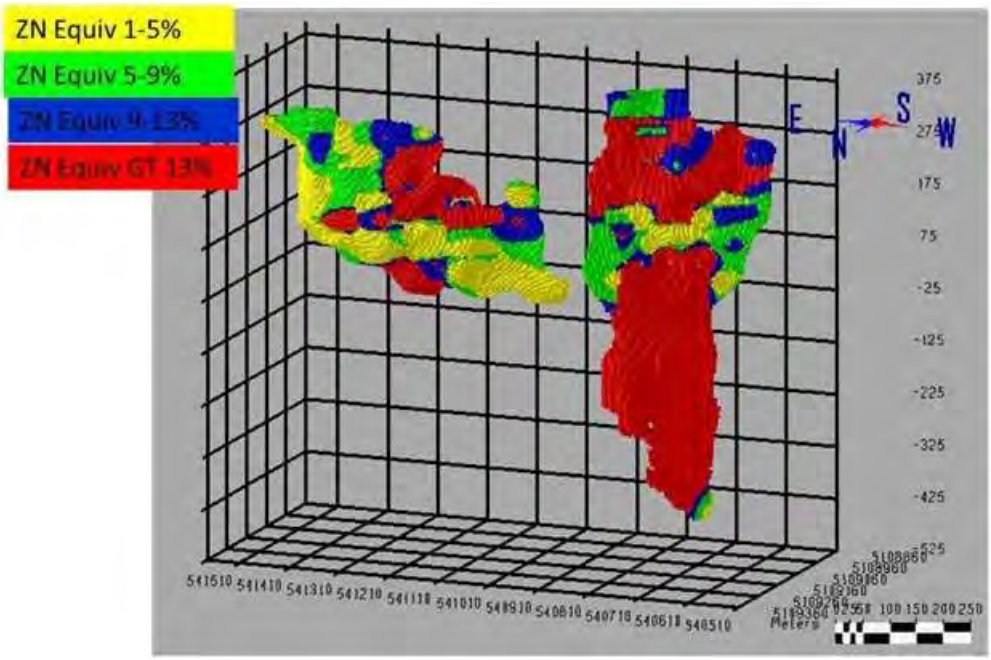



**Figure 14.14 Grade Shells of Lenses – Footwall View Looking Southeast**

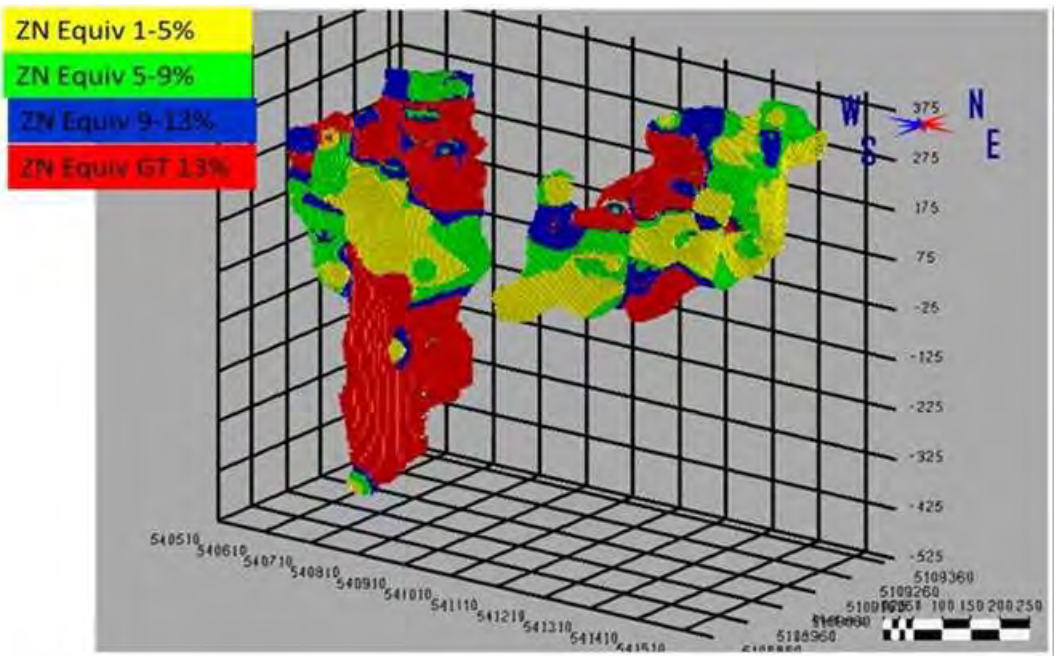



**Figure 14.15 Grade Shells of Lenses – Hanging Wall View Looking Northwest**

A series of grade shells were created for the West and East mineralised zones (lenses). This was undertaken to confirm the continuity of the mineralised zones as well as for future diamond drill and exploration targets.

To the knowledge of the authors, there are no known environmental, legal, title, taxation, socio-economic, marketing, or political factors that could materially affect the Mineral Resource estimate.

In conclusion, it is the opinion of the authors that the Pickett Mountain deposit, as currently defined to a depth of 875m, has significant infill and expansion opportunities. The local exploration target expansion range is 6 to 10 million tonnes grading 12% to 20% ZnEq, based on the current geological model, without

the addition of other lenses. This target size is derived from the interpretation of the drilling, geological structure, geology, and surface sampling carried out on the Property to date. The potential quantity and grade of the target is conceptual in nature. There has been insufficient exploration of this target to define a Mineral Resource and it is uncertain if further local exploration will result in this target being delineated as a Mineral Resource.

### 14.15.1 Mineral Resources Used in the Mine Plan

The mineral resource used in the PEA includes Indicated and Inferred Resources and is an update from the January 7, 2019 Mineral Resource statement. The estimate uses a 7% cut-off grade (or an NSR value of $139/t) rather than the previous 9% cut-off grade ($178/t NSR). The same methodology used in the 2019 estimate was applied to the updated estimate where the metal prices were not updated (to those used in the PEA financial model) and no additional information was either included or excluded even though infill drill results since 2019 is expected to upgrade the mineral resource and could potentially lead to an increase.

The resource estimates used in the mine plan are only those contained within the main zones of the mineralised zones and have had fringe outliers removed from the estimates. They are presented in Table 14.17.

**TABLE 14.17**
**UPDATED MINERAL RESOURCES USED IN MINE PLAN**

| Category | Tonnes | Zn % | Pb % | Cu % | Ag g/t | Au g/t | Density | ZnEq % |
|---|---|---|---|---|---|---|---|---|
| Indicated | 2,177,000 | 9.25 | 3.68 | 1.32 | 96.4 | 0.9 | 3.98 | 18.23 |
| Inferred | 2,294,000 | 9.79 | 3.88 | 1.15 | 101.1 | 0.9 | 3.99 | 18.62 |

The mineral resources were estimated using the metal prices of US$1.20/lb Zn, $2.50/lb Cu, $1.00/lb Pb, $16.00/oz Ag, and $1,200/oz/Au, using a 7% cutoff grade that equates to an NSR cut-off of $139/tonne at the same metal prices. An average recovery of 75% for all metals was assumed. A 10% mining dilution at zero grade was only added to the financial model which also used different metal prices.

# 15.0 Mineral Reserve Estimates

There has not yet been any Mineral Reserve estimation done.

# 16.0 Mining Methods

The Pickett Mountain Project is a polymetallic deposit containing zinc, lead, copper, and some precious metals, namely silver and gold, and is separated into two main zones; the West Zone and the East Zone. The focus of mining will be zinc. The West Zone is narrow but high-grade while the East Zone is broader and has a larger volume but a large portion of it is currently sub-economic.

The zones are near surface making the mine accessible by decline and mobile equipment and allowing the project a shorter time to get into steady-state production.

Initially, mining will commence in the upper part of the West Zone (Zone 1), then the higher-grade Lower West Zone (Zone 3), and main East Zone (Zone 2). A borehole hoist will be developed to increase productivity and minimise the mobile fleet. The overall mine plan is to have three main zones operating to ensure a steady feed to the processing plant (Figure 16.1).

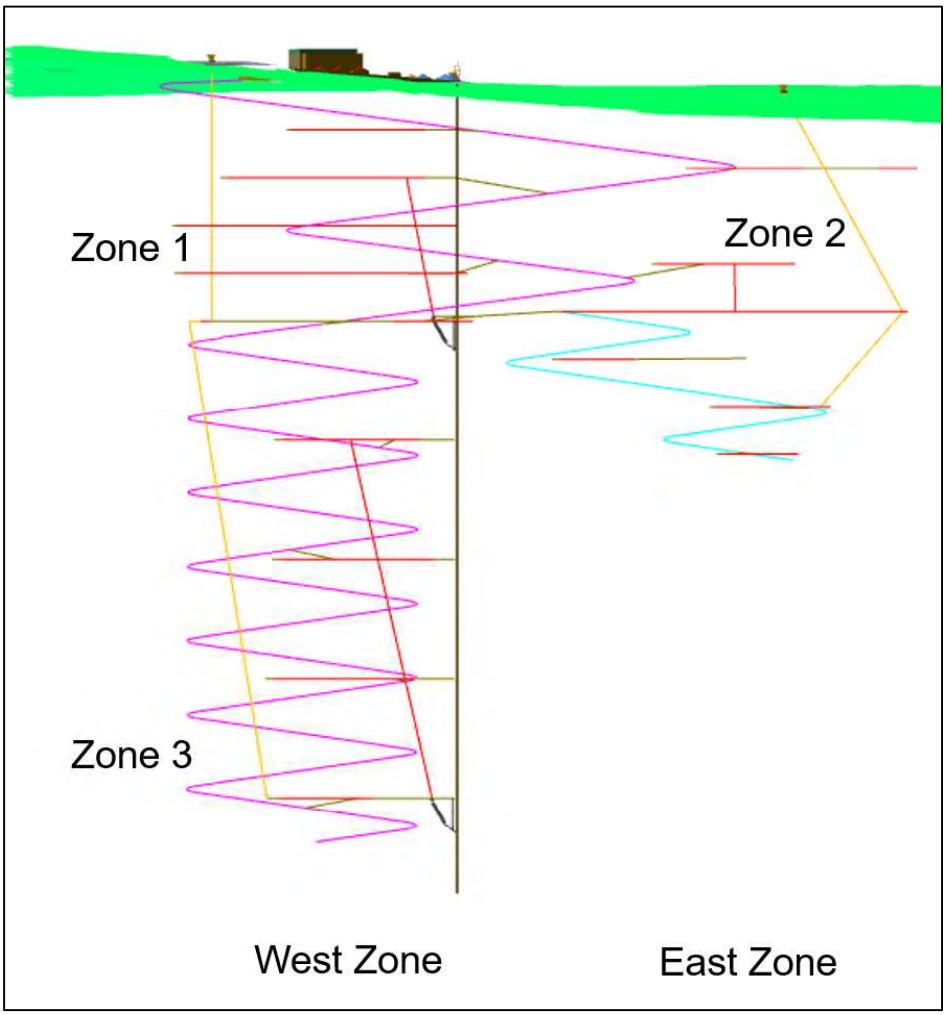



**Figure 16.1 Pickett Mountain Mine Design Longitudinal Section Looking North**

## 16.1 General

The roadway for the portal entrance is to be at a grade that water will drain from the entrance.

The excavation requires an area sufficient to accommodate the ventilation system (including heating), compressor, trailer, water, and generator. This area also needs to be graded to accommodate drainage away from the mine entrance and collected for treatment before releasing into the environment.

Final excavation of the overburden shall be secured from falling into the working area while the portal entrance structure is erected. Length of the entrance canopy will be determined by the depth of overburden and the topography of the selected location.

Roadbed material should be at least 300 mm in depth. A ditch should be established on the same side as the pipelines.

### 16.1.1 Portal Excavation and Decline Drive

The mine will be accessed from the surface by a decline collared in the hillside. An excavation will be cut into the hillside to create a large free face in which to collar the portal. The floor of the cut and the first two rounds of the decline will be designed to be upgrade at a sufficient grade to allow water to drain away from the portal. The decline will be driven at a nominal 15% grade and access the upper sections of the ore zone at 100m intervals. A 50m crown pillar will be left in place. The nominal surface elevation is approximately 400m asl (above sea level). In order to better define the underground levels, 5000 has been added to the surface elevation, making surface nominally 5400 in the mine nomenclature.

The 4.0m × 4.5m decline will proceed down to the 5150 level (250m below the surface) where the bottom of the first mining block will be established. The 5150 level will also serve as the main haulage access for the lens of the East Zone. 2×2×2m safety bays will be driven every 100m where required. Remuck bays will be established at 250m distances along the ramp and electrical substations will be established where required. A main ventilation raise will be driven internal to the ramp at 100m intervals to allow for exhaust ventilation as the ramp proceeds down. The raise will be offset at each elevation, screened and bolted and equipped as an emergency manway for a future second egress.

As mining begins in the upper West Zone, the ramp will proceed to the bottom of the mine at the 4550 level. Below the 5150 level, mining horizons will be established at 125m intervals for Alimak mining, down to the 4650 level. The East Zone will be developed separately with a ramp down from the 5150 level or as take-offs from the main ramp system above this elevation. A typical cross section is shown. Safety bays shall be cut 2×2×2m 300 mm above the finished grade of the ramp on the same side of the opening as the compressed air line (Figure 16.2).

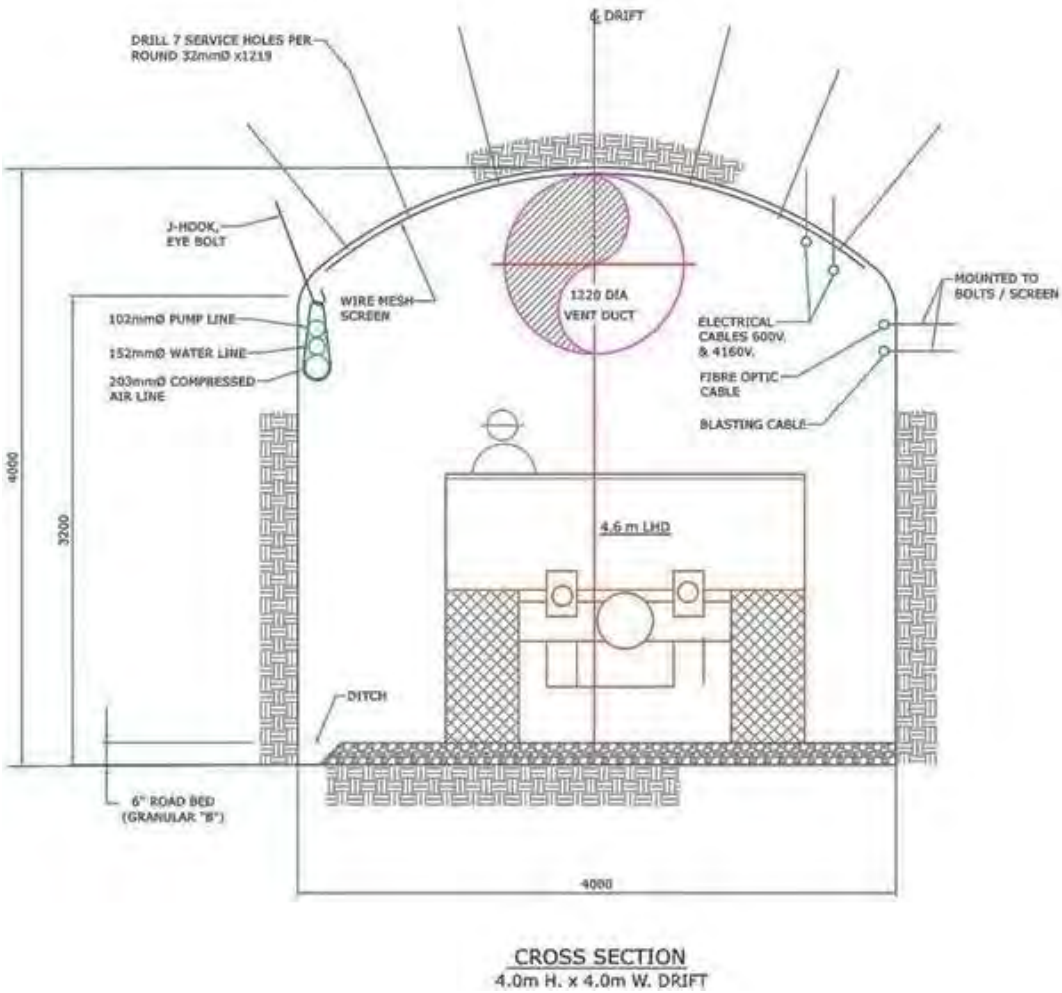



**Figure 16.2 Typical Ramp Cross Section**

## 16.2 Underground Mine Design

On each level, the mining areas would be accessed from the main ramp by a 4.0m × 4.0m wide access drift. The proposed mining method in the West Zone is Alimak mining. This method greatly reduces the lateral development required while allowing the narrow zones to be mined cost effectively. The stopes will be a maximum of 20m wide with a 2.4m × 3.0m Alimak raised driven up the centre of the stope. This will allow for cable bolting of the hanging wall of the stope for support and allow wider stopes to be mined. A backfill distribution system will be set up at 100m vertical intervals to fill the stopes with cemented rock fill. Below the 5150 level, all mining in the West Zone will be done utilising the Alimak mining method at 125m vertical intervals.

Underground development, including excavation of ramps, accesses, and haulage drifts, will employ diesel powered, rubber tired 2 boom electric/hydraulic drill jumbos, load-haul-dump (LHD) units, 30 tonne haul trucks, bolters, and scissor lifts with work platforms. Mining will utilise diesel powered, track and rubber tired mobile equipment including an ITH drill, ANFO loading units, LHDs, and haul trucks.

The East Zone will be a combination of both longhole and Alimak mining. The main core of the East Zone is quite wide allowing for longhole mining to be effective. As the zone approaches surface it gets much narrower making it more amenable to Alimak mining.

## 16.3 Geotechnical Considerations

For the purposes of this study, the geotechnical design has been based on conservative past practices at other operations. Future test work, including oriented core drilling, will be required to characterise the rock strengths and quality of both the ore zones and the waste rock for the next phase of study.

Geotechnical drill holes will be required on the centreline of the portal, the main decline as well as any permanent infrastructure for the mine surface structures.

Lateral development will be supported with 1.8m long resin grouted rebar on a 1.2m by 1.2m pattern and welded wire mesh screen (1.5m by 2.7m sheet with 5.6 mm wire thickness, 100 mm × 100 mm apertures) on the backs and walls to within 1.5m of the floor on the walls. Screen sheets will be installed with 0.2m overlap.

## 16.4 Mine Access and Level Development

### 16.4.1 Main Access

The heading size will be 4.0m high ×4.5m wide and declines will be driven at a 1:7 (-15%) grade. The main decline will be situated in the hanging wall and will be set up as a downcast airway ensuring fresh air is flowing over the truck motors as they climb the haulage way. In the lower sections of the East Zone, the ramp will transition to be located in the footwall.

All personnel, equipment, and materials will be transported into and from the mine via this main ramp. All ore and rock (as required only) will be transported from the underground in diesel powered haul trucks operating in the underground drifts and the main ramp until the borehole hoist is established and then the material flow will be focused on moving resources and rock to passes for hoisting to surface.

### 16.4.2 Level Access and Development

On each level, the mining areas would be accessed from the main ramp by a 4.0m high by 4.0m wide access drift driven in the footwall for Long hole stopes and in the hanging wall for Alimak stopes both parallel to the strike of the ore zones. The wider access drift would allow for truck haulage of material from the production stopes. The proposed mining methods are stoping utilising Alimaks (horizontal ring drilling) and longhole blasting (vertical ring drilling). Stoping will take place in panels, which are nominally 15m-20m wide (along strike and depending on the stope stability based on Mathew's Stability Graph and extend lengthwise up dip over vertical intervals of approximately 50m for the long hole stopes and 100m-125m for the Alimak stopes.

Underground development, including excavation of ramps, accesses, and haulage drifts, will employ diesel powered, rubber tired 2 boom electric/hydraulic drill jumbos, 5 cubic meter load-haul-dump (LHD) units, 30 tonne haul trucks, bolters, and scissor lifts with work platforms. Mining will utilise diesel powered rubber tired mobile equipment including an In-The Hole drill unit as well as a single boom drill with extension rods drill, ANFO loading units, LHDs, and haul trucks.

## 16.5 Rock Handling

Initial ramp development will be done utilising 30 tonne haulage trucks to bring the muck to surface. As the borehole hoisting system is established, rock handling will transition to hoisting of both ore and waste.

## 16.6 Underground Services and Infrastructure

Underground infrastructure will include:

- Breakdown maintenance shop;
- Fuel stations;
- Explosives and detonator magazines;
- Refuge stations;
- Main dewatering sumps;
- Main storage areas;
- Latrines;
- Electrical substations; and
- Mine wide wireless communication and control system.

Mine surface support facilities located in the area of the portal will include a surface ventilation fan set-up, backfill plant, maintenance shop, explosives magazines, mine rescue station, power substation, compressor station, small warehousing facility, laydown yard, and a water storage pond.

### 16.6.1 Electrical Distribution

Primary electrical power for the mine would be provided from the main surface substation connected to the outside powerline. Maine has multiple power suppliers within 11 km to the property. Emera Maine has indicated capacity to supply power for the project within the existing infrastructure.

The powerline would be connected to a surface substation located near to the mine portal. Power from the main substation would feed the main underground power line, a 500 mcm cable, installed in the main access ramp from the surface. This powerline would feed portable substations located on levels central to the working areas. Portable power centres would supply loads on the nearby levels and transform power down to 4,160V and 600V, as required.

On the surface, the substation would also provide 4,160V feeds to drive ventilation fans and other power requirements for the underground mine surface facilities. The system would utilise a switch room/MCC panel near the ramp portal.

The main underground mine electrical feed will consist of a 4,160V, armoured 3 conductors, 5 kV, 500 MCM teck cable installed in the ramp. A grounding conductor will also be hung in the ramp in conjunction with the 4,160 cable. Equipment underground will be powered by 750 KVA portable substations located in the electrical substation openings. The substations will step power down to 600V for mining equipment and 120V for smaller, electrical powered equipment.

Table 16.1 presents the connected load list for underground and estimated electrical power consumption during peak mine development and production periods.

**TABLE 16.1**
**ESTIMATED CONNECTED LOAD**

| Unit | Quantity | Load Factor | Operating Hrs/Day | Consumption Per Unit (kW) | Total Installed | Total Monthly |
|---|---|---|---|---|---|---|
| **Production Hoist** | 1 | 67% | 16 | 626 | 626 | 201,322 |
| Development Jumbo | 2 | 50% | 12 | 180 | 360 | 64,800 |
| Bolter/Screening Jumbo | 2 | 50% | 12 | 90 | 180 | 32,400 |
| Longhole Drill-ITH | 1 | 90% | 20 | 37 | 37 | 19,980 |
| Diamond Drill | 1 | 50% | 12 | 23 | 23 | 4,140 |
| **Ventilation Booster Fans** | | | | | | |
| X/C Ventilation | 12 | 75% | 16.5 | 22 | 264 | 98,010 |
| Ramp/Level Development | 2 | 75% | 16.5 | 93 | 186 | 69,053 |
| **Main Ventilation Fans** | | | | | | |
| Underground Exhaust | 2 | 100% | 24 | 300 | 600 | 432,000 |
| Surface Intake | 2 | 100% | 24 | 300 | 600 | 432,000 |
| **Pumps** | | | | | | |
| Main Dewatering Sumps | 2 | 50% | 12 | 44 | 88 | 15,840 |
| Miscellaneous pumps | 6 | 75% | 18 | 150 | 900 | 364,500 |
| **Compressors** | | | | | | |
| Compressor 1 | 1 | 50% | 12 | 186 | 186 | 33,480 |
| Compressor 2 | 1 | 50% | 12 | 186 | 186 | 33,480 |
| **Lighting and Miscellaneous** | 1 | 80% | 19 | 70 | 70 | 31,920 |
| **Total Monthly Power Consumption (kwh)** | | | | | | **1,832,924** |

#### 16.6.1.1 Electrical Cabling

The electrical cabling shall be hung from messenger cable that will be installed on the opposite side from the air/water lines. Bosserman clips will be used to hold the cables.

The central blasting cable will also be installed on the same side as the electrical bundle except it will be suspended on its own brackets attached to the roof anchors.

### 16.6.2 Compressed Air

Compressed air would be supplied by 2 compressors in enclosures located in the warehouse, backfill, and a compressor building, near the ramp portal. They would provide approximately 23.8 cm per minute at a minimum pressure 8.3 bar (120 psi) to the underground mine. Each compressor would operate at half capacity to ensure one compressor could provide mine requirements when the second compressor is being repaired or maintained. The compressors would supply the main compressed air pipeline located in the main access ramp from the surface.

Compressed air consumption is presented in Table 16.2.

**TABLE 16.2**
**WATER AND AIR USAGE**

| Unit | Quantity | Utilization | Service Water Consumption | | | Compressed Air | |
|---|---|---|---|---|---|---|---|
| | | | Per Unit (l/min) | Total (l/min) | Yearly Consumption | Per Unit (cu.m/min | Total (cu.m/min |
| Development Jumbo | 2 | 70% | 120 | 240 | 84672 | | |
| Development Bolter | 2 | 80% | 60 | 120 | 48384 | | |
| Stopers & Jacklegs | 8 | 50% | 60 | 480 | 120960 | 5 | 40 |
| Alimak Units-Double Drive | 3 | 80% | | | 0 | 10 | 30 |
| ANFO Loader | 2 | | | | 0 | 15 | 30 |
| Long Hole Drill-S36 | 1 | 90% | 38 | 38 | 17237 | 16 | 16 |
| Long Hole Drill-ITH | 1 | 90% | 200 | 200 | 90720 | 25 | 25 |
| Shotcrete Machine | 1 | 100% | 8 | 8 | 4032 | 24 | 24 |
| Air Tools (1 lot) | 1 | 100% | | | 0 | 40 | 40 |
| Misc. Water Usage (1 lot) | 1 | 100% | 20 | 20 | 10080 | | |
| Water Sprays-Mucking | 1 | 100% | 40 | 40 | 20160 | 20 | 20 |
| Gland Water, etc. (1 lot) | 1 | 100% | 10 | 10 | 5040 | | |
| **Total Consumption** | | | | | **401285** | | **225** |

### 16.6.3 Service Water

The underground mine would require approximately 401,000m$^3$ of service water per year for use in drilling, dust suppression, etc. This water will be supplied from a water storage pond on the surface, which will store water recycled from the underground mine. All service water requirements will be met by water pumped out of the mine and sent to the surface water storage pond.

Water would be sent underground in a pipeline located in the trackless access ramp from the surface. This will feed the main distribution lines on the levels, which would send water to the stope access crosscuts. Water pressures and volumes would be controlled by installing water stations, at appropriate vertical intervals within the mine, which would house a transfer station and holding tanks.

### 16.6.4 Mine Communications and Control Systems

An 802.11N (Wi-Fi) voice, video, and data transmission network will connect the mine and the surface operations. The system is comprised of access points (transmits data to and from clients' computers, tags, PLCs, etc.) installed in the mine drifts, which facilitate communication between clients and transfers data to a database server and control system on the surface. Wired telephones will be located at key infrastructure locations, such as the refuge stations. Key personnel (such as mobile mechanics, crew leaders, and shift supervisors) and mobile equipment operators (such as loader, truck, and utility vehicle operators) will be supplied with handheld mobile telephones, suitable for use underground, for contacting over the 802.11 network.

### 16.6.5 Mine Dewatering

The average underground dewatering requirement during production will be approximately 1,420m$^3$ per day. This quantity is based on the mine water balance as follows:

- 1,160m$^3$ per day will be produced by underground production mining and development activities;
- 60m$^3$ per day will decant from backfilled stopes; and
- 200m$^3$ per day net groundwater inflow to the mine (estimated).

During the pre-production and initial year of production periods, water will be pumped directly from level sumps to the surface because mining will be near the surface.

The long-term mine dewatering system will include water collection sumps located on each level. The sumps would be located near the point where the ramp and level access crosscuts intersect and would be designed to prevent water entering the ramp from the levels. Overflow drill holes from the sumps would send water to the main water collection sumps, for settling, recirculation, and/or discharge from the mine. Main collection sumps would be located on the 5000 and 4600 Levels. Each main sump would be comprised of 2 sets of dirty water and clear water sumps. Dirty water sumps would be subdivided by removable timber baffle walls into 3 compartments to aid in settling of solids. The dirty water sumps would be used one set at a time and slimes removed from the non-operational sump with LHDs. Water would overflow from the dirty water sumps into a clear water sump (Figure 16.3).

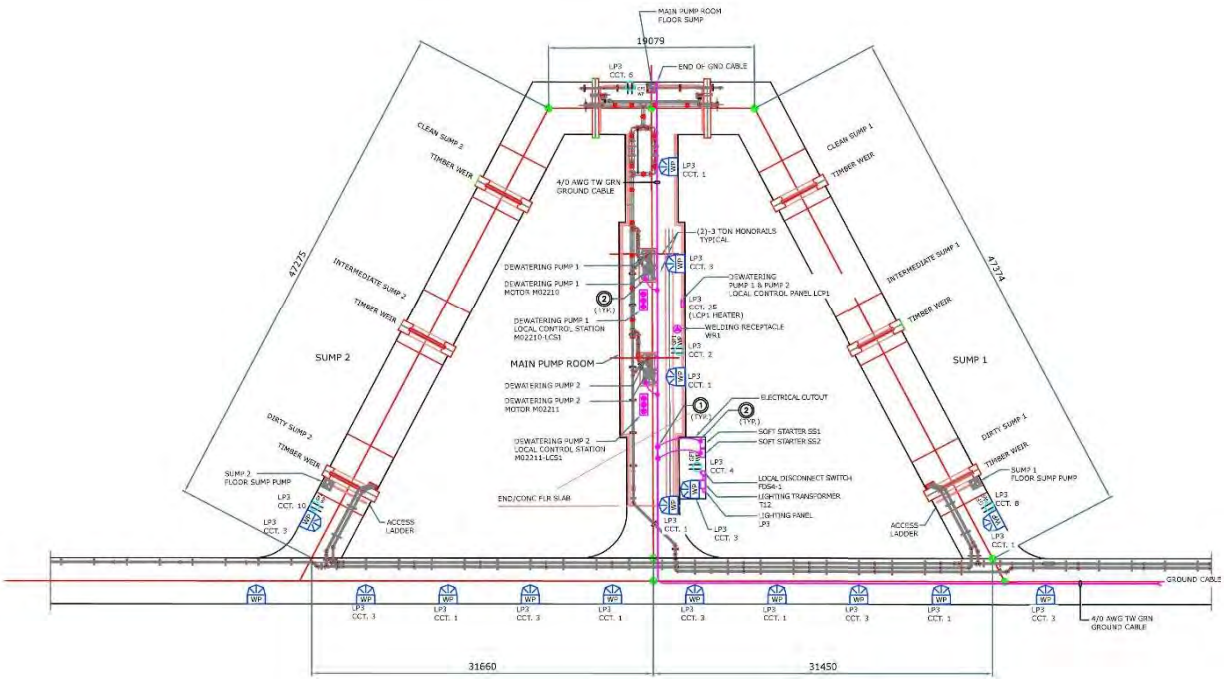



**Figure 16.3 Typical Sump Arrangement**

Each clear water sump, similar in size to the dirty water sumps, would be utilised to treat and store clear water prior to recirculation within the mine or discharge. Water would be pumped to a surface holding pond for underground process water or discharged to the water treatment facility on the surface.

Development crews shall proceed with caution regarding inflows of water. Crew leads shall apprise engineering of flow rates after each round ensuring relevant data has been collected regarding the amount of water that has been pumped to keep the heading dry and any other data worth noting regarding safety of the workplace and dewatering. To keep records of the amount of water pumped out of the mine, a flow meter on the main discharge shall be installed.

### 16.6.6 Breakdown Maintenance Shop

A small breakdown shop will be set up during the pre-production period in an abandoned re-muck off ramp. This shop will be used until a permanent breakdown shop is located lower in the mine. The mobile equipment breakdown maintenance shops would be used to perform all breakdown maintenance on

mobile mining equipment. Major equipment preventative maintenance work and other major repairs would be performed in a surface shop located near the portal.

The permanent breakdown shop would be constructed near the 5150 level, off the ramp. The shop would consist of a main shop area for one large piece of equipment or a couple of smaller units. The facility configuration would consist of an access drift leading to the main shop area, a welding area, wash bay area, parts storage warehouse, tool crib, electrical room, lunchroom, and supervisor's office.

The main shop area would be equipped with an overhead bridge crane. The electrical room, meeting room, and office would be isolated by steel hinged doors. The lunchroom would be equipped with wooden benches and tables and the office would be equipped with computer workstations connected to the mine information management system.

### 16.6.7 Fuel Stations

Portable self-contained fueling and lubrication stations will be located on levels where mining equipment is parked. The units have built in isolation doors and fire suppression.

SatStat fuel station bladders will be filled at the surface tank farm and transported to the underground fueling station on a flat-bed utility vehicle. The SatStat bladder will be set into the stationary SatStat fueling station from which fuel will be dispensed by equipment operators. Each bladder has a capacity of 1,000 litres. The station will be equipped with heat-sensitive fire suppression from Ansul. A second SatStat station storing oils and lubricants will be located near the fuel station. Several of these fueling and lubrication stations will be placed on different levels of the mine (Figure 16.4).

**Figure 16.4 Fail Safe Fuel and Lubrication Systems**

### 16.6.8 Refuge Stations

Main refuge stations would be located approximately every 100m vertical intervals on the 5250, 5150, 5025, 4900, 4775, and 4650 levels. Refuge stations would be fitted with a double door entry system in concrete walls at one end. The facility would include wooden benches and tables, hand washing station, and other equipment and supplies, as well as a supervisor's desk and other associated furniture. The

refuge stations would also be equipped with safety and rescue equipment. Compressed air and water lines would be connected from the mine's supply system to lines inside the refuge station. The facility would be fitted with an electric heater unit and be vented through intake and exhaust ventilation ducts to the outside (Figure 16.5).

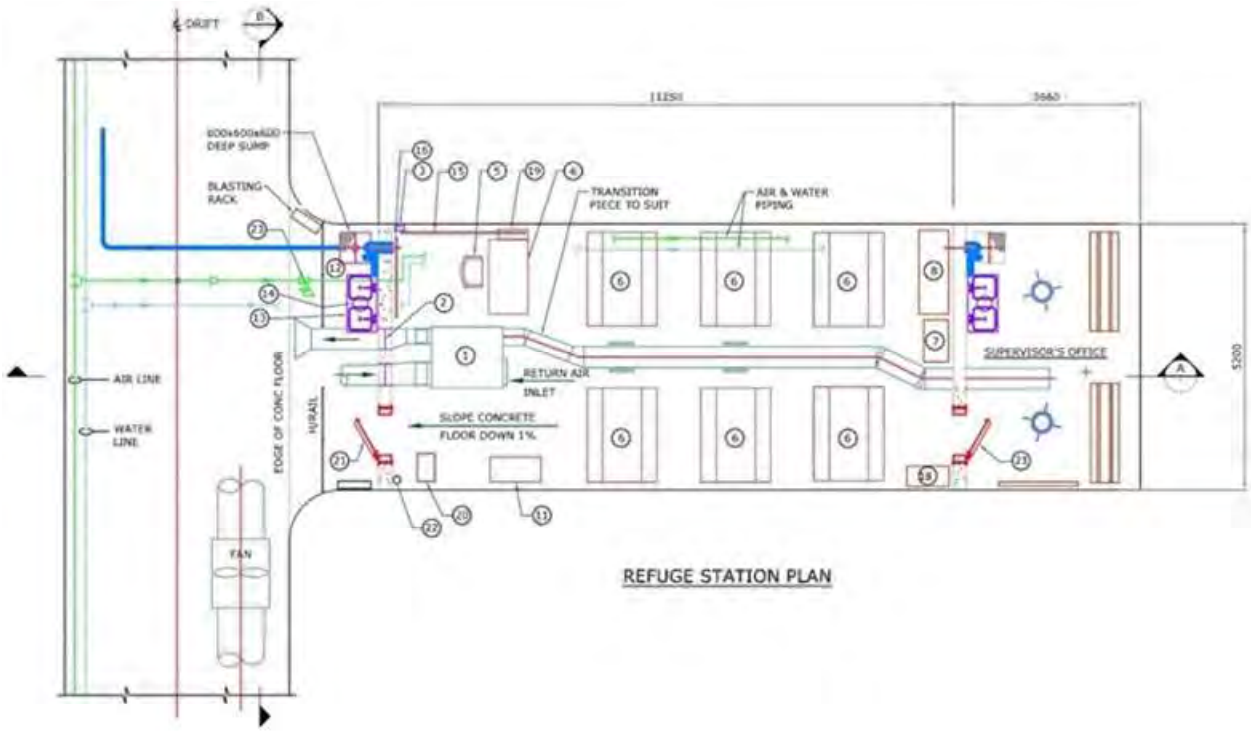



**Figure 16.5 Standard Refuge Station**

### 16.6.9 Explosives Storage

All blasting would utilise ANFO explosives. ANFO would be delivered in bulk bags, to the explosives magazines. Other stick explosives would be stored in this magazine as well.

Explosives magazines would be located on every main level. The explosives magazine floor would be gravel and the magazine entrance would include a concrete wall with doors to allow access for mobile equipment and people traffic. Both sides of the magazine would be fitted with wooden shelving on which bulk explosives bags can be placed. This magazine would require a fire suppression system. A flashing red light would be mounted by the entrance to indicate its location.

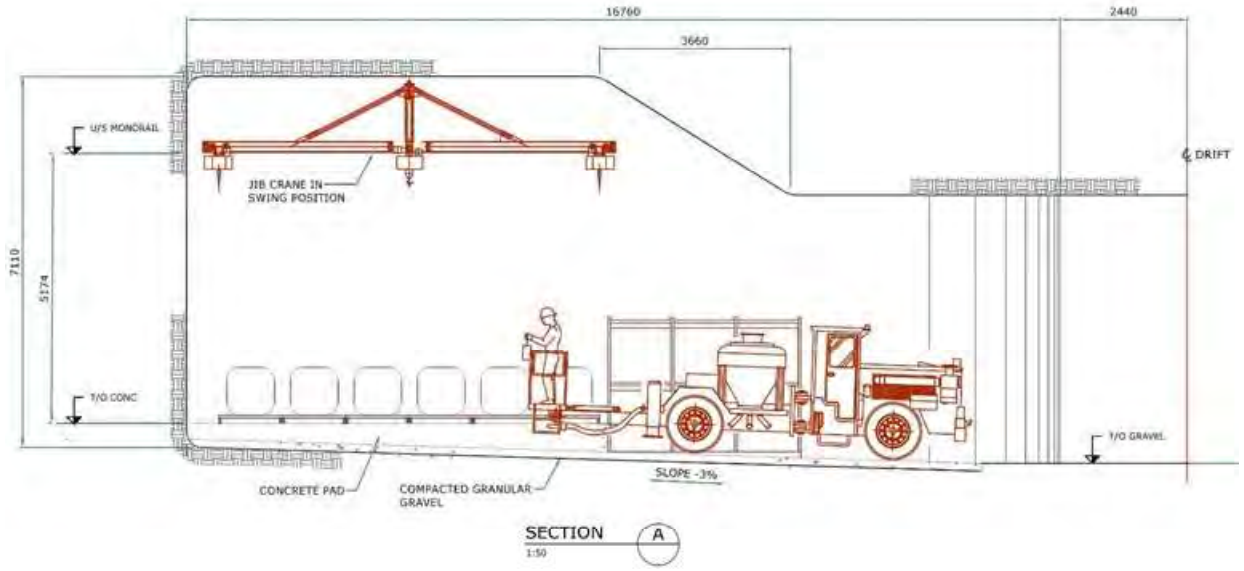



**Figure 16.6 Section Through a Standard Explosives Storage Area**

### 16.6.10 Detonator Magazine

Detonator magazines would be located near the explosives magazines. The magazines would be equipped with a gravel floor and suitable wooden shelving to allow stacking of detonator boxes on each side. The entrance would be blocked with timber posts and screen, with a man door in the wall. A flashing red light would be mounted by the entrance to indicate its location.

### 16.6.11 Materials Storage Areas

Storage areas, specially constructed for the purpose for storing mining consumables including pipe and fittings, ground support materials, ventilation supplies, etc., would be developed on every third level. The storage areas would include shelving and low wooden racking to safely store articles. Materials and parts would be palletised or placed in specially designed containers (for bulk materials and parts) for sending underground via the ramp. Service vehicles would transport the bulk materials to the storage areas. Materials would be distributed from the storage areas to work place storage areas by service vehicles.

### 16.6.12 Restrooms

Portable toilet units, equipped with a mine toilet and small sink, would be located on appropriate working levels and near the refuge stations. Servicing of these will be contracted to the supplier.

### 16.6.13 Surface Support Facilities

Surface support facilities would include a main maintenance shop, backfill plant; explosives magazines, laydown yard, mine rescue station, water storage pond, power substation, and compressor station.

A small maintenance shop facility would be provided to perform major equipment repairs and rebuilds. A description of the shop facility is contained in the infrastructure section of this report. The warehouse for mine items only would be a combination of pallet (large or bulk items) and shelved (smaller items) storage.

The explosives storage area for the mine would be located 500m from the mining and other facilities. The magazines would be housed in metal shipping containers and located so they can be observed by security located at the services site. The magazines would not be in direct line of sight of the mine or other facilities to protect mine personnel, equipment, and facilities.

A laydown yard would be constructed near the ramp portal to store materials and equipment required for the underground mine. This laydown yard would have raised timber stands on which to place large materials, such as screen, pipe, etc. as well as gravel graded areas for storing equipment and materials. A storage building would store equipment requiring protection from the elements.

A fully equipped mine rescue station is required on property. The mine rescue station would be equipped with all necessary equipment, including self-contained breathing apparatus, flame lamps, gas testing equipment, rescue equipment, etc., and supplies and chemicals required to operate the station. There would be enough equipment to, in an emergency, have three 5-person mine rescue teams operating or on standby at any one time.

All underground mine water would be sent to a water storage pond and reused or discharged.

## 16.7 Mining Methods

Two mining methods will be employed at Pickett Mountain. The West Zone is narrow and high-grade and will utilise an Alimak mining methodology. Alimak stopes will be 100m high in the upper part of the West Zone and increase to 125m high below the 5150 level. In the wider areas of the East Zone, below 5145 elevation, a longhole mining method will be employed utilising 6-inch blastholes with stoping at 50m vertical spacing. Both methods will employ a primary/secondary mining sequence.

Mining horizons would be developed on each main level (5350, 5250, 5150, 5025, 4900, 4775, 4650, and 4600 levels) Each Alimak vein stope would be 20m along strike with 1 drawpoint per stope in the centre, from the footwall drift.

An undercut over the full width and length, on the lower main level of the potentially economic mineralisation block, would be developed. An Alimak raise would be driven in the centre of a stope from the undercut to the level above the stope. The raise would be screened over its entire length to facilitate drillers working in the raise. Cable bolts would be installed into the hanging wall of the stope, from the Alimak platform in the raise, to support the hanging wall. The Alimak installation would be left in the raise and a longhole ring drill installed on the work platform of the Alimak. The longhole drill would drill 70 mm horizontal drill holes (approximately 8.5m in length) parallel to the footwall and hanging wall of the potentially economic mineralisation. Drill holes would be loaded with ANFO and Nonel detonators and blasted in horizontal slices into the undercut below. Access to stope raises to allow workers to perform drilling and blasting functions on the Alimak, would be from the level above the stope. Broken potentially economic mineralisation would be mucked from the undercut by LHDs and transported to truck loading stations. The final 10% of the stope will require mucking by remote controlled LHDs.

Stope undercut sills would be developed to full width of the zone to be mined by 3.5m high. The openings would be drilled with 2 boom E/H jumbos and mucked with 3.0m$^3$ bucket LHDs. Ground support would consist of 1.5m resin rebar and screen.

Alimak drilling raises would be developed 3m × 2.4m using stopers and the walls of the raise supported by resin rebar and welded wire mesh screen.

Stope mucking would utilise 3.0 $m^3$ bucket LHDs mucking in the drawpoints.

The stopes would be mined in a primary/secondary sequence. Primary stopes would be those where all stope walls are in rock. Secondary stopes are those where the stope walls along strike in the ore consist of backfill.

Mined out stopes would be backfilled with cemented (primary stopes) and uncemented (secondary stopes) rockfill.

## 16.8 Dilution and Extraction

Expected dilution and mining recovery for the proposed Alimak vein stope mining method would be approximately 10% and 85%, respectively, with these factors included in the mineable resources.

With the Alimak mining method, a pilot raise will be developed and supported with 1.8m long resin grouted rebar on a 1.2m by 1.2m pattern and welded wire mesh screen (1.2m by 2.4m sheet with 5.6 mm wire thickness, 100 mm × 100 mm apertures) on the backs and 1.2m rebar and screen on the walls. Screen sheets will be installed with a 0.2m overlap.

The length of stopes have been established using an allowable hydraulic radius (open stope area divided by perimeter) that depends on the rock quality and using an empirical design method. If the stopes were to remain open after mining, then sill pillars and rib pillars would be required to prevent the collapse of the hanging wall, but significant ore would be left unmined. To minimise pillars and prevent the possibility of ground failure, stopes will be backfilled.

The following geotechnical design criterion has been used for the stopes at the Pickett Mountain deposit. The ore thickness ranges from 3.0m-5.0m wide with an average of approximately 3.5m. Stope widths are planned at 20m along strike and stope lengths up dip of approximately 100m-125m based on the level spacing and orebody dip of approximately 80°. Stope lengths have been established using an allowable hydraulic radius.

To ensure hanging wall stability while mining of a stope, the pilot raise would also have fully grouted (cement) 8.5m twin-strand bulbed, 15.2 mm cable bolts on a 2.5m pattern installed into the hanging wall of the stope in a narrow fan pattern. Cables should be tensioned and installed with plates.

In the middle and lower sections of the East Zone, longhole mining in a primary/secondary sequence will be utilised. In order to minimise development, the levels have been spaced at 50m intervals and the drilling has been sized at 6-inch blastholes. A central cross-cut will be driven at the top of each stope and an ITH drill will be required to drill the holes in a fan pattern from this crosscut. Mining will progress upwards from the bottom of the mining block, thus, necessitating silling to be done only on the bottom level.

Primary stopes will be filled with cemented rockfill while secondary stopes will be filled with unconsolidated fill except on the 5150 level where a sill will need to be established to allow for mining to come up underneath this original mining horizon. In this case, the bottom 10m of the stope will require good quality cemented rockfill.

More geotechnical drilling will be conducted at the Pickett Mountain deposit to improve rock quality data along strike and at depth and aid in optimising stope geometry and support requirements.

The potentially mineable underground resource is estimated to be 4,180,000 tonnes at a grade of 8.56% Zn, 1.11% Cu 3.4% Pb .79g/t Au, and 88.8 g/t Ag. The tonnes and grade include an average dilution of 10% overall and a recovery of 85% of the potential resource. This PEA relies on Indicated Mineral Resources (approximately 48.7% of the total resource tons) but also Inferred Mineral Resources.

It should be noted that the Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as Mineral Reserves. For the PEA, the metallurgical recovery is based on early stage test work. Also, the cost projections range in accuracy from PEA to Feasibility level. Therefore, there is no guarantee that the economic projections contained in this PEA would be realised.

## 16.9 Mining Operations

### 16.9.1 Drilling

Longholes in the Alimak stopes will be drilled off using a longhole drill boom incorporated into the Alimak platform with pressurised stabiliser arms, which can be extended to the walls of the pilot raise to maintain drill setups. The drill would use 1.5m long extension steel and button bits to drill the long holes of 64 mm diameter. The same drilling unit would be used to drill cable bolt holes.

A track mounted ITH drill capable of drilling up to 6-inch holes will be required to drill off the longhole stopes.

### 16.9.2 Blasting

All stoping will be blasted with ANFO. All explosives will be initiated using electric initiation systems connected to a central blasting system. Alimak stopes will be blasted from the bottom up, initiating 4-5 rings per blast. During this process, the raise climber will access the raise only from the top cut. Due to the length of the stopes, it will take approximately 2 weeks to blast the entire stope. Longhole stopes will be taken in three lifts, the first two (5-7m and 10-15m) to create sufficient void to blast the bulk of the stope in the final blast (25m-30m).

### 16.9.3 Ground Support

As the mine is developed and the nature of the rock, the mineralisation, and the geotechnical features of the area are revealed by excavation, the mine design may require change in the field. Such changes are to be undertaken by competent, qualified, and authorised professional engineers. Variability of the rock mass will require ongoing design decisions using the construction layouts to reflect the reality of the situation in progress. All decisions shall be documented and approved by the management team on site.

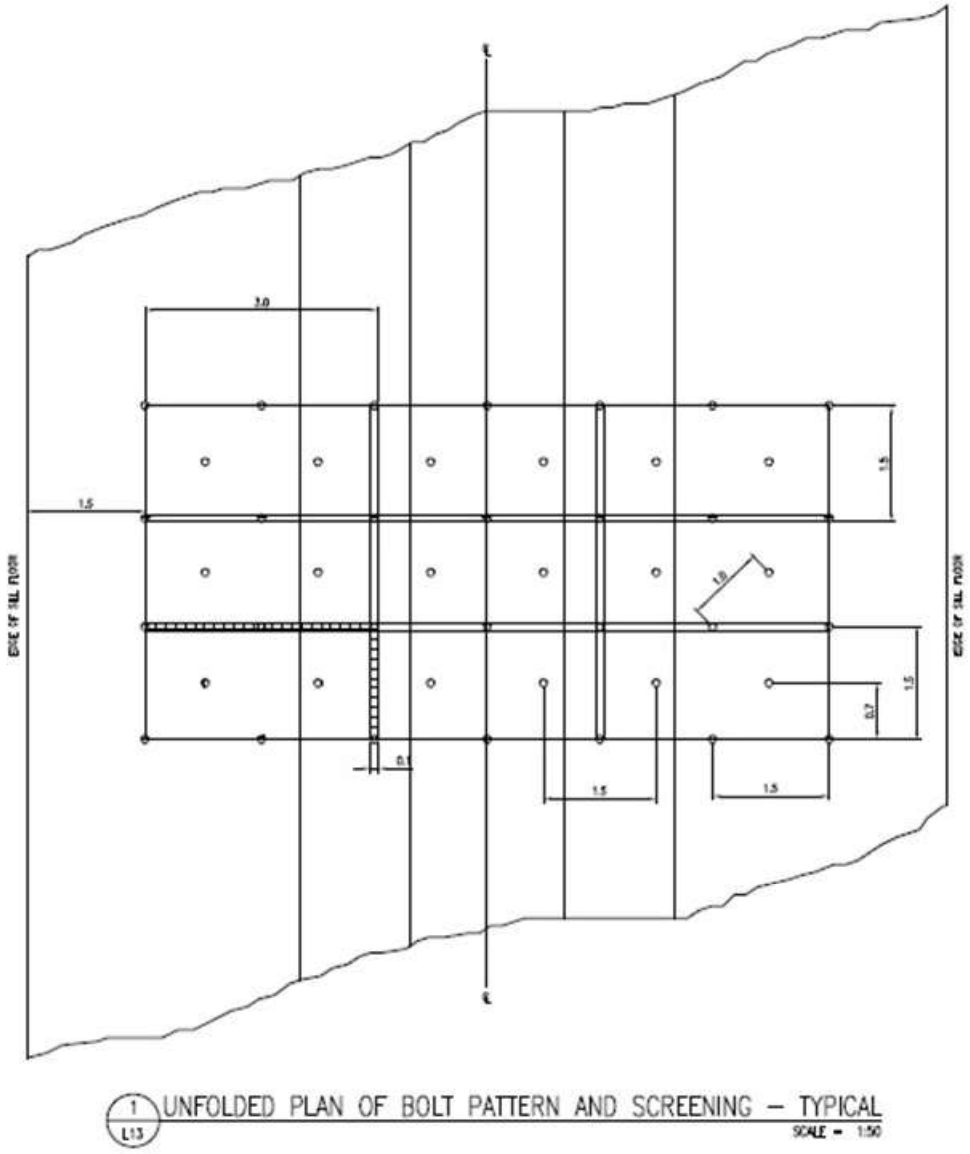
Provisional rock support shall be as follows:

- Until rock parameters are derived from exploration/geotechnical drilling and the ground control design has been designed and approved by a qualified, competent, and certified geotechnical professional(s), the following is the estimated ground support for the excavations at the Pickett Mountain Project:

    - 1.8m length × 20 mm diameter rebar bolts installed with resin on a 1.2m × 1.2m pattern;
    - Weld mesh 100 mm × 100 mm squares installed in required areas only;

- Fiber reinforced shotcrete applied to appropriate depth in required areas only; and

6.0m cement grouted cable bolts installed in areas greater than a 5.0m diameter span (Figure 16.7,




- Figure 16.8, Figure 16.9, and Figure 16.10).

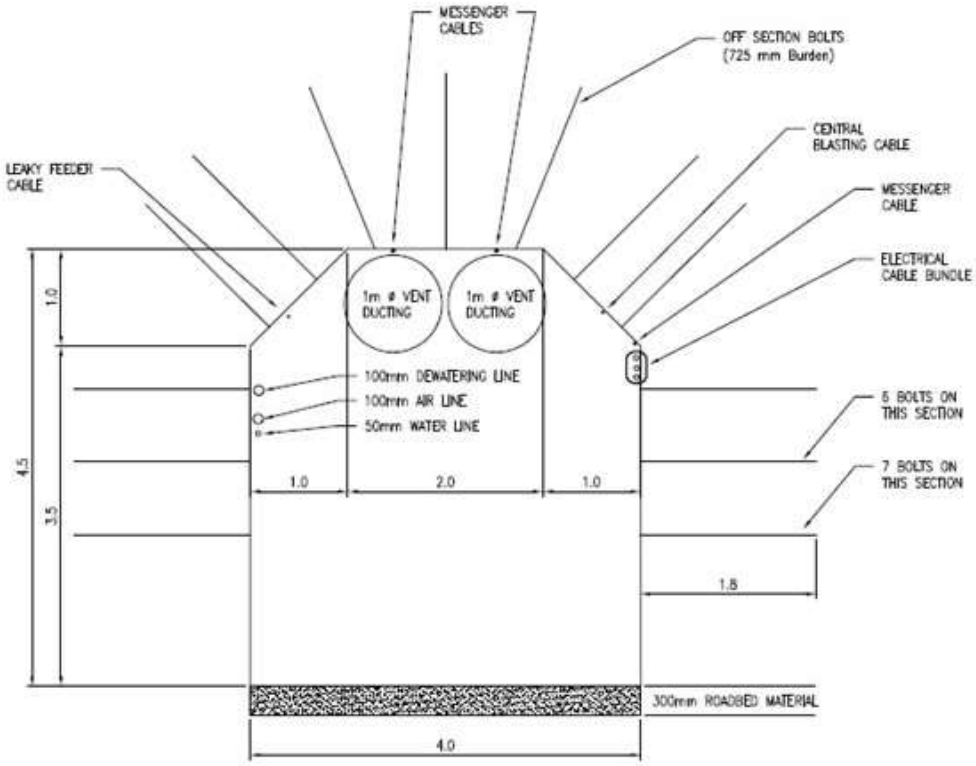



**Figure 16.7 Section of a Typical Drift**

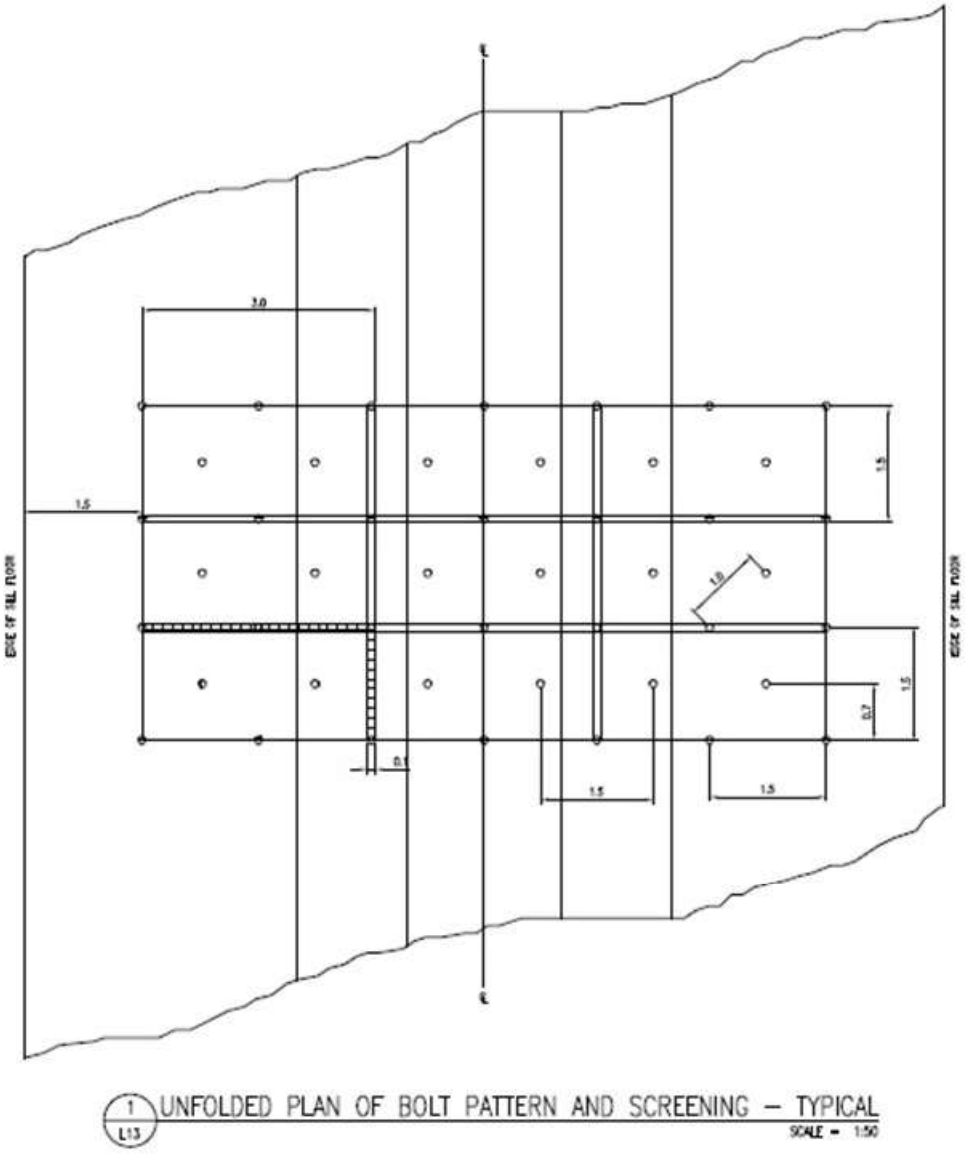



**Figure 16.8 Nominal Bolting and Screening Pattern**

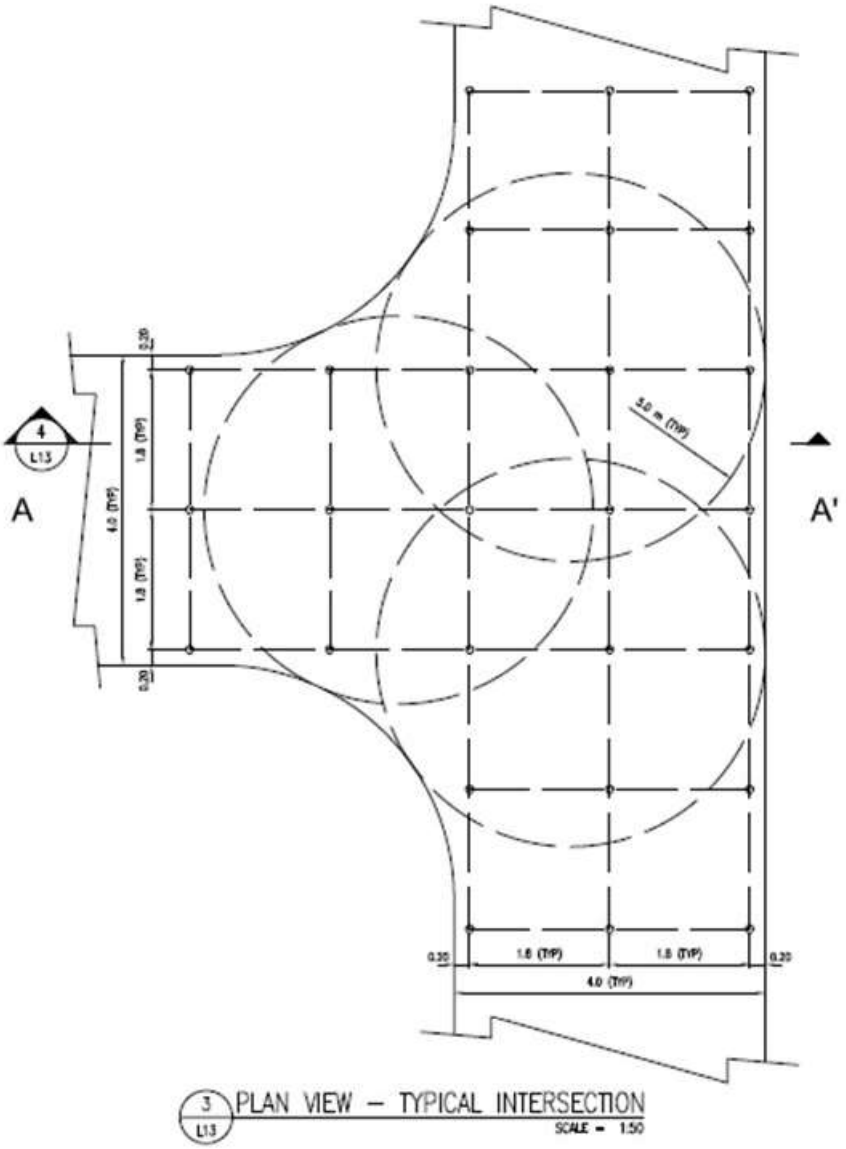



**Figure 16.9 Plan of Cable Bolting Pattern in Intersections**

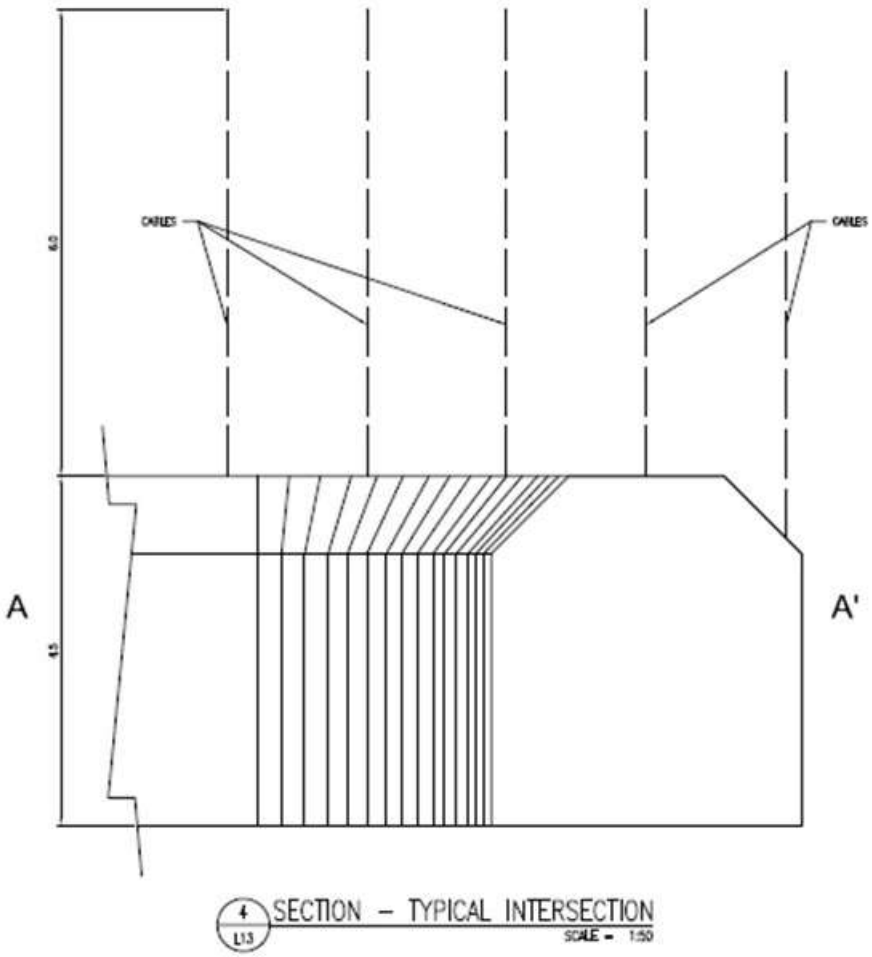



**Figure 16.10 Section Showing Cable Bolts in an Intersection**

### 16.9.4 Mucking

Mucking of the production stopes will be done utilising 5.0m$^3$ remote capable LHD units. Until the borehole hoist is in operation, initial production will be hauled to the surface with 30 tonne haulage trucks. Once the ore pass system and borehole hoisting system has been constructed, all mucking will be done with the LHD units and report to the ore pass on the level.

Borehole hoisting is the use of hoisting plant to hoist rock, and materials or both, vertically through a borehole, between a mine level and surface or between two levels of an underground mine.

The borehole or, in this case, the 8 foot by 10 foot raise, is part of the overall hoisting system that comprises: the hoisting plant (including the hoist, power supply, ropes, and sheaves); the headworks at the top of the raise (including the dumping and/or off-loading arrangements); the raise including the rope guide system; the 10 tonne capacity skip for carrying the hoisted material; the counter weight on the opposite side; and the loading pockets at the mid-level and at the bottom of the raise.

The hoisting system will be configured for primary production hoisting, while still providing a ventilation function Figure 16.11.

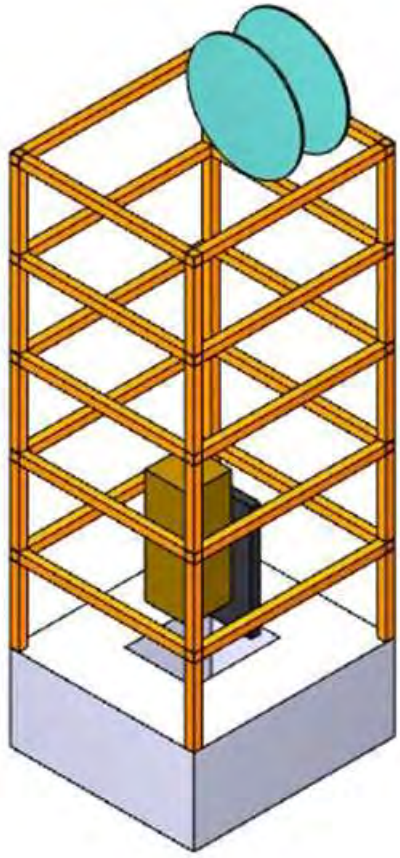


**Figure 16.11 Borehole Hoist Showing Skip and Counterweight**

## 16.10 Mining Equipment

The mine development group will require two 2 boom electric/hydraulic jumbos, two 5m$^3$ bucket LHDs, two 30-tonne truck c/w electric retarder, 2 scissor lift trucks, two electric/hydraulic scissor screener bolting units, one ANFO loading unit, 3 double drive Alimak units, handheld drills, and 2 light utility vehicles.

The mine production group, including stope preparation, will require 2 longhole drill units for the Alimaks, 2 cable inserting units and grout pumps, two 5m$^3$ LHDs c/w remote capability, two 30-tonne trucks with ejector style boxes, 1 ITH drill capable of 6-inch drilling, 1 ANFO loading unit, 1 scissor lift, and 2 light utility vehicles.

The mine services and construction group will require 1 scissor lift truck, 2 utility boom trucks, 2 personnel carriers, 1 grader, 1 light service vehicle and a 3.0m$^3$ LHD forklift unit.

The maintenance group will require 3 light utility vehicles, one equipped with a man basket lift attachment. Warehousing will require 1 front-end loader. The mine staff, engineering, and geology will require 3 light utility vehicles. Table 16.3 presents the mine equipment fleet.

**TABLE 16.3**
**MINE EQUIPMENT FLEET**

| Equipment | Units | Development | Production | Services | Maintenance | Staff | Total |
|---|---|---|---|---|---|---|---|
| Electric/Hydraulic 2 Boom Jumbo | each | 2 | | | | | 2 |
| Scissor Screener Bolter | each | 2 | | | | | 2 |
| 5 cu.m. LHD (c/w Remote System) | each | 2 | 2 | | | | 4 |
| Haulage Trucks 30 tonnes(c/w Electric Retarder) | each | 2 | | | | | 2 |
| Haulage Trucks 30 tonnes (c/w ejector box) | each | | 2 | | | | 2 |
| Scissor-Lift Truck | each | 2 | 1 | 1 | | | 4 |
| ANFO Loader | each | 1 | 1 | | | | 2 |
| Longhole Drill Rig | each | | 1 | | | | 1 |
| Cable Bolt Unit | each | | | | | | 0 |
| Utility Boom Truck | each | | | 2 | | | 2 |
| 3.0 cu.m. LHD | each | | | 1 | | | 1 |
| Light Service Vehicle | each | 2 | 2 | 1 | 3 | 3 | 11 |
| Man Carrier | each | | | 2 | | | 2 |
| Grader | each | | | 1 | | | 1 |
| Double drive Alimak units | each | 3 | | | | | |
| Handheld Drills (jackleg/stoper) | each | 24 | | 4 | | | 28 |

Underground operations and maintenance personnel will be transported to their working places in personnel carriers. During the shift, workers will travel around the mine in light utility vehicles, such as Toyota Landcruiser or Hilux vehicles, equipped with bench seats in the box for people to sit on. Service vehicles for materials and parts will consist of flat bed or pickup trucks with a box, which can hold palletised, containerised, or individual items. Mine staff, engineering, and geology personnel will travel in light utility vehicles.

## 16.11 Mine Backfilling

All stopes will be backfilled with rock backfill, cemented and uncemented, to fill the voids and prevent caving. The rock backfill will consist of development waste and mined waste rock from a surface quarry. The fill will be delivered at a rate of approximately 850 t/d in order to keep up with the voids created by mining.

### 16.11.1 Underground Distribution System

The fill would be delivered to the top of the stopes by the boreholes and/or Alimak raises. Fill loading chutes and slurry distribution systems will be spaced approximately 100m vertically throughout the mine at the approximate centroid of the mining area. Slurry would be pumped from the backfill plant located by the mine portal through a series of 6 inch holes to the required fill distribution level.

Each distribution system will feed off a main backfill raise from surface. Two backfill systems will be required, one for the West Zone and one for the East Zone. Slurry will be pumped to a tank at the operating system location and sprayed into the muck as the backfill truck moves back and forth underneath the loading chute. For secondary stoping, all fill will be uncemented unless a pillar needs to be established to allow mining to proceed beneath the secondary stope. Wherever possible, waste development will be used as fill.

Fill fences, constructed at the stope entrances, would consist of a muck pile jammed to the back of the crosscut. Backfill would be delivered to the top of the stope, or a borehole, by a 30-tonne haulage truck equipped with an ejector box. Truck dump bumpers will be installed at each filling location.

## 16.12 Ventilation

The ventilation system is designed to adequately dilute the exhaust gases produced by diesel equipment. The required air volume was calculated as 0.05 cm per second (100 cubic feet per minute) per brake horsepower of diesel equipment, as per Canadian standards for Tier 3 diesel engines. Where Tier 4 diesel engines are available with equipment, a reduced ventilation volume of 0.025 cm per second (50 cfm) may be allowed for this equipment. The horsepower rating of the underground equipment was determined and utilisation factors were applied to estimate the total amount of air required (see Table 16.4, below). A model of the Pickett Mountain Mine main ventilation circuit was created in VNETPC™ from the mine design and standard frictional resistance values. Headings that would only be supplied with air via auxiliary ventilation were not included in the model.

The mining operation to support the mining equipment fleet would require ventilation air volumes of approximately 120-130m$^3$ per second (250,000-275,000 cfm). The ventilation system would consist of a push-pull system utilising ventilation raises and the main access ramp (Figure 16.12).

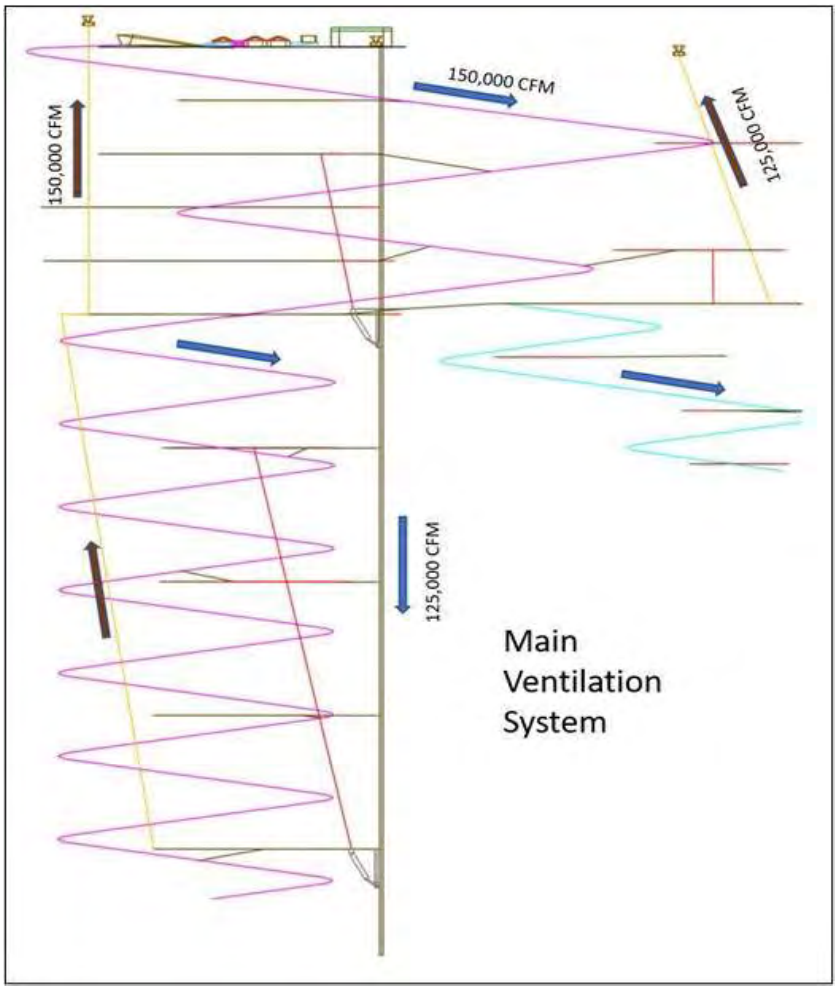



**Figure 16.12 Main Ventilation System Showing 150,000 CFM Down Ramp and 125,000 CFM Down the Borehole**

Two 2.7m by 3.3m ventilation raises would be developed from surface to the bottom of the mine in legs and be located at the furthermost end of the levels. An additional ventilation raise of the same size would be developed internal to the ramp as the ramp development progresses downwards. This raise would provide the main exhaust for the ramp during development and would be reversed to provide additional fresh air and a secondary escapeway once the main ventilation system is operational. One main exhaust raise would be located at the extremities of both the West Zone and the East Zone to provide ventilation for production mining.

The main air intake would be down the ramp, which would then exhaust out on each mining level, as required. Air would flow along a level, be picked up by auxiliary ventilation fans, and pushed into stope accesses. From there, air would flow in the LHD mucking drift and up the pilot raise in the centre of the stope to the main footwall drift on the level above the stope. Air would travel in the main footwall drift to the exhaust raise and to the surface in the raise. If required, low pressure fans would be connected to the ramp near the portal to assist air movement from the surface.

Ventilation doors and fan installations will be constructed at the portal to accommodate passage of men and equipment to and from the mine. The intake raise, internal to the main ramp, will also have a manway installed in it to provide a second means of egress.

The intake raise will be equipped with high volume, low head fans and a mine air heating unit fired by propane. The intake fans would be two 182 cm, 1,000RPM and 150 HP at approximately 1 kPa operating pressure and supply 130$m^3$/s (275,000 cfm) of fresh air.

The exhaust fans installations will be located on the first level below surface at the top of the two exhaust ventilation raises (west and east exhaust raises). An offset from the lower raise will be required at this level to accommodate the fans and bulkhead structure. The 2 exhaust raise ventilation fans will be 152 cm, 1,500 RPM, 150 HP fans with a capacity of approximately 65$m^3$/s (140,000 cfm) with maximum operating head pressure capacity of approximately 2-2.5 kPa. Flow into the exhaust raises will be controlled by the use of 75-100 HP fans and ventilation regulators and bulkheads. The portal fans will be two 100 HP fans moving 65$m^3$/s (140,000 cfm) of air, at approximately 2-2.5 kPa operating pressure. The central ventilation raise internal to the ramp will be similarly equipped. Fans will be variable speed to facilitate adjusting of air volume delivery to working areas, as required.

Fresh air delivery to the stopes will be controlled using auxiliary ventilation fans and ducting. Ventilation regulators, doors, and bulkheads will also be used to control the airflow in the mine.

The ramp development will use 150 HP fans. Other lateral development will use a combination of 75 HP and 100 HP fans depending on the heading length. Development headings are sized to accommodate large ducting (122 mm), to reduce head losses.

Auxiliary ventilation delivery to stopes will typically use 30-50 HP fans, with 91 mm (36 inch) flexible ducting.

**TABLE 16.4**
**VENTILATION REQUIREMENTS**

| Units | Quantity | Engine kW | Engine Hp | Total Installed Hp | Utilization | Total Ventilation CFM (000) |
|---|---|---|---|---|---|---|
| Electric/Hydraulic 2 Boom Jumbo | 2 | 110 | 148 | 295 | 25% | 74 |
| Scissor Screener Bolter | 2 | 110 | 148 | 295 | 25% | 74 |
| 5 cu.m. LHD (c/w Remote System) | 4 | 235 | 315 | 1261 | 50% | 630 |
| Haulage Trucks 30 tonnes | 4 | 310 | 416 | 1663 | 60% | 998 |
| Scissor-Lift Truck | 4 | 110 | 148 | 590 | 25% | 148 |
| ANFO Loader | 2 | 110 | 148 | 295 | 30% | 89 |
| Utility Boom Truck | 2 | 110 | 148 | 295 | 50% | 148 |
| 3.0 cu.m. LHD | 1 | 75 | 101 | 101 | 50% | 50 |
| Light Service Vehicle | 11 | 55 | 74 | 811 | 30% | 243 |
| Man Carrier | 2 | 110 | 148 | 295 | 20% | 59 |
| Grader | 1 | 110 | 148 | 148 | 50% | 74 |
| **TOTAL** | | | | **6048** | | **2586** |

## 16.13 Development and Production Schedules

Mine production will be 1,200 t/d or 432,000 t/year. Development is scheduled to meet stope mining requirements, on each yearly basis. Priority will be given to developing the down ramp in order to establish the first mining block on the 5150 level then progress down to the bottom of the West Zone to establish mining from the 4650 level upwards.

### 16.13.1 Productivities

Development crews in waste headings will generally have multiple headings available for advancing at any time. For development scheduling, each crew is scheduled to advance 1.5 rounds (3.5m length) per day, of 4.0m by 4.5m or 4m by 4m headings, for a total of 1,835m of advance per year (not including safety bays, slashing, cut outs, etc.).

With ore development, stoping, and backfilling, the following parameters were used in determining stope requirements:

- Each stope pilot raise produces approximately 70 tonnes per round, 1.5 rounds per day. There will be one pilot raise being developed at any time for a total of 100-140 t/d.
- Each stope can blast and muck the equivalent of 250-300 t/shift, requiring 2 available stopes mining at a time.
- To meet daily production will require 2 stopes in mining; 1 stope in pilot raise development, 1 stope in access development, 1 stope being backfilled, and 1 being readied for backfilling. Therefore, a total of 6-7 stopes at any time is required.
- Development has been scheduled so it is well ahead of the mining requirements and mining takes place on more than one level simultaneously.

### 16.13.2 Underground Mine Development Schedule

The development schedule ensures development is in place approximately 6-12 months before production zone stope development and mining is required.

The development metres are based on preliminary level plans generated from the block model with lateral development centre lines applied to the plans to access all the stoping areas scheduled in the potentially economic mineralisation production schedule. Ramping and raising connect the different levels with quantities determined, accordingly. A 20% additional development factor was applied to all metres to account for safety bays, small storage areas, and other cut outs required.

### 16.13.3 Mine Production Schedule

The mine production schedule is based on mining 1,200 t/d of potentially economic mineralisation, for 360 days per year. Table 16.5 and Table 16.6 presents the development schedule for life of mine.

**TABLE 16.5**
**LIFE OF MINE LATERAL DEVELOPMENT SCHEDULE**

| | | | | Year -2 | Year -1 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Access Development | Borehole Hoist | Dump Access | 200 | | | 100 | | 100 | | | |
| | | ancilliary | 30 | | | 15 | | 15 | | | |
| | Main Access | East Decline | 1368 | | | 660 | 500 | 208 | | | |
| | | Main Decline | 5950 | 1,439 | 1,352 | 1,500 | 1,500 | 159 | | | |
| | | Ancillary | 1098 | 216 | 203 | 324 | 300 | 55 | - | - | - |
| | | Vent Accesses | 355 | 70 | 70 | 70 | 70 | 75 | | | |
| | Exploration | | 600 | | | | | | 300 | 300 | |
| Longhole Mining | 5355 | 45 Bottom | | | 60 | | | | | 223 | 355 |
| | 5255 | 145 | | | 60 | | | | | 224 | 353 |
| | 5155 | 245 | | | 120 | 316 | 320 | 200 | 157 | 321 | 125 |
| | 5105 | 295 | | | | 155 | 291 | | | | |
| | 5055 | 345 | | | | | 245 | 123 | 144 | | |
| | 5005 | 395 | | | | | | | | 250 | 143 |
| Alimak Mining | 5350 | 50 | | | 485 | | | | | | |
| | 5250 | 150 | | | 640 | 255 | | | | | |
| | 5150 | 250 | | | 680 | 275 | 63 | | | | |
| | 5025 | 375 | | | | | 191 | 150 | 400 | 123 | |
| | 4900 | 500 | | | | | 190 | 150 | 321 | 123 | |
| | 4775 | 625 | | | | | | 300 | 297 | 50 | |
| | 4650 | 750 | | | | | | 300 | 216 | 221 | |
| | 4600 | 800 | | | | | | | | | |
| | Level Development Totals | | - | 1,725 | 3,670 | 3,670 | 3,670 | 1,835 | 1,835 | 1,835 | 976 |

**TABLE 16.6**
**LIFE OF MINE VERTICAL DEVELOPMENT SCHEDULE**

| | Year -2 | Year -1 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vertical Development | | | | | | | | | | | |
| West Exhaust | | | | 300 | 477 | | | | | | |
| East Exhaust | | | | | | | 456 | | | | |
| Decline Exhaust | 202 | 218 | 218 | 162 | | | | | | | |
| West Backfill System | | | 275 | | | 350 | 175 | | | | |
| East Backfill System | | | | | 200 | 225 | | | | | |
| Borehole Hoisting System | | | | | | | | | | | |
| Alimak | | | 400 | | 450 | | | | | | |
| 400 Pocket | | | 72 | | | | | | | | |
| 750 Pocket | | | | | 80 | | | | | | |
| Mineralised Development m | | 400 | 1,250 | 1,550 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 800 |
| Total Vertical Development m | 202 | 618 | 2,215 | 2,012 | 2,207 | 1,575 | 1,631 | 1,000 | 1,000 | 1,000 | 800 |

The production schedule is derived from scheduling all the stopes, which meet the 7% ZnEq cut-off grade. At the end of Year -1 initial stoping started on the 5150 level working up to the 5350 level, as this minimises pre-production development, while accessing more than one year of production. Table 16.7 presents the summary production schedule.

**TABLE 16.7**
**LIFE OF MINE PRODUCTION SCHEDULE**

| | Year -1 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | **Totals** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tonnage | 64800 | 367200 | 432000 | 432000 | 432000 | 432000 | 432000 | 432000 | 432000 | 432000 | 292094 | **4180093** |
| Zn % | 8.43 | 8.43 | 8.43 | 11.79 | 11.46 | 11.46 | 9.04 | 6.43 | 6.52 | 5.93 | 4.93 | **8.56** |
| Cu % | 1.52 | 1.52 | 1.52 | 1.01 | 1.02 | 1.02 | 1.03 | 0.92 | 0.97 | 1.08 | 0.98 | **1.11** |
| Pb % | 3.47 | 3.47 | 3.47 | 4.64 | 4.53 | 4.53 | 3.56 | 2.48 | 2.53 | 2.36 | 1.89 | **3.40** |
| Au g/t | 0.80 | 0.80 | 0.80 | 0.92 | 0.90 | 0.90 | 0.78 | 0.76 | 0.71 | 0.65 | 0.59 | **0.79** |
| Ag g/t | 94.34 | 94.34 | 94.34 | 118.82 | 116.62 | 116.62 | 92.17 | 65.88 | 67.44 | 59.08 | 50.19 | **88.80** |

## 16.14 Mine Surface Infrastructure

Surface facilities will generally be centred near the portal or processing plant.

Surface support facilities will include explosives magazines, mine supervision, geology, engineering and administration offices and mine change house, power substation, warehouse and laydown yard, and water collection ponds.

### 16.14.1 Explosives Magazines

The explosives magazine would be located 500m from any facility, including the mine portal. The actual magazines would be provided and permitted by the explosives supplier.

The area would be cleared and a gravel base laid. The shipping containers used to store the explosives and detonators would be raised off the ground to assist in the transfer of explosives from the delivery trucks to the magazines. The area would be fenced around its entire perimeter with a locked gate access. The area would be provided with lighting. Outside the fencing, a berm of several metres height would be constructed to contain any potential explosions in the magazines.

### 16.14.2 Other Facilities

The backfill plant would be capable of supplying cement slurry to the underground to meet the total daily backfill requirements to support production underground. The following criteria are used in the plant capacity design:

- Yearly Mining Rate: 432,000 tonnes
- Mine Operating Days: 360 days
- Daily Mining Rate: 1,200 tonnes
- Backfilling Capacity: 900 t/d
- Backfilling Placement Time: 18 hours per day
- Backfilling Rate per Hour: Approximately 35 tonnes per hour
- Backfill Mixtures 70% Solids: Approximately4% cement by weight and uncemented

A small surface quarry will be required to augment the development waste and supply sufficient fill.

A warehouse, backfill, and compressor building will be constructed from shipping containers stacked two high for walls and a roof placed on top of the container walls. The building will have dimensions of 10m by 36m. The containers will provide space for warehouse storage of smaller items. Larger items will be stored at the main warehouse near the processing plant. Items would be stored on a combination of pallet (large or bulk items) and shelved (smaller items) storage systems. Valuable items would be placed in a locked storage area.

A mine laydown yard will be constructed near the portal to store materials and equipment required for the underground mine. This laydown yard would have raised timber stands on which to place large materials, such as screen, pipe, etc. as well as gravel graded areas for storing equipment and materials. A cold storage building will store equipment requiring protection from the elements but will not require heating. Smaller supplies and components requiring heated storage would be placed in the warehouse at the mill.

All underground mine water would be sent to the water treatment facility and reused or discharged. All mine process water will be obtained by gravity clarification of mine effluent water in a 3-stage settling pond system. It is assumed that this system is of sufficient capacity to produce clear enough overflow that can be used for the underground equipment and to a lesser degree, the backfill plant. Additional steps, such as the use of flocculants, might have to be considered should the clarity of the recycled mine water not be suitable for use in meeting the site process water demands.

Mine process water will be transferred from the settling ponds to the underground mine workings by a surface pump house feeding the main water distribution piping system through a water line located in a dedicated mine service raise.

A drilled well will be used to meet all of the potable water demand at the mine.

A fully equipped mine rescue station is required on the property and will be incorporated into the shipping containers near to the warehouse, compressors, and backfill building. The mine rescue station will be equipped with all the necessary equipment, including self-contained breathing apparatus, flame lamps, gas testing equipment, rescue equipment, etc., and supplies and chemicals required to operate the station. There will be enough equipment to, in an emergency, have two 5-person mine rescue teams operating or on standby at any one time.

The mine will be technically supported by the geology and engineering departments. The geology department will be responsible for mapping and interpretation, sampling of production drill holes, grade control, and ore reserve estimations. There will be a separate exploration group to undertake the exploration work on the property and to prove up new mineral resources for potential mining. The engineering department will be responsible for mine planning, production scheduling, surveying, geotechnical design, collecting, and reporting performance statistics for the mine and any other technical requirements that support the operation.

## 16.15 Grade Control

Grade control will be conducted by geological technicians and performed on a daily basis. Material grades will be measured and compared throughout several locations of the process, including the muck pile in each heading, surface storage pads, concentrator feed belts, and concentrate and tailings handling locations.

## 16.16 Underground Personnel

The underground workforce is anticipated to be initially contracted then move to an owner operated workforce in year 3 of operation. Significant training will be required throughout the entire project life due to lack of local experience. The local skillset is mainly industrial. Timber and mechanical industries are prevalent, which carry skillsets that are similar to mining, such as equipment operation and repair. More highly specialised skillsets will take longer to train. Table 16.8 shows the anticipated manpower compliment in the mine.

**TABLE 16.8**
**UNDERGROUND MINE AND MAINTENANCE MANPOWER COMPLEMENT**

| Positions | Total Complement |
|---|---|
| Alimak Stoping | |
| Driller | 4 |
| Blaster | 2 |
| LHD Operator | 2 |
| | |
| Longhole Stoping | |
| Driller | 4 |
| Blaster | 2 |
| LHD Operator | 2 |
| Lateral Development | 16 |
| Alimak Raise Development | 10 |
| **Total Mine Development and Stoping Manpower** | **42** |

| Position | Total Complement |
|---|---|
| Serviceman | 8 |
| Grader Operator | 4 |
| Construction/Services/Backfill Leader | 1 |
| Construction /Services/Backfill Helper | 2 |
| Lamproom/Dryman | 4 |
| Hoistman | 4 |
| **Total Services Complement** | **23** |

| Position | Total Complement |
|---|---|
| Leadhand Mechanic | 4 |
| Mobile Mechanic | 4 |
| Mechanic | 4 |
| Mechanics Helper | 4 |
| Electrician | 2 |
| Electrician Helper | 2 |
| Stationary Mechanic | 2 |
| **Total Mine Maintenance Department Manpower** | **22** |

| Position | Complement |
|---|---|
| Mine Manager | 1 |
| Mine Superintendent | 1 |
| Mill Superintendent | 1 |
| Technical Services Superintendent | 1 |
| Senior Engineer | 1 |
| Accountant | 1 |
| Eng/Geo technicians | 2 |
| Purchasing/Warehouse Manager | 1 |
| Environmental Coordinator | 1 |
| Medical Contract | 1 |
| Security Guard | 4 |
| Site Services | 1 |
| **Total Complement** | **16** |

# 17.0 Recovery Methods

The conceptual process flowsheet and the process design criteria were developed based on the metallurgical results discussed in Section 13.0.

## 17.1 Conceptual Process Flowsheet

SGS test work in 1984 and RDi test work in 2018 indicated that sequential flotation process was a better choice over the bulk Cu/Pb flotation process. The conceptual process flowsheet, given in Figure 17.1, consists of three stage crushing to produce feed of $P_{80}$ of 0.5 inch for the milling circuit. The potentially economic mineralised material is ground to $P_{80}$ of 37 microns in a ball mill with $SO_2$. The ground product is conditioned with M200 and A325 at natural pH and rougher copper concentrate floated. The rougher concentrate is reground to $P_{80}$ of 21 microns and the concentrate is cleaned two to four times to produce a plus 25% Cu concentrate.

The rougher copper tailing and first-cleaner tailing are combined and sent to the lead flotation circuit. Lime, $ZnSO_4$/NaCN are added to condition the potentially economic mineralised material to pH 9.5 and A325 collector is used to float lead minerals. The lead rougher concentrate is reground to $P_{80}$ of 14 microns and subjected to two to four stages of cleaner flotation to produce marketable Pb concentrate.

The Pb rougher and first-cleaner tailings are combined and conditioned with lime and copper sulfate and zinc rougher concentrate floated using A343 collector and M200 frother. The zinc concentrate is reground to 22 microns and cleaned in two to four stages of flotation to produce a marketable zinc concentrate.

The zinc rougher and first-cleaner flotation tailings are combined and constitute final tailing at this time.

RDi's open-circuit test work indicates that two to three cleaner flotation stages would be sufficient for producing marketable-grade Cu, Pb, and Zn concentrates using slightly different reagents than used in the SGS study. However, the Capex is determined for four stages of cleaners for each mineral.

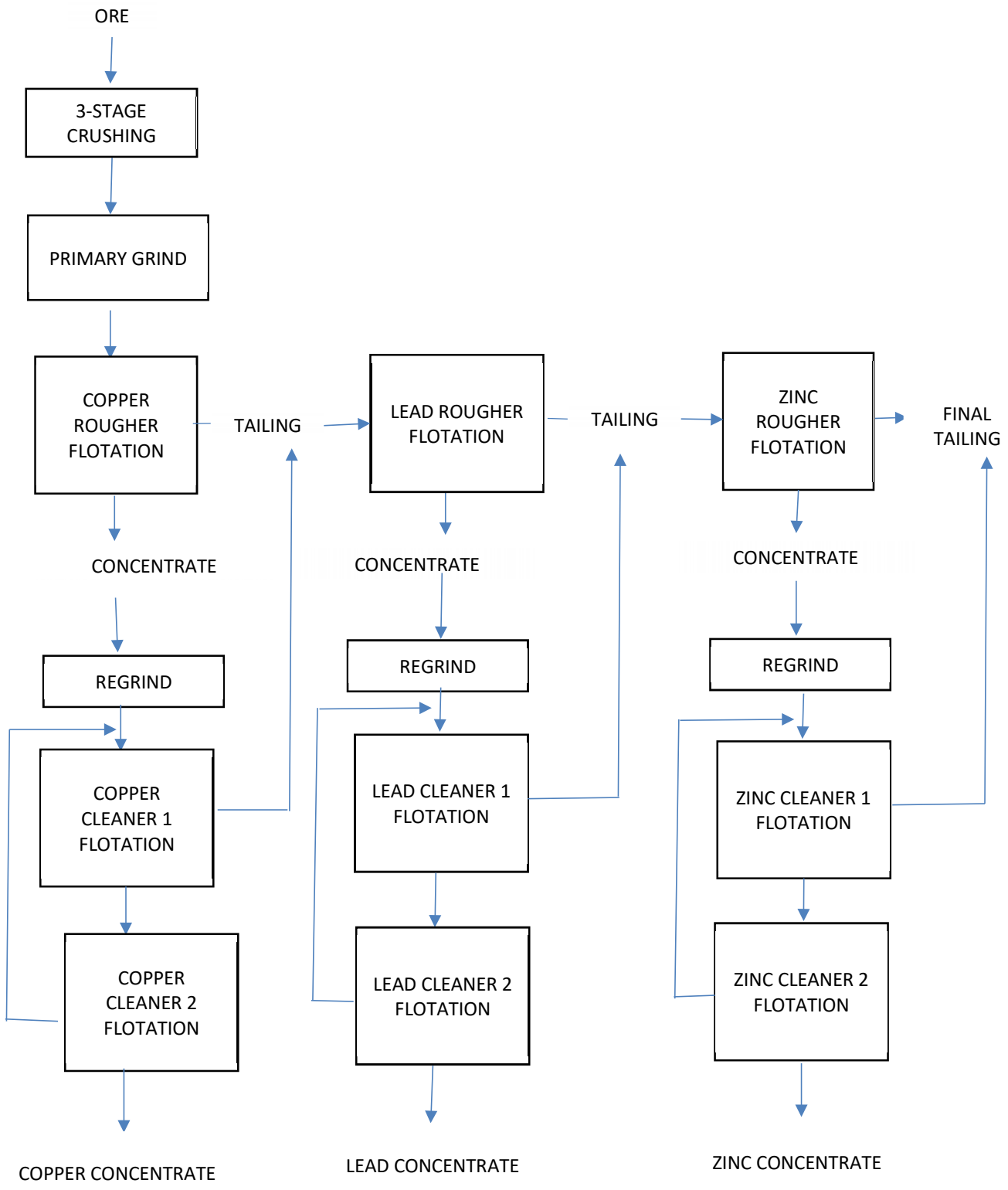



**Figure 17.1 Conceptual Process Flowsheet**

## 17.2 Process Design Criteria

The plant is designed to process 1,300 mtpd with an overall availability of 92%. The design criteria were developed using the locked-cycle flotation test No. 46, discussed in Section 13.0. The design criteria are given in Table 17.1.

**TABLE 17.1**
**DESIGN CRITERIA FOR PLANT PROCESSING 1,300 MTPD**

| No. | Parameter | Units | |
|---|---|---|---|
| 1. | Plant Tonnage | dmtpd<br>dmtph | 1300<br>54.2 |
| 2. | Plant Availability | % | 92 |
| 3. | Design Plant Tonnage | dmtph | 59.0 |
| 4. | Crushing Circuit Feed, $F_{80}$ | Inches | 4 |
| 5. | Crushing Circuit Product, $P_{80}$ | inches | 0.5 |
| 6. | Bond's Ball Mill Work Index | Kwh/st | 10.94 |
| 7. | Flotation Feed, $P_{80}$ microns | | 37 |
| 8. | Cu Rougher Conc.<br>Regrind Product, $P_{80}$ | Microns | 21 |
| 9. | Pb Rougher Conc.<br>Regrind Product, $P_{80}$ | Microns | 14 |
| 10. | Zn Rougher Conc.<br>Regrind Product $P_{80}$ | Microns | 22 |
| 11. | Cu Flotation Circuit<br>Rougher<br>Cleaner 1<br>Cleaner 2<br>Cleaner 3<br>Cleaner 4 | <br>Min<br>Min<br>Min<br>Min<br>Min | <br>20<br>15<br>10<br>7.5<br>5.0 |
| 12. | Pb Flotation Circuit<br>Rougher<br>Cleaner 1<br>Cleaner 2<br>Cleaner 3<br>Cleaner 4 | <br>Min<br>Min<br>Min<br>Min<br>min | <br>20<br>15<br>10<br>7.5<br>5.0 |
| 13, | Zn Flotation Circuit<br>Rougher<br>Cleaner 1<br>Cleaner 2<br>Cleaner 3<br>Cleaner 4 | <br>Min<br>Min<br>Min<br>Min<br>Min | <br>20<br>20<br>15<br>10<br>7.5 |

## 17.3 Reagents

The consumption of reagents in the milling circuit was estimated from the locked-cycle test. The consumption of each reagent per tonne of ore is given in Table 17.2.

**TABLE 17.2**
**ESTIMATED REAGENT CONSUMPTION PER TONNE OF ORE**

| Reagent | Kg/t |
|---|---|
| $SO_2$ | 1.34 |
| Lime | 5.5 |
| $ZnSO_4$ | 1.6 |
| NaCN | 0.8 |
| A325 | 0.15 |
| M200 | 0.063 |
| $CuSO_4$ | 1.15 |
| A343 | 0.05 |
| Flocculant | 0.10 |

## 17.4 Process Make-up Water

The water balance was estimated based on the following assumptions:

- Open-circuit scoping flotation test data was used to estimate the tonnage of copper, lead ,and zinc concentrates.
- The remaining tailing will also be thickened and filtered since there will not be tailing pond at site.
- All the filtered products will have 20% moisture. The remaining water will be collected and recycled as process water to the plant.

The estimated overall water is given in Table 17.3. It assumes no evaporation loss. The overall water balance indicates that the plant will need approximately 325m$^3$/day of fresh water since the amount is lost to the products from the plant. However, if pressure filters are installed, the water requirement would be less.

**TABLE 17.3**
**CONCENTRATOR WATER BALANCE**

| Product | Solids | | Water t/d or m$^3$/d | Comments |
|---|---|---|---|---|
| | % | t/d | | |
| Plant Feed (Flotation Feed) | 30 | 1,300 | 3,033.3 | Need Per Day |
| | 80 | 20.15 | 5.04 | Lost in Concentrate |
| Pb Conc. | 80 | 13.78 | 3.45 | Lost in Concentrate |
| Zn Conc. | 80 | 64.35 | 16.09 | Lost in Concentrate |
| Tailings | 80 | 1,201.72 | 300.43 | Lost in Concentrate |
| Process Water Recycle | 0 | 0 | 2,708.29 | Amount Recovered |
| Makeup Process Water | 0 | 0 | 325.01 | Makeup Per Day |

## 17.5 Material Balance (Product Production)

Several assumptions were made in order to calculate the material balance for the conceptual process flowsheet. They were as follows:

- Limited scoping level test work has been completed to date. Only open-circuit test data was available for obtaining material balance.

- An assumption was made that 95% of the metal of interest recovered in the rougher flotation will report to the final concentrate.

- Reliable data for lead flotation was not available. Hence, assumed that the lead concentrate will assay 35% Pb based on historical data and the lead recovery in the concentrate will be ±70%.

The material balance is presented in Table 17.4. Additional open-cycle and locked-cycle tests need to be undertaken in order to refine/confirm the material balance for the conceptual process flowsheet.

**TABLE 17.4**
**MATERIAL BALANCE FOR THE PROCESSING PLANT**

| Product | Recovery % | | | | | | Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wt. | Cu | Pb | Zn | Au | Ag | Cu | Pb | Zn | Au | Ag |
| Plant Feed | 100 | 100 | 100 | 100 | 100 | 100 | 1.32 | 1.59 | 8.86 | 0.93 | 98.0 |
| Cu Rougher Concentrate (open circuit) | 9.6 | 84.7 | 18.2 | 6.0 | 29.0 | 49.6 | 11.6 | 3.01 | 5.35 | 2.8 | 505.0 |
| Cu Final Concentrate (cleaner 2) | 4.3 | 80.5 | 4.8 | 1.3 | 28.6 | 46.5 | 24.8 | 1.79 | 2.63 | 6.19 | 1059.0 |
| Pb Circuit Feed | 95.7 | 19.5 | 95.2 | 98.7 | 71.4 | 53.5 | 0.26 | 1.58 | 9.14 | 0.69 | 54.8 |
| Pb Rougher Concentrate | 13.9 | 8.0 | (74.0) | 9.1 | 33.1 | 31.9 | 0.73 | (8.05) | 6.00) | 2.2 | 225 |
| Pb Final Concentrate (Cl3 Conc) | 3.2 | 2.4 | (70.3) | 1.5 | 9.5 | 22.1 | 1.01 | (35.0) | (4.00) | 2.76 | 677 |
| Zinc Circuit Feed | 92.5 | 17.1 | 24.9 | 97.2 | 61.9 | 31.4 | 0.24 | 0.4 | 9.31 | 0.62 | 33.3 |
| Zinc Rougher Conc. | 37.2 | 6.3 | 16.7 | 94.2 | 36.1 | 17.4 | 0.22 | (0.4) | 22.4 | 0.9 | 46 |
| Zinc Final Conc. (Cl 2 conc.) | 14.2 | 1.9 | 6.4 | 89.5 | 4.9 | 5.2 | 0.18 | 0.72 | 55.7 | 0.32 | 36 |
| Final Tailing | 78.3 | 15.2 | 18.5 | 7.7 | 57.0 | 26.2 | 0.26 | 0.38 | 0.87 | 0.68 | 33 |
| **Note:** The numbers in brackets were assumed based on past experience. Additional test work will be needed to confirm that the assumed grade and recovery can be achieved | | | | | | | | | | | |

The material balance projected Cu, Pb, and Zn recoveries in their respective concentrate to be 80.5%, 70.3%, and 89.5%. The concentrate grades were 24.8% Cu, 35% Pb, and 55.7% Zn, respectively.

The historical locked cycle recoveries and grades for Cu, Pb, and Zn in their respective concentrates were 77.4% at 23.1% Cu, 77.5% at 50.9% Pb, and 87.7% at 53% Zn, respectively.

The results are similar in the two cases except for the Pb concentrate. The samples tested at RDi had been aged, and hence, effected lead metallurgy. Higher lead recovery and concentrate grade are to be expected for fresh core samples. The lead recovery and concentrate grade are assumed to be the same as obtained in the locked-cycle test.

# 18.0 Infrastructure

A total of $19.5 million will be required to supply and install the infrastructure for the Pickett Mountain Project.

## 18.1 Existing Infrastructure

The Pickett Mountain Project is a green fields mining project in the midst of a logged area that has access roads used by the foresters to reach timber lots. The right-of-way has been established and it requires upgrading to meet safety standards for higher volumes of traffic that will occur with the advent of construction and operation of the mine.

## 18.2 Access Road

The access road from the paved highway (Hwy 11) is approximately 5 miles (8 Km) to the mine site. There are $1.5 million set aside to upgrade the road ensuring safe reliable access year round (Figure 18.1).

**Figure 18.1 Potential Road Access Upgrade**

## 18.3 Site Pad

Based on the size of the operation, the lay of the land, and considering the environmental and social sensitivity of any construction of mines, it has been determined to utilise a 1,500 foot by 500 foot (460m by 150m) pad as the main construction and operation area. The project requires accommodation for the building and construction phase as well as have the room necessary to safely operate the various components of the process.

Figure 18.2 shows the westerly most configuration of the main mining infrastructure pad (see Figure 18.4, below, for overall site plan).

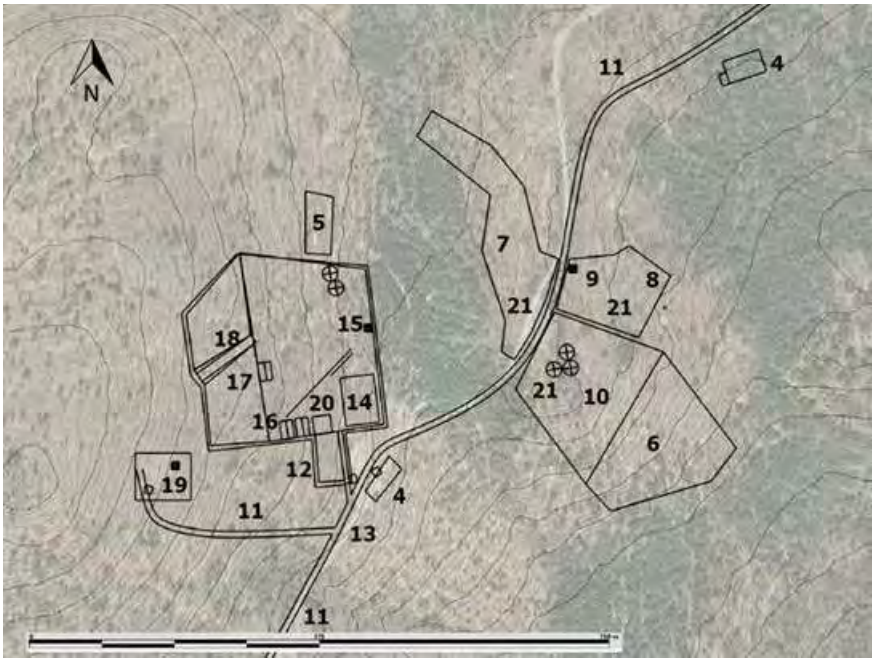



**Figure 18.2 Potential Pad Design**

### 18.3.1 Main Pad Preparation

Maine Drilling and Blasting was contacted to get budgeting pricing on the preparation of the main pad. There is a $65,000 mobilisation fee plus $3.45 per cubic yard to drill and blast the material necessary to level out the area. The volume required to make this pad including its sub-grade is approximately 500,000 cubic yards at a cost of $1.79 million. This is only the figure for drilling and blasting and not the figure for removing the material, crushing it to size, and then placing it to grade.

### 18.3.2 Pad Construction

The pad placement will consist of various grades of cleaned crushed stone covering the entire area. The thickness is 15 feet to accommodate underground piping, electrical utilidors, and other infrastructure that needs protection from mine equipment or staging areas. The cost is estimated at $2.71 million at a $5 per ton rate.

#### 18.3.2.1 Parking

An additional $50,000 has been allocated for parking at the mine site. Parking will be designed to accommodate roughly 75 employees in order to manage contractors during construction. Parking will be outdoors and will be of simple construction specifically, levelled, and compacted till base with a compacted ¾ inch minus gravel cover.

## 18.4 Main Power to Site

Emera Power was recently purchased by Enmax of Calgary, Canada to form the new corporation, Versant Power (https://www.emeramaine.com/). Previously, Emera had indicated that the price of delivering 6 MVA to the Mine site would be $7.0 million.

### 18.4.1 Power Distribution

Power distribution on site was quoted as $2.0 million. This allowed for step down from the supplied Enmax line to 4160V distribution on site. Distribution will be via overhead lines on the surface with some underground tech cable near buildings and leading to underground workings.

## 18.5 Potable Water System

The potable water system also includes the process water system that needs to meet or exceed dissolved solids that may interfere in the extraction process notwithstanding the ability to use as a source for drinking and bathing.

The water needs to be drawn from an authorised site by the State of Maine to a suitable tank and from the tank, distributed after being treated for organics, total dissolved solids, as well as metal ions.

The price of the system is approximately $250,000.

## 18.6 Sewage System

The two main factors that dictate the size and complexity of a commercial septic system are the maximum amount of wastewater that the buildings could produce daily, and soil/site conditions. Some domestic sewage systems today may require a separation of grey water and black water to ensure proper operation of the overall process in turning the waste products into environmentally safe materials. The assumption here is to forgo this issue and design a system for 2,500 gallons per day.

The price of the system is approximately $250,000.

## 18.7 Buildings Earthworks

Once the main area has been established, the construction contractors will require excavation of the various buildings, including the mill, the electrical substation, offices, and other outer buildings, including warehouse bunks.

The price of the system is approximately $750,000.

## 18.8 Quarry

Several quarry and road construction contractors were contacted and the budget quote received for crushed rock was $15 per ton FOB plant plus $12 per ton delivered to site for a total price of $27 per ton.

The alternative option is to construct a quarry on site and operate it at approximately $5 per ton and utilise the crusher system to produce the products needed for surface and underground. This latter idea

has been shown inside the Tailings Area in Figure 18.4. This location being conceptual will require evaluation of depth to water table and material quality prior to excavating.

## 18.9 Fuel and Fuel Storage

Fuel pads and waste oil depots need to be constructed to ensure any spillage will be contained and, in the event of a fire, a method to prevent the spread to other infrastructure or surrounding bush. Monies allocated for these items are $25,000.

## 18.10 Propane

Propane needs special attention as the contents of the tank are under pressure and protection of a potential explosion is needed. An extra $10,000 has been allocated to accommodate a berm around the tank making the total cost of containment $35,000.

## 18.11 Change House (Dry Facility)

The building is sized for worker and staff personnel (underground and surface) to change out of their street clothes for work gear. The facility will have a street clothes locker on one side, a shower/washroom facility in the middle, and a work gear PPE on the other side. Monies allocated are $750,000.

## 18.12 Materials Pads

Whatever the pads are holding, whether it be potentially economic mineralisation, waste rock, acid generating waste rock or backfill, each material storage pad will require construction and lining. Lining of acid generating or potentially acid generating pads will require a minimum of 2 feet this of clay or silt covered by a geosynthetic liner and a protective layer. Non-acid generating pad simply require a clay or till base and a working layer.

### 18.12.1 Rock Dump Construction (Clean)

Berms and drainage systems containing water and preventing seepage are designed to handle two and one half years of development.

The pad size is 300×35×15m and will cost $125,000 to construct.

### 18.12.2 Rock Dump (Acid Generating)

The acid generating rock pad requires significantly more attention to detail regarding drainage, collection, and potentially pumping to a holding pond for further treatment. Lining the pad with clay and a geosynthetic liner then a gradational covering over the membrane ensures no leakage to the environment. The effluent will be directed to a holding pond for further treatment.

The pad costs are designated at $400,000 and 150m square by 2m thick.

### 18.12.3 Ore Pad and Temporary Stockpile

The stockpiles of ore and development will have a similar design as the acid generating pad and will similarly cost $400,000.

## 18.13 Office Maintenance Complex

The offices and maintenance complex are constructed of dry-storage shipping containers to speed construction and to minimise foundation work. The compressor room will be in one of the units and the stand-by generator in another. Finally, there are office and maintenance areas throughout the containers.

Costs set aside for these buildings are $750,000.

## 18.14 Surface Explosives Storage

Surface storage of explosives are set at $25,000 and will be rented from the explosives supplier until underground storages can be established.

## 18.15 Accommodations

No onsite accommodations have been considered in this study. Employees and contractors will commute to the site.

## 18.16 Water Management System

Water management will be a series of collection ditches and pond used to collect impacted water from around the property outside of the tailings facility. Water drawn from the tailings facility will be recirculated back into the processing facility as process water. The collected surface impact water, along with mine discharge water, is pumped into a raw water collection pond. This water is then treated through a water treatment facility. Treated effluent water that achieves background or better water quality is then discharged into a clean water holding pond. Water from the clean water holding pond is then reused in mining and milling process and excess water is allowed to discharge to the environment via several septic fields named potential discharge points (PDP). These discharge points function in such a way to ensure the released water weeps (disperses) back into the ground water below the surface as it would if the project did not, take place. There will be no single point discharge of any water to into any natural creeks, streams or bodies of water.

## 18.17 Water Treatment Facility

Collected water will be mixed using a series of frac tanks with hydroxide and Metclear (metal precipitating agents) to form a metal precipitate. The metal precipitate will be captured by an ultrafiltration membrane (filter) for disposal and the decant solution will return to the frac tanks to be reused in the process. The ultrafiltration permeate (clear water) will either be discharged (if it meets State environmental standards) or flow through a reverse osmosis unit, if required (TBD). Reverse osmosis permeate will be either discharged or reused as mine process water. Reverse osmosis concentrate will flow to the storage tank for decant and solids removal. This report considers a Build Own Operate option from the supplier and includes the reverse osmosis unit as a conservative approach. The water treatment facility will be owned before the operation is closed and may be used in reclamation and longer term standby post closure

treatment, if ever required. The block diagram below (Figure 18.3) shows the anticipated design of the water treatment facility.

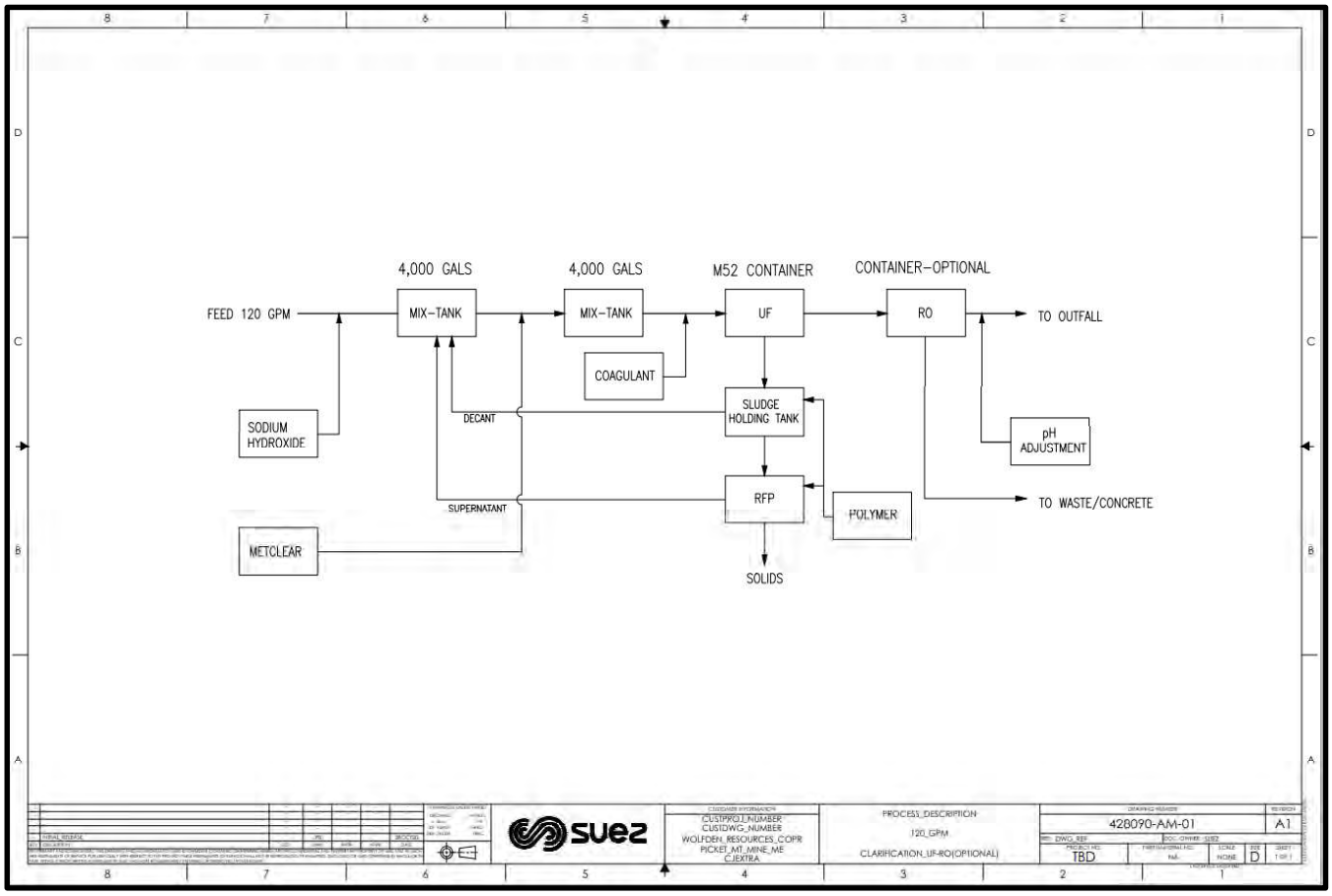



**Figure 18.3 Water Treatment Plant Block Diagram**

## 18.18 Garbage

Domestic garbage will be collected and taken to the nearest approved landfill site and managed by a local contract.

## 18.19 Standby Power Plant

An estimate of 3 MVA will be required to ensure safety of the operation during a power disruption. The standard method of providing this power is through diesel generators.

## 18.20 Communications

There will be a requirement for high speed intranet on site and potentially connecting to the outside internet. Pricing is to be determined but covered under contingency at this time.

## 18.21 Security

Security of all industrial sites are required and fencing is required around all hazardous points as well as gates for entry onto the property (Figure 18.4).

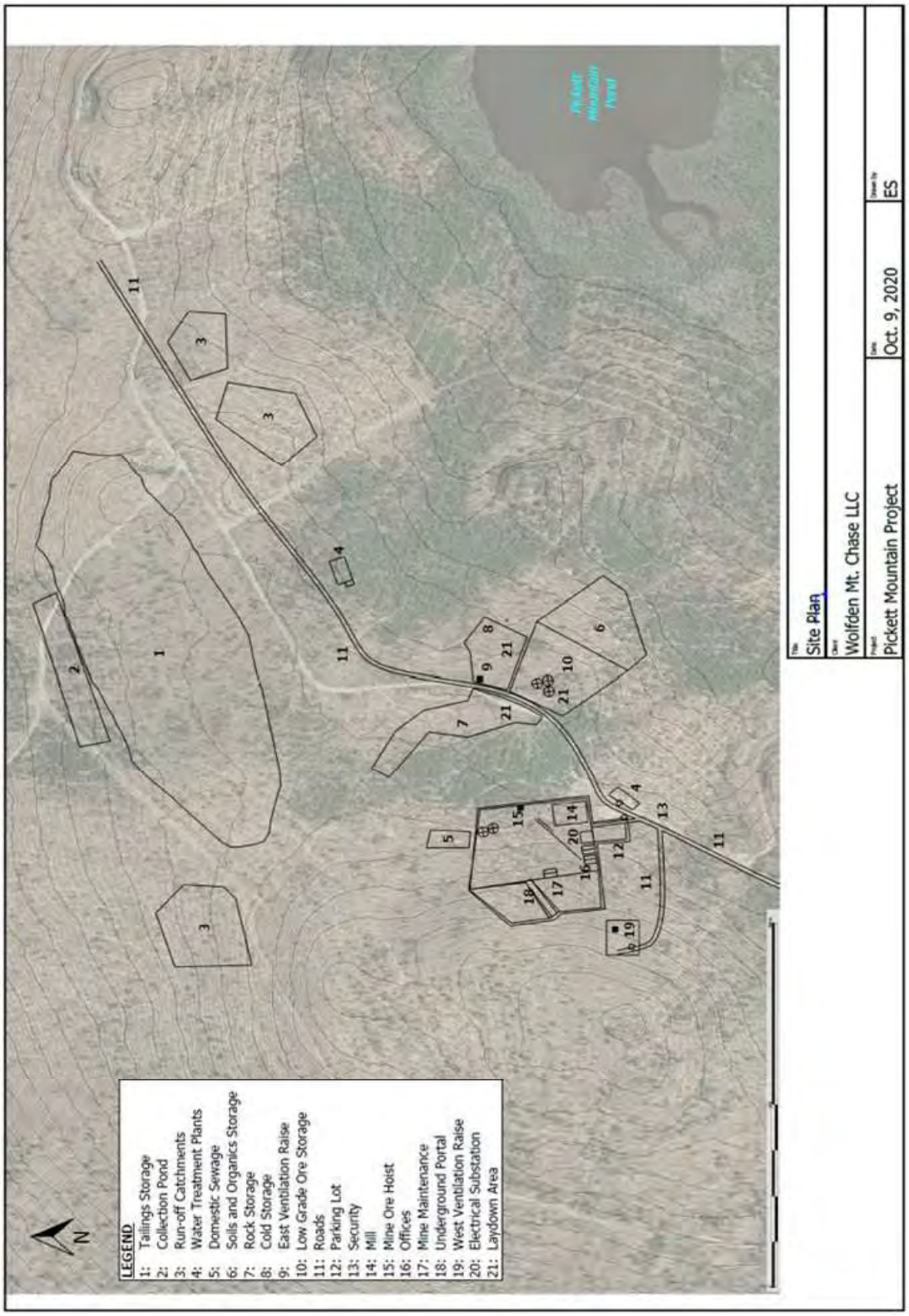



**Figure 18.4 Plan Showing General Arrangement of Surface Infrastructure**

## 18.22 Tailings Management Facility

Tailings will be dewatered by thickening followed by pressure filtration to produce a filter cake consistency tailings that will be deposited in a filter stack (Dry Stack) Tailings Management Facility (TSF) in compliance with State Regulations (Maine, 2017). The regulations allow for amendments, if tailings alternatives may be demonstrated to be equivalent; however, a filter cake TSF is well suited for this project over alternative methods because:

- Reduced footprint allows for full containment of tailings within limited space available;
- Soil-like tailings consistency allows for steep deposition slopes that are ideal for the hillside topography of the TSF site;
- Lack of natural containment mean hydraulically placed tailings would require significant containment dams;
- Water recovered in the mill obviates the need for large tailings ponds for mill make-up water, especially during winter months when significant amount of water lost to ice;
- The mill process rate allows for filtered tailings to be handled and deposited using minimal resources;
- The facility is readily expandable by stacking higher or expanding the footprint without significant dam construction;
- Amenable to progressive reclamation and immediate closure as the filtered tailings do not require drying prior to installation of closure cover; and
- Reduced risk of containment loss result of low water content tailings.

The main risks to successfully developing a filter cake TMF that will need to be carefully managed are:

- Off-spec tailings that are not sufficiently dewatered by filtration will require additional rework, drying, or re-processing before they can be deposited; and
- The design deposited dry density may not be achievable during the winter months and may require temporary storage until spring when the thawed tailings may be compacted.

### 18.22.1 Operating Data

Approximately 4.1 Mt/4.5 M short tons (M-st) of mineralised material will be mined and processed over 9 years (approximately 1.2 ktpd/1.32 kstpd) to produce three separate concentrate streams for copper, lead, and zinc. Approximately 20% of the mineralised material will be shipped offsite as concentrate, with the remaining 80% or 3.3 Mt/3.5 M-st of tailings stored on site.

Tailings will be dewatered by thickening to approximately 60-63 wt% solids followed by pressure filtration to approximately 83-85% wt% solids and having between 15%-17% moisture calculated as process engineering (Mine Paste, 2020). Based on a specific gravity of 3.25 and a void ratio of 0.6, SLR estimated the filtered tailings density to be 2.0 tonnes per cubic metre (2.1 t/m$^3$)/125 pounds per cubic foot (pcf) with a corresponding TMF storage capacity of 1.6 million m$^3$.

### 18.22.2 Design Criteria

Key Project design criteria, assumed for the TMF, are summarised as follows:

- **Life of Mine** (Commercial Production): 9 years
- **Mined Tonnes**: 4,100,000 tonnes (4,520,000 tons)
- **Tailings Produced**: 3,280,000 tonnes (3,620,000 tons)
- No Underground Backfill
- **Dam Classification**: Significant (CDA, 2013)
- **Environmental Design Flood**: 500-year 24-hour storm (198 mm/7.8 inches)
- **Inflow Design Flood**: 1,000-year 24-hour storm (217 mm/8.5 in)
- **Contact Water Containment**: composite liner system with solution collection system
- **Contact Water Drainage**: maximum 0.3m/1 ft head above containment system liner
- **Seepage Control Measures**: collection pond with water reused by mine or treated and discharged
- **Closure Cover**: composite liner system with drainage layer and soil cover for vegetation growth

The contact water containment/drainage and closure cover requirements are per state regulations (Maine, 2017).

The Project constraints for the TMF are:

- **Target Maximum Height of TMF**: less than the height of trees 7m/22 ft
- **Wetlands Setback Distance**: 23m/75 ft minimum
- **Re-zoning Boundary Setback Distance**: 122m/400 ft minimum

The maximum height of the TMF was targeted to not exceed the height of trees by Wolfden to minimise the visibility of the TMF to the general public from the surrounding areas. However, this constraint is considered flexible with the design criteria and setback distance constraints taking precedence.

### 18.22.3 TMF Conceptual Design

The TMF is comprised of the following design components:

- Containment system, consisting of a composite liner system, to minimise the seepage to the environment;

- Perimeter berms to provide containment of the tailings;

- Collection Pond to store excess contact water;

- Collection Ditches to convey contact water to the Collection Pond; and

- Surface Water Ditches to convey fresh, or non-contact water, around the TSF.

The design and operation of a filter cake disposal facility is dependent on tailings to the specified consistency, *i.e.*, filtering to near optimum moisture content to allow for placement and compaction.

Additional rework of the tailings may be necessary to achieve the optimum moisture content and design dry density.

If adequate and consistent filtering cannot be achieved, the system may not work.

A site plan, showing the location of the TSF and appurtenant structures, is shown in Figure 18.5.

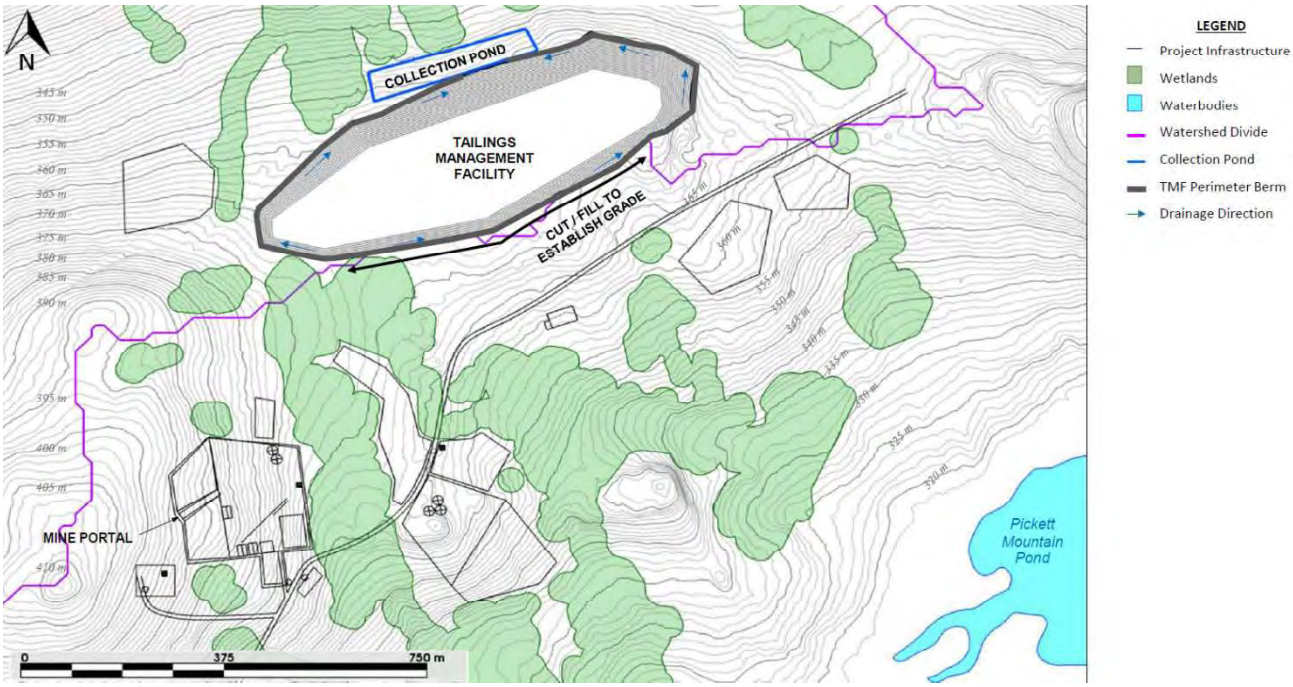



**Figure 18.5 Plan Showing General Arrangement of Tailings Management Facility**

### 18.22.4 Base Grade and Containment System

The base or foundation of the TMF will generally follow the natural topography of the ground surface, sloping from the topographic divide downwards to the Collection Pond in the north. The topographic ridge features two small crowns (approximately 2m/6 ft tall) that will need to be regraded to provide positive internal drainage to the Collection Pond on the north side of the TSF.

A containment system is required by State regulation (Maine, 2017) consisting of a composite liner and drainage layer. Contact water collected above the composite liner will gravity drain to the Collection Ditches and ultimately the Collection Pond. Contact water will be recirculated to the mill. Minimal contact water in excess of the mill requirement will be directed to the water treatment plant.

The containment system is comprised of the following components, from bottom to top:

- 0.6m/2 ft minimum thick low permeability soil fill (permeability less than $1\times10^{-6}$ centimetres per second (cm/s));
- 1.5 mm/60 mil High Density Polyethylene (HDPE) geomembrane; and
- 0.6m/2 ft minimum thick Drainage Collection Layer.

The containment system is required to also ensure that the contact water head does not exceed 0.3m/1 ft above the HDPE liner. To satisfy this condition, a series of perforated, corrugated polyethylene (PCPE) drainage pipes will be installed within the free draining Drainage Collection Layer.

### 18.22.5 Perimeter Berm and Ditch

A 1m to 3m (3 ft to 9 ft) high perimeter berm will be provided along the toe of the TMF. The berm will be used for anchoring the geomembrane liner and for creating a Collection Ditch for contact water collection along the tailings perimeter. The height of the perimeter berm will be a function of the length of the tailings slope. The south side of the TSF is situated on flat ground and will have a minimum berm height of 1m (3 feet), while the north side of the TSF is situated on a slope and will have a maximum height of 3m (10 feet).

Filtered tailings will be placed up to the perimeter berm, maintaining a minimum 1m (3 ft) deep ditch between the filtered tailings and berm slopes. The grade of the ditch will follow the natural topography, sloping from north to south. Grading will be required on the topographic divide through a grading plan that ensures a minimum 1% slope that drains toward the east side then turning and draining downhill south to the Collection Pond. Borrow from the cut of the two crowns can be used to regrade the lower areas in between.

The perimeter berm will be notched at the low point in the TMF to allow drainage from the TMF to the Collection Pond.

### 18.22.6 Collection Pond

Contact water from precipitation and tailings seepage will drain into the perimeter Collection Ditch system, which ultimately drains to the Collection Pond on the north side of the TMF.

The Collection Pond was sized to contain a total of 43,000m$^3$, which is the run-off from an Environmental Design Flood (EDF) in addition to the maximum operating level. SLR sized the Collection Pond based on the following:

- SLR assumed a maximum operating pond volume of 5,000m$^3$ (18,000 cf) for a facility of this size and with progressive reclamation potentially reducing the quantity of contact water generated. The filtered tailings are relatively dry with an estimated gravimetric moisture content of about 18% which SLR expects to result in very little free water to drain out. Rainfall is expected to be the main source of contact water, and some infiltration is expected to report as tailings seepage.

- The EDF criterion for the Project is defined as the 500-yr 24-hr. event required by (Maine, 2017). SLR calculated an EDF volume of 38,000m$^3$ to be stored in the Collection Pond based on a the lined TMF footprint area of 215,000m$^2$, a 500-yr 24-hr. event of 198 mm and a run-off factor of 90%.

SLR assumed that the containment berms for the Collection Pond will be constructed by placing and compacting soils excavated from within the Collection Pond footprint. The Collection Pond will be constructed with a similar containment system as the TMF to prevent solution seeping into the groundwater, and is comprised of the following components, from bottom to top:

- 0.6m/2 ft minimum thick low permeability soil fill (permeability less than $1\times10^{-6}$ cm/s)

- 1.5 mm/60 mil HDPE geomembrane

A spillway equipped with a rip rap protected channel and energy dissipation downstream of the south side of the pond will prevent overtopping and will be sized to safely pass the IDF event, defined as the 1,000-year 24-hour event. The water discharged by the spillway will drain overland north to Pleasant Lake. In the event of such a major storm, rain water would be pumped directly into the mine in order to prevent usage of the spillway.

### 18.22.7 Closure

At closure, the TMF is required to be fully covered with a geomembrane liner on the outer slopes and vegetated with similar plant species found naturally in the area. In the active phase of closure, water treatment and environmental monitoring will be required until it is demonstrated that the site conditions meet pre-mining conditions. As the site reaches passive phase of closure, no additional treatment or monitoring would be expected.

A closure cover, consisting of a composite liner equivalent to the basal liner, is required to be constructed over the TMF (Maine, 2017).

The closure cover liner system is comprised of the following components, from bottom to top:

- 0.6m/(2 ft thick low permeability soil fill (permeability less than $1\times10^{-6}$ cm/s)
- 1.5 mm/60 mil HDPE geomembrane liner
- 0.3m/1 ft thick Drainage layer
- 0.3m/1 ft thick random soil for a root penetration layer,
- 0.15m/0.5 ft thick topsoil vegetation growth medium, revegetated with small grasses and shrubs

At closure, the contact water collected in the Collection Pond will continue to require treatment until water quality meets regulatory requirements. Once the water quality requirements have been met, the geomembrane may be removed and the Collection Pond breached to prevent future accumulation of water with the area covered with soil and vegetated.

Selective areas of the TMF can be progressively reclaimed during the operations phase by installing the closure cover system. Reclamation will be limited by the areas of the cell that are final and do not tie into an adjacent cell (*i.e.*, the internal boundaries of the cells should not be reclaimed). Progressive reclamation will allow the closure costs to be spread out into the operating period, allowing the closure construction to be reduced in cost and duration in addition to providing an opportunity to evaluate the closure cover performance.

# 19.0 Market Studies and Contracts

## 19.1 Market Studies

No market studies were conducted at this time. The pricing used for the various commodities was market consensus pricing, as provided by Wolfden.

The metals price deck used is in Table 19.1.

**TABLE 19.1**
**METAL PRICE DECK**

| Commodity | Consensus Pricing | |
|---|---|---|
| Zinc | $ | 1.15 |
| Copper | $ | 3.00 |
| Lead | $ | 1.00 |
| Gold | $ | 1,500.00 |
| Silver | $ | 18.00 |

## 19.2 Contracts

The following contracts will be part of the construction and/or operation of the Pickett Mountain project:

- Zinc, lead, and copper concentrate offtake agreements are estimated with input from major smelters including a large, diversified resource conglomerate and commodity trader, for life of mine feed at International Benchmark terms.
- Pickett Mountain's initial underground construction, ramp up, and operation for up to 3 years will be conducted by mining contractors.
- Site infrastructure construction will be performed, in majority, by locally sourced contractors.
- Water treatment activities will be performed by specialised supplier and operator.
- Pickett Mountain concentrate material will be transported to the nearest deep water port via local logistics contractor.
- Construction, operations, supplies, and consumables contracts have not been established; however, estimates by service providers used in this document have been supplied by potential candidates.

No contracts currently exist for construction or operation of the project. The contracts listed above have submitted budgetary quotations and estimates for input to the study.

# 20.0 Environmental Studies, Permitting, and Potential Impacts

The proposed mine project is located on a 528.2-acre parcel within a 7,145-acre tract of privately owned land owned by Wolfden Mt. Chase LLC, a wholly owned subsidiary of Wolfden Resources Corporation. The proposed mine project is within Maine's unorganised territory and subject to regulatory approval of both the Maine Land Use Planning Commission (LUPC) and the Maine Department of Environmental Protection (MEDEP).

This item is organised as follows:

- ***Section 20.1, Regulatory Framework*** discusses the roles of both LUPC and the MEDEP in the permitting process for the Pickett Mountain Mine Project;
- ***Section 20.2 Permit Status*** summarises the status of the project with respect to permitting;
- ***Section 20.3 Environmental Studies and Issues*** provides a summary of the results of environmental studies completed, identifies additional studies that are expected to be required, and discusses known environmental issues that could materially impact the project's ability to extract the mineral resources or mineral reserves;
- ***Section 20.4 Social and Community Requirements*** provides a discussion of potential social or community related requirements and plans for the project and the status of negotiations or agreements with local communities; and
- ***Section 20.5 Mine Closure*** provides a discussion of mine closure including remediation and reclamation requirements and costs.

## 20.1 Regulatory Framework

### 20.1.1 Land Use Planning Commission (LUPC)

Within the regulatory framework of the State of Maine, the LUPC was commissioned and charged by the Maine Legislature with developing a comprehensive plan to extend principles of sound planning, zoning and development to the unorganised and de-organised townships of the State. Through its Comprehensive Land Use Plan (CLUP) the LUPC reviews, approves, and administers development projects ensuring that proposed projects meet the broad and specific goals of the Commission and objectives of the legislature. Specifically the legislatures purpose was "*to preserve public health, safety and general welfare; to support and encourage Maine's natural resource-based economy and strong environmental protections; to encourage appropriate residential, recreational, commercial and industrial land uses; to honor the rights and participation of residents and property owners in the unorganised and de-organised areas while recognising the unique value of these lands and waters to the State; to prevent residential, recreational, commercial and industrial uses detrimental to the long-term health, use and value of these areas and to Maine's natural resource-based economy; to discourage the intermixing of incompatible industrial, commercial, residential and recreational activities; to prevent the development in these areas of substandard structures or structures located unduly proximate to waters or roads; to prevent the despoliation, pollution and detrimental uses of the water in these areas; and to conserve ecological and natural values.*"

The purpose of LUPC's oversight in the context of metallic mineral mining projects is to certify that the project meets the goals and the objectives established in the CLUP and that the property can be rezoned

to allow the project to move forward with a Mining Permit Application under the MEDEP Chapter 200 rules. The area proposed for the project is currently zoned as a general management subdistrict. The proposed project is a major planned development that must be conducted within a Planned Development (D-PD) subdistrict as required by the LUPC for metallic mineral mine projects, consistent with standards for said subdistricts and within the intent and provisions of 12 M.R.S.A. Chapter 206A. Under Chapter 685-B, Development Review and Approval, a permit is not required for metallic mineral mining projects that are reviewed under the Maine Metallic Mineral Mining Act. This project will require review and permitting by the MEDEP under its Chapter 200 rules for Metallic Mineral Exploration, Advanced Exploration and Mining, since all metallic mineral mining activity within a D-PD district is permitted through the MEDEP. The LUPC must certify to the MEDEP that the proposed development is an allowed use and that the proposed development meets applicable land use standards established by the LUPC and not otherwise considered as part of the MEDEP's review.

Pursuant to 12 M.R.S.A., Section 685-A(8-A), no change in a district boundary shall be approved by the Commission unless there is substantial evidence that:

- The change would be consistent with the standards for D-PD Development Subdistrict boundaries in effect at the time; the Comprehensive Land Use Plan; and the purpose, intent and provisions of 12 M.R.S.A. Chapter 206-A; and

- The change in districting will have no undue adverse impact on existing uses or resources or a new district designation is more appropriate for the protection and management of existing uses and resources within the affected area.

### 20.1.2 Maine Department of Environmental Protection (MEDEP)

The MEDEP is charged with permitting and regulation of metallic mineral mining projects under its Chapter 200 rules. The Maine Metallic Mineral Mining Act (Act) provides the framework for all metallic mining activity within the state. The current statute became effective on June 1, 2014. The Maine Board of Environmental Protection, on January 5, 2017, unanimously voted to repeal the existing Chapter 200 rules and adopt new rules. In June 2017, an Amendment Bill LD-820 to the Act, "To Protect Maine's Clean Water and Taxpayers from Mining Pollution" became law, which provides additional provisions and restrictions. The Chapter 200 Rules under the MEDEP were repealed and replaced with the current rules on December 28, 2017.

The intent of the 2014 statue was to streamline the existing permitting system and incorporate many of the permitting requirements under one regulatory agency, the MEDEP. Under the Act, permits that were previously required under other state law are no longer required in that those provisions are covered directly in the new metallic mining permit program.

The rules and recently enacted legislation effectively require best-in-class environmental protection technologies and practices, as well as financial assurance provisions for site closure.

Pickett Mountain is the first project in Maine to apply for permits under this regulatory scheme.

## 20.2 Mine Permitting Stages and Status

Wolfden initiated discussions with the Maine LUPC in 2019 to formulate a plan and a schedule to submit a Petition to Rezone a portion of its land (528.2 acres) from a General Management subdistrict to a Planned Development (D-PD) subdistrict. A draft petition was submitted to the LUPC on January 27, 2020.

The petition was submitted with the understanding that certain specific field studies would be initiated in the Spring of 2020 and provided when completed. The Petition is listed as LUPC Zoning Permit 779 – Wolfden Mt. Chase, LLC.

These studies included reconnaissance level and detailed mapping (delineation) of vernal pools and wetlands as well as Phase 0 archaeological survey. Results of these studies have been submitted to the LUPC together with a revised application on June 12, 2017 that addressed comments and requests for additional information provided to Wolfden in letters from the LUPC dated March 6, 2020, April 15, 2020, and May 27, 2020. Pursuant to additional communication by electronic mail and telephone, Wolfden has also agreed to conduct a soil suitability study, by a Maine certified soil scientist, where the mine development facilities are proposed. The soils field work was conducted in September/October 2020. Other requested information, including this PEA, have resulted from this correspondence between LUPC and Wolfden. As part of the application review process, LUPC may make additional information requests. Once all additional information requests have been addressed, Wolfden would provide a final petition. On July 27, 2020, LUPC accepted Wolfden's petition as complete for processing and review. However, subsequent to this date, LUPC has requested clarification and additional information for several areas of the petition. Wolfden is actively addressing these additional requests.

The petition contains information on 21 specific information questions concerning the project and is supported by 15 Exhibits and one Appendix to specifically address LUPC Chapter 12 Requirements for Mining and Level C Mineral Exploration Activities.

The petition provides information on project location, description, site conditions, and current use of the property, local public and community services, surrounding land uses, and anticipated impacts, consistency of the project with the CLUP including development goals, natural and cultural resources, as well as financial capacity and corporate standing of the applicant. Key areas of assessment include potential for project impacts on public services, local recreational resources, scenic resources, rare or special plant communities, and wildlife habitats including wetlands, lakes and ponds, and suitability of site soils for intended uses.

The LUPC will follow the following general steps in its review:

1. Review to determine if petition is complete and acceptable for processing – Completed

2. Petition will be reviewed by Commission staff once accepted for processing

3. Initiate Public Hearing Process once Commission review is complete

4. Closure of the hearing record

5. Commission deliberation and decision

On May 28, 2020, the LUPC posted the following petition review schedule (Figure 20.1):

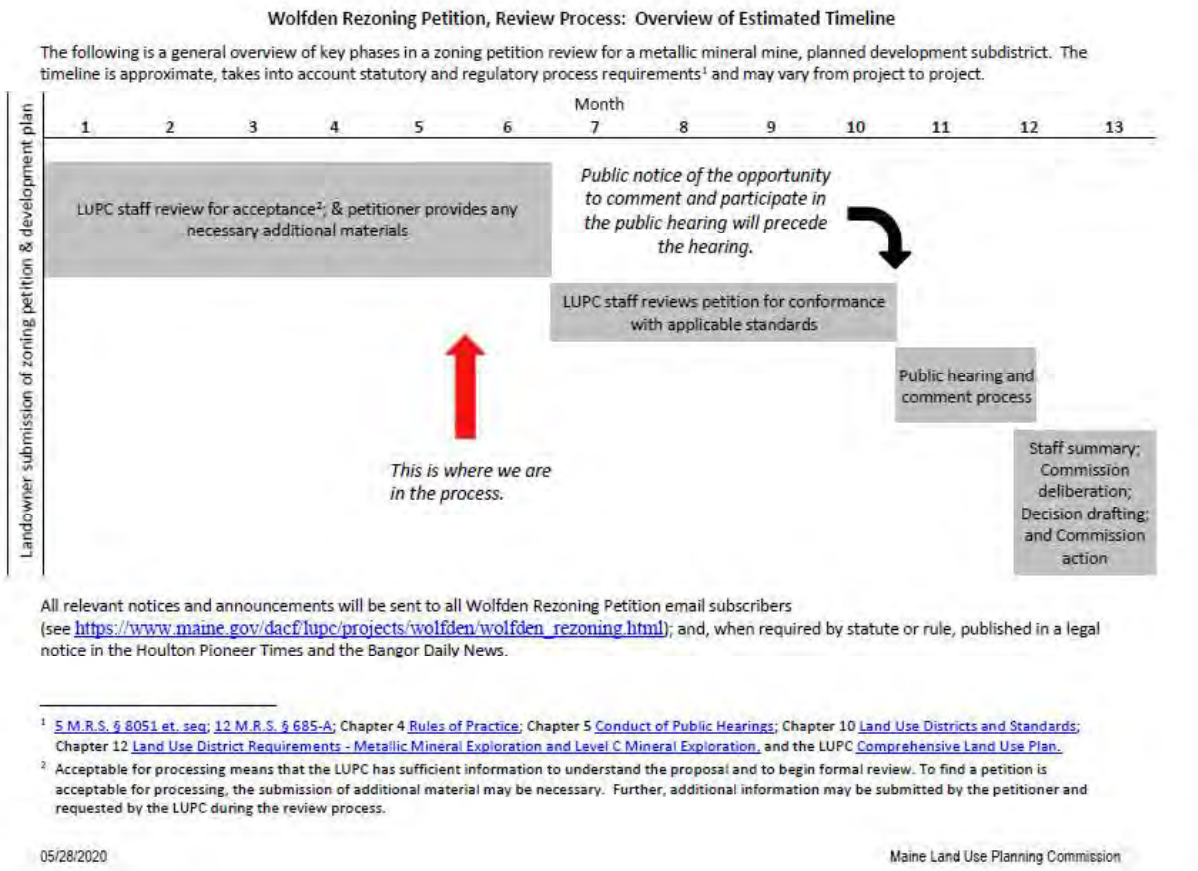



**Figure 20.1 LUPC Posted Following Petition Review Schedule**

The application process with the MEDEP under the Chapter 200 rules has not been formally initiated. This project will be the first project under the new MEDEP mining regulations to seek a permit. While the mining regulations have not detailed any specific requirements that need to be meet, there has been no precedent set for how the regulations will be applied. Under the current regulatory framework, Wolfden can pursue a concurrent application process rather than a sequential process to reduce permitting timeframes. This, of course, is at the applicant's sole risk. Wolfden may prepare a Baseline Characterisation and Quality Assurance Plan (Baseline Work Plan) for submittal to MEDEP to allow it to proceed with required two years of baseline water quality monitoring while the LUPC deliberates on the Rezoning Petition.

The MEDEP Chapter 200 regulations will require the following submittals and notification steps and public involvement as part of the mine application process:

## PRE-APPLICATION PHASE

- Pre-Application Meeting (including required Pre-application information and reports)
- Publication and Notice of Baseline Work Plan
- Preparation of Environmental Impact Assessment Scoping Document

## APPLICATION CONTENTS

- Baseline Site Characterisation Report
- Mining Operation Plan
- Engineering Report
- Quality Assurance Plan
- Environmental Impact Assessment
- Alternatives Analysis
- Mine Plan
- Monitoring Plan
- Contingency Plan.
- Financial Assurance

## APPLICATION PHASE

- Advanced Notice of Intent to File
- Notice of Intent to File Applications
- Adjudicatory Hearings
- Intervenor Status
- Assistance Grants for Municipal and County Intervenors (Applicant Supported)
- Access to the Site by Intervenors
- Public Information Website (Applicant Financially Responsible)

The Chapter 200 rules also specify a lengthy list of criteria for permit approval and the term of the mining permit has conditions. Once approved a permit will remain in effect for the life of the mining operation and reclamation period so long as mining commences with 4 years of issuance. The MEDEP will conduct annual reviews of the mining operations and assess compliance with the permit terms. If the MEDEP determines at any time that the Permittee is in noncompliance with the Act, rules, permit, or order, and determines that the violation is causing an imminent and substantial endangerment, the Commissioner may issue an order requiring that the Permittee cease mining for metallic metals, and cease the removal of metallic metals from the site until the compliance issues are corrected to the Department's satisfaction.

If the Permittee has not conducted mining activities covered by the mining permit within 4 years after the effective date of the mining permit, the MEDEP may terminate or request surrender of the mining permit, after public notice. The Permittee may request MEDEP approval of an extension of time to conduct mining activities covered by the mining permit prior to Department ordered termination or surrender the permit. The Department may approve an extension of time to commence construction of mining facilities or conduct mining activities if the Permittee demonstrates that the mining operations are expected to commence within a reasonable time period.

The Chapter 200 rules have specific requirements for the type of mining that can be conducted and the manner in which mining residuals such as tails are managed. Specifically, the rules only allow underground mining methods and require tailings disposal as dry stacked tailings in lined facilities to be closed with a final cover of equal hydraulic performance. Technically the project can meet these two requirements. The other technical requirements of the Chapter 200 rules are too numerous to summarise here. Review of the many requirements for mine design, mine operation, mine closure, water collection and treatment, and reclamation and environmental monitoring, did not identify technical or operational requirements that could not be met by a well-designed and responsibly managed project.

## 20.3 Environmental Studies and Impact Assessments

Both desktop and field environmental studies have been conducted or are in progress in conjunction with the LUPC submittal.

Desktop studies generally included compiling and analysing existing information on the following areas and topics:

- Surficial and bedrock geology and hydrogeology
- Site soils and suitability for intended uses
- Location of significant mapped sand and gravel aquifers and groundwater resources
- Lake survey maps and fish management programs
- Recreational resources within 3 miles of the Site
- Viewshed and visibility of Site within 3 miles (Impacts to scenic resources)
- Noise
- Correspondence with the Maine Natural Areas Program for rare and exemplary botanical features in proximity to the Pickett Mountain Project. Based on current information and reconnaissance, rare and exemplary botanical features (rare, threatened, or endangered plants) have not been observed or are not known or expected to exist in the area proposed for rezoning.
- Correspondence with the Maine Department of Inland Fish and Wildlife (IF&W) for potential for significant wildlife, endangered, threatened of special concern species within the project area. The IF&W reported it has not mapped any significant wildlife habitats within the project area. The IF&W did identify Great Blue Heron colonies as possible species of concern, if they are found to be present on the site and noted the special protection afforded to eight species of bats and concern for habitat protection.
- Correspondence with the Maine State Historic Preservation Office identified a stone tool archeological habitation site near the headwater of Pickett Pond (Site 147.001).

**Synopsis** - Based on initial desktop studies and subsequent detailed field studies (wetlands/vernal pools and archaeological resources) provided in the LUPC petition, the applicant concluded the project would not have an undue or unacceptable impact on the types of natural resources that are under the jurisdiction and purview of the LUPC. The petition, overall, concluded the proposed project would meet the goals and specific requirements of the LUPC and could be completed in a manner that would fit harmoniously within the surrounding area. There are certain aspects of the project that the LUPC has requested more detailed studies or additional information. These include but not limited more information on soil suitability, noise, scenic, and economic impact. Field studies provided or that are underway in 2020 are described below.

Field Studies have been conducted in the following areas:

**Archaeology** - A Phase 0 Archaeological Assessment was conducted in June 2020 in accordance with direction from Maine State Historic Preservation Office. The assessment included background research and a field inspection. Background research considered various 19th and 20th Century maps of the area, contemporary topographic and bedrock/surficial geological maps, and review of MHPC site files associated with previously identified site 147.001. These resources confirmed the potential presence of tool-stone geological resources near the project area, possibly including chert and fine-grained volcanics. A more detailed Phase 1 survey could be recommended when Wolfden continues to the next phase of background study test work and permitting for the MEDEP.

**Wetlands and Vernal Pools** - Vernal pools were identified and mapped over a two-week period during amphibian breeding season in May/June 2020. Egg mass counts (wood frog and spotted salamander) did not indicate that the vernal pools identified would be considered significant vernal pools under State of Maine criteria. Wetland delineation and reconnaissance was completed over the 528-acre parcel in June 2020, and included identification of flowing and potentially intermittent streams. Several large and smaller isolated wetlands were mapped. Large contiguous upland areas are also present. The location and sizes of areas required to construct and operate the mining project were conceptually laid out by others. Site designs and layouts layouts have been located such that no wetlands, vernal pools, or stream channels, including a 75-foot setback on each, would be impacted by site development.

The following additional field studies are currently underway to provide additional details and clarity for the LUPC petition:

**Soils** - A survey to characterise the suitability of soils for the intended uses on the property is underway and will be completed in the fall of 2020. This work will be conducted by a Maine certified soil scientist with support from a Maine licensed civil engineer. Collectively, an assessment of soil suitability will be conducted to respond to an information request by the LUPC. The primary areas of interest will be areas proposed for septic systems, subsurface re-infiltration of treated water (PDPs), the plant site (ore pads, rock stockpiles, and building locations), roads, and the tailings management facility. If soils are found to be unsuitable, alternative engineering and construction approaches will be evaluated and presented to overcome these limitations.

**Noise Study** – At the request of the LUPC, additional noise modeling studies are being conducted to supplement initial calculations and to address information requests submitted to the LUPC. The initial calculations in the petition suggested that noise will be within permissible levels required under both LUPC and MEDEP rules and guidance.

The following additional field studies will need to be provided during the MEDEP Baseline Study:

**Aquatic Species** - A qualified professional aquatic biologist will need to conduct a survey of aquatic and semi-aquatic species present along the inlet and outlet streams to Pickett Pond and the West Branch of the Mattawamkeag River to the inlet of Pleasant Lake. Biological sampling is discussed below. The aquatic survey will include documentation of observations concerning presence, absence, and relative abundance of aquatic species including but not limited to invertebrates, fish, amphibians, reptiles (turtles), and freshwater mussels.

The aquatic species survey will also include fish populations in Pickett Pond, Pleasant Lake, and Grass Pond. The fish population survey will be conducted by manual methods or electrofishing (removal), if necessary. The objective will be to survey the types of different species within the shallow ponds, potential for spring holes to support the colder water species and gauge the importance of feeder streams as nursery habitats for the cold-water species. Based on findings of the initial surveys, analyses of fish tissue may be required.

**Aquatic Invertebrates** - Aquatic invertebrate (macroinvertebrate) species will be assessed using the biological sampling methods and procedures presented in the revised MEDEP guidance for Biological Sampling and Analysis of Maine Rivers and Streams (MEDEP, 2002). Based on the initial aquatic survey, locations for rock baskets or rock bags (depending on water depth and flow) will be selected within inlet and outlet streams to Pickett Mountain Pond and the inlet stream to Pleasant Lake. The biological sampling will consist of one event conducted between July 1 and September 30, 2021, when low streamflow conditions occur, and the biological community is under greatest stress.

**Flora** - A botanical meander survey will be conducted within the area proposed for development for Rare, Threatened, and Endangered (RTE) species by a qualified botanist. In consultation with MNAP, the botanist shall develop a target list of plant species and exemplary botanical features as the primary focus for the survey.

**Terrestrial Fauna** - A terrestrial fauna survey to determine species present, distribution, and abundance including the existence of RTE species and presence or absence of significant wildlife habitats. The fauna survey will include habitat assessment for Great Blue Heron and Rusty Blackbird, as state listed species of concern. These surveys will need to be completed prior to June 15th, 2021, the close date for these species.

A species assessment encompassing a meander survey of the area proposed for development for individual species and or suitable habitat for the species identified will be conducted by a wildlife biologist. Habitat assessments will also include a desktop study of preferred prey species habitat (snowshoe hare) for the Canadian Lynx.

**Ambient Water Quality Monitoring** - Baseline water quality monitoring will include at least 2 years of data collected over 24 months to generate the information on surface water and sediment chemical characteristics, stream discharge and flows, groundwater quality, and groundwater elevations. This work will require collection of surface water and sediment samples from streams and ponds for chemical analysis. This work will require installation and sampling of both overburden and bedrock groundwater monitoring wells to establish baseline groundwater quality and characterise groundwater hydrogeologic conditions. These data will be used to support development of a numerical groundwater flow model that is a required element in the baseline report.

**Site Visibility and Scenic Impacts** - Additional assessment of scenic impacts is expected under the MEDEP application. Initial viewshed models and assessment of site visibility indicate that scenic impacts should be limited to the immediate hill tops, which are largely within Wolfden owned land. The geomorphology and the site topography, extent of typical tree height and forest cover is favourable providing a visual screen of the project from most vantage points within a three-mile radius of the site. The site will not be visible from any for miles from any State park or publicly maintained trails or sites.

**Noise Modeling** – Additional noise modeling studies may be needed to supplement the Noise Study (discussed above) provided to LUPC.

## 20.4 Social and Community Requirements

There are no specific social or community requirements. The LUPC petition included a required assessment of "Socioeconomic Impacts of Proposed Mining Upon Immediate Area, Adjacent Communities County and State." This assessment developed data on the local economy and workforce, locally provided markets and services including:

- Housing;
- Education;
- Solid waste disposal;
- Emergency services (fire and ambulance);
- Healthcare and medical;
- Public safety, and
- Power and utilities.

The analysis indicated there is adequate capacity to provide these services to the extent needed for the proposed mine project and for anticipated employees who are largely expected to be employed and trained from the existing labour pool.

The demographics of the current population and employment statistics included the following towns and communities (Table 20.1):

**TABLE 20.1**
**DEMOGRAPHICS OF THE CURRENT POPULATION AND EMPLOYMENT STATISTICS**

| Communities in Proximity to the Site | |
|---|---|
| Within 20 Miles | Within 20-30 Miles |
| Crystal | Central Aroostook |
| Dyer Brook | Glenwood |
| Island Falls | Hammond |
| Moro, Merrill | Haynesville |
| Mount Chase | Hodgdon |
| Oakfield | Houlton |
| Patten | Linneas |
| Sherman | Littleton |
| Smyrna | Ludlow |
| South Aroostook | Masardis |
| Staceyville | Medway |
| | Monticello |
| | New Limerick |
| | North Penobscott |
| | Orient |
| | Oxbow |
| | Reed |

The regional public schools that served these communities (Table 20.2):

**TABLE 20.2**
**REGIONAL PUBLIC SCHOOLS**

| School Year | SAU Name | School Name | Number of Students |
|---|---|---|---|
| 2019 | RSU 29/MSAD 29 | Houlton Elementary School | 423 |
| 2019 | RSU 29/MSAD 29 | Houlton High School | 364 |
| 2019 | RSU 29/MSAD 29 | Houlton Junior High School | 298 |
| 2019 | RSU 29/MSAD 29 | Houlton Southside School | 319 |
| 2019 | RSU 50 | So Aroostook School | 358 |
| 2019 | RSU 70/MSAD 70 | Hodgdon Middle/High School | 191 |
| 2019 | RSU 70/MSAD 70 | Mill Pond School | 284 |
| 2019 | RSU 89 | Katahdin Elementary School | 145 |
| 2019 | RSU 89 | Katahdin Middle/High School | 181 |
| Total | | | 2,563 |

Wolfden correspondence with the principal towns in the closest proximity to the Site resulted in these communities providing concurrence letters that the project would not pose an undue burden on services provided by these communities and that other purchased services (solid waste, communications, power) had adequate capacity.

## 20.5 Mine Closure

The mine (Dry Tailings Facility, Potentially Economic Mineral, Staging Area, Interim Waste Rock Storage Facility, Surface Water Management Facility) will be constructed in a manner to capture contaminated leachate and surface water run off for collection, treatment, and management.

At Pickett Mountain, there will be 3 classes of structures.

**Class 1** is a permanently fixed structure that will remain post-closure of the property. Specifically, this will be the dry stacked Tailings Management Facility. The final design of the final cover system will be designed to meet the performance requirements of the MEDEP Chapter 200 rules, providing a performance of equal to or better than the liner system, so that leachate will not be generated once closed.

**Class 2** is a non-permanent structure that is deemed acceptable to decommission and remove only after the site has been deemed ready for rezoning back to a General Management (M-GN) Subdistrict. Specifically, this will be the water management and water treatment facilities including all drainage and water collection structures.

**Class 3** is a non-permanent structure that is decommissioned and removed as soon as production operations cease. Specifically, this includes all buildings on site that are not related to water collection and treatment, potentially economic mineralisation and waste rock storage pads, and non-essential roadways.

Upon completion of mining and processing of material from the Pickett Mountain mineral deposit, all Class 3 structures will immediately be decommissioned and sold, or, to the extent practical, demolished and deconstructed to allow inert materials to be placed in remaining open underground workings (raises and drifts). The land surface will then be contoured and smoothed to reasonably match the original landscaping. This closure work will be conducted under an approved erosion and sedimentation control plan and reclamation plan under the MEDEP Permit. Material from the overburden storage areas (original soils stripped prior to mine construction) will be placed on top of the regraded surface as final soil cover

to support natural growth of vegetation. Openings to surface from underground that are non-essential will be plugged and capped with engineered concrete or steel plugs to ensure future access cannot happen, either purposefully or not. All precipitation that contacts these locations will continue to be collected and monitored for water quality and treated before being discharged. After removal of all Class 3 structures, it is anticipated that water quality of run-off being collected and treated will already begin to improve.

**Class 1** structures will remain in place into perpetuity. Concurrently with the placement of tailings on the Tailings Management Facility (TMF), the facility will be reclaimed through progressive capping and revegetating. Therefore, the final reclamation will be to cover the TMF with an engineered composite cap derived from soil material components provided from local borrow sources. After it is capped and contoured to support precipitation drainage, the TMF will be covered with a final vegetative soil layer using the remaining material from the overburden storage areas. This will support regrowth of natural vegetation and long-term, permanent erosion control. Precipitation that falls on the TMF will drain off around the perimeter of the facility. The restoration design will include appropriately sized and constructed drainage features to handle storm events, consistent with DEP's stormwater management requirements. With all the Class 1 and Class 3 structures being closed or removed, the remaining site features will not adversely impact the water quality of run-off that is being collected and treated prior to discharge. After roughly 1-year post-complete closure, it is anticipated that the drainage water from the site will be back to historical quality and no longer require treatment. After this has been confirmed, Wolfden will decommission and remove the water management facility. The water management facility will be excavated and inert material (demolition debris) placed underground and the area recontoured. A final engineered plug will be placed in the portal area to completely and permanently block access to any underground workings.

Once final reclamation work is completed, continued post-closure monitoring of surface water and groundwater will take place for a duration that is specified in the DEP mining permit. Within the first year, samples will be taken frequently, following the sampling requirements established for operating the property. The frequency of monitoring and duration will be established statistically based on water quality trends and data.

The property will then be rezoned. Land use restrictions and deed covenants will be instituted over land occupied by the tailings facility to ensure that no industrial or commercial activity occurs over that portion of the site post closure.

Beneficial re-use of the property will include timber harvesting, as it occurs presently outside the tailings facility footprint. Also, the portal will be closed in a manner that will allow entry underground to bats, providing valuable habitat. Recreational uses will be allowed on the property, including hunting, hiking, ATV riding, etc. Restriction would be placed on the tailings facility in order to protect that area from damage by off road vehicles. In order to ensure protection of the tailings facility area, a series of permanent signs will be posted around the perimeter restricting access to authorised personnel only. In addition, if any future transfer of land ownership were to take place, the deed would restrict the use of heavy equipment or any small vehicles and recreational vehicles within the tailings area, to ensure that damage to the tailings cover is mitigated.

The Financial Assurance Trust fund required by MEDEP is included as capital cost in year -2. Costs include cost to cap and close the remaining open TMF facility cell (only one of five cells would open at any time), inspection and maintenance of the TMF facility, facility-wide post-closure monitoring including groundwater monitoring wells, surface water monitoring locations, resampling of baseline soil and sediment locations to document post closure conditions, and allow comparison of pre-mining and post mining chemical data for these media. A worse case failure scenario includes construction of a new Water

Treatment Facility and a groundwater pump and treatment system, as well as site monitoring for 100 years post closure. The total cost for the Financial Assurance Trust used in the PEA is $13,684,557. This considers a present value from future costs at a discount rate of 2% based on standard federal rates and does not include any salvage value for assets at closure. As the project progresses through its life, this financial assurance trust fund is anticipated to be reviewed and may be modified to reflect the ongoing and anticipated remediation requirements of the project during operations based on the results of the sequential closure of each cell of the tailings facility.

The reclamation and closure of the five TMF cells will occur as periodic events during the mine operation. It assumed that a new tailings cell will be opened every 2 years and the existing cell will be capped and closed. Cost for these elements were developed by SLR and are listed under TMF capital costs in Section 21.1.10 and are carried as a separate, stand alone cost in the cashflow model. The cost for the closure of the last remaining TMF cell is $1,226,081 (SLR). The cost for building demolition, remaining mine backfill, and site grading/re-vegetation was developed by AMPL, and is estimated at $2,200,000, $600,000, and $978,393, respectively. The total reclamation and closure cost (approximately $5,000,000) for these elements will be paid for through salvage income following the cessation of mining. Salvage income is expected to be in the range of $5,200,000 or 15% of the construction cost. The income for the salvage component of mine closure and reclamation has not been included as part of the financial analysis in this PEA, but should be factored in in the next phase – preliminary feasibility study.

# 21.0 Capital and Operating Costs

## 21.1 Capital Expenditures

The capital expenditures estimates are based on budget pricing from suppliers for critical components, consultants, contractors, and a review of other Canadian projects. Smaller equipment and facilities component costs were factored based on industry norms for the type of facility being constructed and, where possible, adjusted to reflect local conditions. Much of the pricing used was from supplier quoted prices obtained within the last 3 years from other projects. Capital expenditure estimates are within ±40%.

Labour rates are based on contractor costs in the region and country, for similar types of work. Where costs were either not available or irrelevant, costs from other similar projects in Canada were used. The rates used include all cost and profit components payable to contractors.

All expenditure estimates are in 2020 constant US Dollars.

### 21.1.1 Basis for Estimates

The capital expenditures estimate includes the following:

- Mine development, mining equipment mobile (leased) and fixed and associated consumables and maintenance parts for development and infrastructure;
- Project infrastructure equipment and materials;
- Construction materials;
- Labour;
- Temporary buildings and services;
- Construction support services;
- Spare parts;
- Initial fills (inventory);
- Freight;
- Vendor supervision;
- Owner's cost;
- Engineering, Procurement, and Construction Management;
- Commissioning and start up; and
- Contingency.

### 21.1.2 Direct Costs

Direct costs are all costs associated with permanent facilities. This includes mine development openings, equipment and material costs, as well as construction and installation costs.

Mine infrastructure costs for facilities, such as maintenance shops, mine dewatering, refuge stations, etc., were developed based on the conceptual plans and general arrangements presented earlier. Wherever possible, equipment and material quotes and contractor installation costs were used.

Other major equipment expenditure estimates are based on quotes obtained from suppliers and installation costs estimated as part of this study.

During the pre-production and sustaining development periods, all materials and equipment pricing are based on quotes obtained from local US or Canadian suppliers.

All major equipment expenditures include freight only. Applicable taxes and duties have not been included in the capital expenditure estimates.

All major equipment expenditures include freight only. Applicable taxes and duties have not been included in the capital expenditure estimates.

Where possible, direct costs are based on actual takeoffs:

- Earthwork/site work;
- Concrete;
- Structural steel;
- Buildings and architectural;
- Electrical;
- Instrumentation and controls; and
- Piping.

Commodity pricing for earthwork, concrete, steel, architectural, and piping were based on local Maine costs (in some cases escalated to 2020 costs from past costs). Labour rates and equipment usage rates used throughout the estimate were provided by mining contractors and other sources. Commodity prices were from local suppliers, where available.

Pricing was obtained from local contractors for rock excavation and transport during the pre-production stage.

Labour rates generally reflect U.S. contractor rates as well as industry rates obtained from a University of Virginia Tech 2016 Study. The mine labour costs are based on four types of estimates:

- Owner operator expected labour rates.
- Contractor budget prices for undertaking the tasks associated with constructing a specific installation.
- Average industry rates a contractor will be expected to charge for performing specific tasks.
- Lateral and raise development rates, developed and based on expected productivity and labour, materials, and equipment costs for such an underground development program.

All labour costs include government mandated contributions and the costs for company provided benefits.

### 21.1.3 Indirect Costs Estimate

The indirect costs cover all the costs associated with temporary construction facilities and services, construction support, freight, vendor representatives, spare parts, initial fills and inventory, Owner's costs, EPCM, commissioning, and start-up assistance.

The costs for construction facilities include all temporary facilities, services and operation, site office operations, security buildings and services, construction warehousing and material management, construction power and utilities, site transportation, medical facilities and services, garbage collection and disposal, and surveying.

**Spare Parts** – The cost for spare parts is factored based on equipment costs where the vendors did not provide cost for spares needed for the first year of operation.

**Initial Fills (Inventory)** – The estimated cost for initial fills is based on 3 months of operating requirements.

**Freight** – The freight costs were either provided by the vendor or estimated based on weights and typically include containerised and break-bulk shipping, and each are respectively divided into ocean freight and inland freight. For imported equipment, the cost of freight and export packing, ex-works to the nearest port, is included with the cost of the equipment. Freight insurance is included in the Owner's cost.

**Vendor Representatives** – The requirement for the vendor representatives to supervise the installation of equipment or to conduct a checkout of the equipment prior to start-up of the equipment, as deemed necessary for equipment guarantees or warranties, has been included in the estimate. Typically, the cost for this item is inclusive of salary and travel.

**Taxes and Duties** – Taxes and duties have been excluded.

**Engineering, Procurement, and Construction Management (EPCM)** – EPCM has been calculated based on the Pickett Mountain Project team managing development and construction, and using consultants where deemed appropriate by Wolfden.

**Capital Cost Qualifications and Exclusions** – All surface construction work will be executed by contractors.

Capital expenditures estimates exclude:

- Sunk costs;
- Taxes and duties;
- Deferred capital;
- Financing and interest during construction;
- Additional exploration drilling;
- Escalation;
- Corporate withholding taxes;
- Legal costs;
- Metallurgical testing costs;
- Condemnation testing; and
- Salvage revenues.

All expenditure estimates are in 2020 constant US Dollars.

### 21.1.4 Underground Mining

Underground capital cost estimates are based on quote pricing from suppliers, consultants, and contractors, provided with reasonable detail specifications to ensure equipment or service provided is specific to the project and includes all costs specific to the project and application. Some small equipment and facilities component costs were factored based on norms for the type of facility being constructed and adjusted to reflect local conditions.

Construction and installation labour rates are based on owner/operator costs for the types of work envisaged for the project.

Most mobile mining equipment is leased by Wolfden. Alimaks, hand-held drills, and light service vehicles will be purchased by Wolfden.

The mine pre-production capital expenditures are estimated to total $54.0 million including a 20% contingency. The breakdown of the mine capital expenditures is presented in Table 21.1.

**TABLE 21.1**
**BREAKDOWN OF MINE CAPITAL EXPENDITURES**

| Component | Expenditures ($millions) | | Total Expenditures ($ millions) |
|---|---|---|---|
| | Year -2 | Year -1 | |
| Mine Development | 6.75 | 14.69 | 21.44 |
| Underground Infrastructure | 3.21 | 6.95 | 10.16 |
| Surface Infrastructure | 10.00 | 10.11 | 20.11 |
| Mining Equipment | 0.99 | 0.99 | 1.98 |
| Contingency | - | - | 10.74 |
| | | | 64.42 |

The initial capital expenditure for the underground mine will include the collaring of an access portal and development of a decline down to an elevation of 300m below the surface. From the ramp, production levels will be established on the 5350, 5250, and 5150 levels. Stopes will be developed for production mining with the excavation of Alimak raises in ore from one level up to the overlying level.

The mine development will also include the development of a ventilation raise, installation of mine fans and heaters, installation of a pumping system and reticulation systems for electricity, communications network, compressed air, process water, and mine drainage water.

The pre-production period for the Pickett Mountain Mine is expected to be 21 months and will be conducted simultaneously with plant construction, infrastructure investments, and mine site preparatory work.

The mine development capital expenditures and underground mine infrastructure capital expenditure estimates are shown in Table 21.2 and Table 21.3, respectively. Capital Expenditures for equipment purchases and leasing total $20.7 million dollars including a 20% contingency.

**TABLE 21.2**
**MINE DEVELOPMENT CAPITAL EXPENDITURES ESTIMATES**

| | | Year -2 | Year -1 | Total Units (m) | Pre-production | Total Pre-Production |
|---|---|---|---|---|---|---|
| **Main Access** | East Decline | | | | | |
| | Main Decline | 1439 | 1352 | 2791 | $ 3,703 | $ 10,333,739 |
| | Ancillary | 216 | 203 | 419 | $ 3,703 | $ 1,550,061 |
| | Vent Accesses | 70 | 70 | 140 | $ 3,703 | $ 518,353 |
| | | | | | | |
| **East Zone** | 5355 Level | 0 | 60 | 60 | $ 3,703 | $ 222,151 |
| | 5255 Level | 0 | 60 | 60 | $ 3,703 | $ 222,151 |
| | 5155 Level | 0 | 120 | 120 | $ 3,703 | $ 444,303 |
| | | | | | | |
| **West Zone** | 5350 Level | 0 | 485 | 485 | $ 3,703 | $ 1,795,723 |
| | 5250 Level | 0 | 640 | 640 | $ 3,703 | $ 2,369,614 |
| | 5150 Level | 0 | 680 | 680 | $ 3,703 | $ 2,517,715 |
| | | | | | | |
| **Decline Exhaust Raise** | | 202 | 218 | 420 | $ 1,783 | $ 749,058 |
| | | | | | | $ 20,722,869 |
| **Contingency** | | | | | $ 0 | $ 4,144,574 |
| **Total Pre-production Development Expenditures** | | | | | | **$ 24,867,443** |

**TABLE 21.3**
**UNDERGROUND MINE INFRASTRUCTURE CAPITAL EXPENDITURE ESTIMATES**

| Component | Quantity | Units | Unit Cost (US) | Total Cost (US) | Year -2 | Year -1 |
|---|---|---|---|---|---|---|
| SURFACE INFRASTRUCTURE | | | | | | |
| Mine Portal | 1 | L.S. | $ 350,000 | $ 350,000 | $ 350,000 | |
| Surface Intake Vent Fan Installation | 1 | L.S. | $ 650,000 | $ 650,000 | $ 650,000 | |
| Mine Air Heaters | 1 | L.S. | $ 80,000 | $ 80,000 | $ 80,000 | |
| Explosives Magazines (Supplier Provided) | 1 | L.S. | $ 25,000 | $ 25,000 | $ 25,000 | |
| Compressors | 3 | L.S. | $ 258,462 | $ 775,385 | $ 258,462 | $ 258,462 |
| Cemented Backfill Plant | 1 | L.S. | $ 1,500,000 | $ 1,500,000 | | $ 1,500,000 |
| Mine Rescue and Fire Fighting Equipment | 1 | L.S. | $ 255,274 | $ 255,274 | $ 255,274 | |
| Hoisting plant system | 1 | L.S. | $ 4,500,000 | $ 4,500,000 | | $ 2,250,000 |
| Total Surface Infrastructure | | | | $ 8,135,659 | $ 1,618,736 | $ 4,008,462 |
| | | | | | | |
| Mob, Setup & Demob | 1 | L.S. | $ 100,000 | $ 100,000 | $ 100,000 | |
| | | | | | | |
| UNDERGROUND SUPPORT SERVICES FACILITIES | | | | | | |
| Exhaust Ventilation Fans Installations | 1 | L.S. | $ 750,000 | $ 750,000 | | $ 750,000 |
| Maintenance Breakdown Shop | 1 | L.S. | $ 250,000 | $ 250,000 | | |
| Fuelling Station (Marcotte) | 10 | L.S. | $ 69,231 | $ 692,308 | $ 138,462 | $ 138,462 |
| Explosives & Detonators Magazines Construction & Equipping | 6 | L.S. | $ 66,154 | $ 396,923 | $ 66,154 | $ 132,308 |
| Main Storage Area Construction & Equipping | 1 | L.S. | $ 36,000 | $ 36,000 | | $ 36,000 |
| Main Dewatering Sump Construction & Equipping | 2 | L.S. | $ 88,462 | $ 176,923 | | $ 88,462 |
| Refuge Station Construction & Equipping | 7 | L.S. | $ 107,692 | $ 753,846 | $ 107,692 | $ 107,692 |
| Portable Toilets | 7 | L.S. | $ 5,000 | $ 35,000 | $ 5,000 | $ 5,000 |
| | | | | | | |
| Total Underground Support Services Facilities | | | | $ 3,091,000 | $ 317,308 | $ 1,257,923 |
| | | | | | | |
| MINE SERVICES | | | | | | |
| Portable Substations | 25 | each | $ 95,942 | $ 2,398,558 | $ 575,654 | $ 575,654 |
| Mine Communication | 1 | L.S. | $ 192,308 | $ 192,308 | | $ 192,308 |
| Computers, Peripherals & Software | 1 | L.S. | $ 84,615 | $ 84,615 | $ 42,308 | $ 42,308 |
| Engineering & Geology Equipment | 1 | L.S. | $ 33,846 | $ 33,846 | $ 33,846 | |
| Backfill Distribution System | 8 | L.S. | $ 350,000 | $ 2,800,000 | $ 350,000 | $ 700,000 |
| Underground Booster Fans & Auxilliary Ventilation | 1 | L.S. | $ 338,000 | $ 338,000 | $ 169,000 | $ 169,000 |
| Mine Lamps | 75 | each | $ 200 | $ 15,000 | $ 7,500 | $ 7,500 |
| | | | | | | |
| Total Mine Services | | | | $ 5,862,327 | $ 1,178,308 | $ 1,686,769 |
| | | | | | | |
| TOTAL MINE INFRASTRUCTURE EXPENDITURES | | | | $ 17,188,986 | $ 3,214,351 | $ 6,953,154 |

### 21.1.5 Processing Plant

The following methodology was used to develop the capital cost for the processing plant treating 1,300 dmtpd of ore and 92% plant availability:

1. Major equipment was sized based on available metallurgical data. The list of equipment along with the cost are provided in Table 21.4.

2. Cleaner flotation cells for second to fourth stage were not sized because two or three stages of cleaners may be sufficient. However, estimated cost was provided for the flotation cells.

3. Feed bins, conditioning tanks and other miscellaneous equipment were costed at 25% of the major equipment cost.

4. Construction, EPCM, installation etc. were factored for this study.

5. Process water treatment plant, which may or may not be required, was estimated at $1 million.

**TABLE 21.4**
**MAJOR EQUIPMENT LIST FOR MILLING CIRCUIT**

| No. | Equipment | HP | No. of units | Cost/unit $ | Total Cost $ |
|---|---|---|---|---|---|
| 1. | Grizzly Feeder | 1 | 1 | 15,000 | 15,000 |
| 2. | 20 x 30 Jaw Crusher | 100 | 1 | 268,000 | 268,000 |
| 3. | 3 ft. Cone Crusher | 200 | 1 | 375,000 | 375,000 |
| 4. | 2.5 for Short Head Cone | 100 | 1 | 375,000 | 375,000 |
| 5. | 4 ft. x 8 ft. Vibrating Double Deck Screen | 10 | 1 | 52,500 | 52,500 |
| 6. | 30 in. x 100 ft. Conveyor 30 HP each | 90 | 3 | 72,000 | 216,000 |
| 7. | 12 in. x 5 ft. Vibrating Feeder W/Bin | - | 1 | 15,000 | 15,000 |
| 8. | 14 ft. diameter x 22 ft. long Ball Mill | 1500 | 1 | 1,000,000 | 1,000,000 |
| 9. | 10 in. Cyclones | - | 8 | 3,500 | 28,000 |
| 10. | Sump/Pump (1400 gpm) | 44 | 1 | 45,000 | 45,000 |
| 11. | Rougher Flotation Cells 40 HP each, 500 $ft^3$ | 600 | 15 | 70,000 | 1,050,000 |
| 12. | Pumps (1400 gpm) 44 HP each | 132 | 3 | 30,000 | 90,000 |
| 13. | Cleaner 1 Flotation Cells 20 HP, 150 $ft.^3$ | 300 | 15 | 45,000 | 675,000 |
| 14. | Cleaners 2 to 4 Cells | | | | 1,000,000 |
| 15. | Regrind Mills 100 HP | 300 | 3 | 350,000 | 1,050,000 |
| 16. | Thickener 20 ft. diameter 3 HP each | 9 | 3 | 50,000 | 150,000 |
| 17. | 1000 gpm Plate & Frame Filter, 10 HP | 30 | 3 | 230,000 | 690,000 |
| 18. | 300 cfm Vacuum Pump, 1 HP | 3 | 3 | 27,000 | 81,000 |
| 19. | Reagents Tanks & Pumps | - | - | - | 824,500 |
| | | | | Sub-total | 8,000,000 |
| 20. | Miscellaneous Equipment (25% of sub-total) | | | | 2,000,000 |
| | | | | **TOTAL** | **10,000,000** |

The total plant cost, given in Table 21.5, was estimated to be approximately US$36 million. The cost estimate includes a contingency of $5.26 million (20%).

**TABLE 21.5**
**PLANT CAPITAL COST**

| No. | Item | Cost $ |
|---|---|---|
| 1. | Equipment | 10,000,000 |
| 2. | Installation Labor (@ 70%) | 7,000,000 |
| 3. | Concrete (@ 10%) | 1,000,000 |
| 4. | Piping (@ 30%) | 3,000,000 |
| 5. | Structural Steel (@ 10%) | 1,000,000 |
| 6. | Insulation (@ 3%) | 300,000 |
| 7. | Instrumentation (@ 7%) | 700,000 |
| 8. | Electrical (@ 12%) | 1,200,000 |
| 9. | Coating & Sealants (@ 1%) | 100,000 |
| 10. | Mill Building | 1,000,000 |
| 11. | Process Water Treatment | 1,000,000 |
| | Sub-total | 26,300,000 |
| 12. | EPCM (@ 15% of sub-total) | 3,945,000 |
| 13. | Contingency (@ 20% of sub-total) | 5,260,000 |
| | **Total** | **35,505,000** |

### 21.1.6 Surface Infrastructure

Total pre-production capital expenditures for project infrastructure and surface department are estimated to be approximately $21.8 million, including a 20% contingency. The breakdown of expenditures is presented in Table 21.6. Major expenditure components are for access road upgrading, power supply and distribution, site preparation, waste rock and ore storage pads, shops equipping, water supply and treatment, and mobile equipment.

**TABLE 21.6**
**INFRASTRUCTURE AND SUPPORT SERVICES CAPITAL EXPENDITURES**

| Component | | Cost |
|---|---|---|
| Main Access Road | | $1,500,000 |
| Main operations pad prep | | $1,790,000 |
| Pad construction | | $2,708,333 |
| Versant Power Transmittion | | $5,600,000 |
| Power distribution | | $2,000,000 |
| Potable Water System | | $250,000 |
| Parking | | $50,000 |
| Sewage System | | $250,000 |
| Buldings earthworks | | $750,000 |
| Maintenance Shop | | 350000 |
| Fuel storage | | $25,000 |
| Propane | | $35,000 |
| Dry facility | | $750,000 |
| Waste dump Construction (Clean) | | $125,000 |
| Waste dump Construction (Acid Generating) | | $400,000 |
| Ore Pad/Temp Stockpile | | $400,000 |
| Office buildings | | $750,000 |
| Effluent pond | | $750,000 |
| Cap and powder magazines | | |
| | | $18,483,333 |
| EPCM | 8% | $ 1,478,667 |
| First Fills | | $75,000 |
| Spare Parts | | $75,000 |
| Contingency | 20% | $ 4,022,400 |
| **Total Infrastructure Expenditures** | | **$24,134,400** |

### 21.1.7 Project Indirects and Owner's Costs

Project Indirects and Owner's Costs are estimated at US$6.72 million over the 2-year pre-production period. Owner's costs also include all equivalent General and Administration costs, which would be incurred during the construction phase.

### 21.1.8 Total Capital Expenditures

The estimated project pre-production capital expenditure, inclusive of contingencies and working capital, is approximately US$153.7 million. The total expenditures include EPCM, contractor overheads and a 20% contingency on all estimated expenditures. A summary of project pre-production capital expenditures is presented in Table 21.7. A working capital allowance of US$11.6 million is estimated to be required.

**TABLE 21.7**
**PROJECT PRE-PRODUCTION CAPITAL EXPENDITURES**

| Cost Component | | Year -2 | Year -1 |
|---|---|---|---|
| | | Expenditure | |
| Underground Development | | $ 6,745,987 | $ 14,689,701 |
| Mine Facilities and Equipment | | $ 3,214,351 | $ 6,953,154 |
| Mine Equipment Leasing and Remanufacturing | | $ 987,430 | $ 987,430 |
| Infrastructure | | $ 10,000,000 | $ 10,112,000 |
| Surface Mobile Equipment | | | $ 1,000,000 |
| Tailings Management Facility | | | $ 2,001,495 |
| Build and equip mill | | $ 9,000,000 | $ 25,581,000 |
| Owners Indirects | | $ 2,217,000 | $ 4,116,000 |
| Reclamation and Closure | | $ 13,684,557 | |
| Contingency @ 20% | | $ 9,169,865 | $ 15,392,956 |
| Working Capital | | | $ 11,524,000 |
| Sub-total Capital Expenditures | | **$ 55,019,190** | **$ 92,357,736** |
| **Total Capital Expenditures** | | **$147,376,925** | |

The capital estimates include the following conditions and exclusions:

- Qualified and experienced construction labour would be available at the time of execution of the project;
- A water supply capable of supplying the required demand of the processing plant is assumed to be available;
- No extremes in weather have been anticipated during the construction phase; and
- No allowances have been included for construction-labour stand-down costs.

### 21.1.9 Working Capital

Working Capital has been estimated at US$11.5 million based on 4 months of the estimated operating costs for the year.

### 21.1.10 Sustaining Capital

Sustaining capital is estimated at US$100 million for the life of the mine and consists of continuing underground development, expansion and construction of mine facilities and equipment, equipment leasing and replacement, construction of the tailings storage facility, and staged closure costs of the tailings storage facility. Sustaining capital requirements are presented in Table 21.8.

**TABLE 21.8**
**PROJECT SUSTAINING CAPITAL REQUIREMENTS**

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Underground Development | $15,533,815 | $15,236,152 | $9,381,831 | $8,453,491 | $8,535,734 | $4,734,586 | $1,468,628 | $1,468,628 | $1,174,903 |
| Mine Facilities and Equipment | $4,417,577 | $1,794,115 | $809,788 | | | | | | |
| Mine Equipment Leasing and Remanufacturing | $3,175,078 | $3,175,078 | $3,175,078 | $2,187,648 | $2,187,648 | | $1,376,923 | | |
| Tailings Storage Facility | $247,860 | $1,226,081 | $1,629,618 | $1,226,081 | $1,629,618 | $1,226,081 | $1,629,618 | $1,226,081 | $1,629,618 |
| | $23,374,330 | $21,431,426 | $14,996,316 | $11,867,220 | $12,353,001 | $5,960,667 | $4,475,169 | $2,694,709 | $2,804,521 |
| | | | | | | | | | |
| **Total Sustaining Capital** | **$99,957,359** | | | | | | | | |

The tailings storage facility is planned to be constructed in phases, with five roughly equal-sized cells constructed sequentially and progressively reclaimed after each cell is completed. The construction and reclamation costs have been split evenly in 5 phases for this cost estimate; however, realistically, these costs would be greater for initial construction and final closure, and less during the intervening years of operation.

### 21.1.11 Financial Assurance Trust – Reclamation and Closure Costs

The Financial Assurance Trust fund, required by MEDEP, is included as capital cost in Year (-2). The total cost for the Financial Assurance Trust used in the PEA is $13,684,557. This considers a present value from future costs at a discount rate of 2% based on standard federal rates and does not include any salvage value for assets at closure.

The reclamation and closure costs include the cost for the closure of the last remaining TMF cell is $1,226,081 (SLR). As outlined in Section 21.0, the cost for the closure of all other TMF cells is included in the TMF capital cost line item. The cost for building demolition, remaining mine backfill, and site grading/re-vegetation was developed by AMPL, and is estimated at $2,200,000, $600,000, and $978,393, respectively. The total reclamation and closure cost (approximately $5,000,000) for these elements will be paid for through salvage income following the cessation of mining. Salvage income is expected to be in the range of $5,200,000. The income for the salvage component of mine closure and reclamation has not been included as part of the financial analysis in this PEA; therefore ,the cost for reclamation, which will be funded by the revenue stream, was not included as a line item cost. The salvage revenue should be factored and reflected in the next technical study – preliminary feasibility study.

## 21.2 Operating Cost Estimates

### 21.2.1 Basis for Estimates

Operating costs are based on U.S. and other country normal prices from suppliers and other similar type projects, for consumables and parts. The cost of power is based on online posted rates for the State of Maine.

Critical operating cost components are based on the following costs:

- The diesel fuel price is assumed to be US$0.80/litre.
- The electrical power cost is assumed to be US$0.085 per kWh.

Labour costs for the operating period are based on the manpower schedules presented for each department and the associated labour costs. The costs include a burden component of approximately

30%. Labour rates are based on local rates where available and/or contractor costs in the region and country, for similar types of work. Where costs were not available, costs from other similar projects were used. The rates used include all cost and profit components payable to contractors.

All costs are quoted in constant 2020 US Dollars.

### 21.2.2 Mining

Individual costs for underground mining have been estimated for manpower, equipment operating, maintenance, and materials consumptions from first principles. The total underground mining cost is estimated to be $47.73 per tonne of potentially economic mineralisation (presented in Table 21.9).

**TABLE 21.9**
**MINE OPERATING COSTS**

| | Longhole Stoping | | Alimak Stoping |
|---|---|---|---|
| **Component** | **Cost** | | **Cost** |
| Stope Development | $ 3.55 | | Incl. in Dev |
| Cable Bolting | | | $ 1.53 |
| Longhole Drilling Operating Costs | $ 0.70 | | $ 0.25 |
| Longhole Blasting | $ 1.09 | | $ 0.46 |
| Stope Mucking | $ 2.80 | | $ 2.80 |
| Longhole Drilling Manpower | $ 6.33 | | $ 10.57 |
| Services Equipment | $ 2.07 | | $ 2.60 |
| Heating Costs | $ 0.84 | | $ 0.84 |
| Electrical Power | $ 4.02 | | $ 4.02 |
| Backfill | $ 12.00 | | $ 12.00 |
| Services Manpower | $ 13.16 | | $ 13.16 |
| | | | |
| **Total Mining Cost per Tonne** | **$ 46.55** | | **$ 48.22** |

Mines services and overheads costs include all other non-direct stoping costs for the Picket Mountain Mine. Mine services operating costs are associated with maintaining underground facilities and services (power, water supply, etc.), operating and maintaining ventilations fans, supplies for safety and training, including personal protective equipment and mine rescue, and operating and maintaining all support mobile equipment used in the mine.

The average mining cost is $47.73 based on an approximate 30/70 split for longhole mining and Alimak mining.

The mining costs are based on costs provided by U.S.-based underground contractors and from Infomine™ data supplied by Virginia Tech University regarding mining costs in the U.S.

### 21.2.3 Water Treatment Facility

The total costs for the water treatment facility are included in the operating costs as it is anticipated to operate via a Build Own Operate contract with the supplier. This type of arrangement ensures that the supplier has full control over the construction and operation of the plant in order to manage costs and

ensure the water quality is achieved to the levels agreed upon (background or better quality). The supplier then charges the project owner a flat rate per day to operate the plant. The cost to operate the water treatment plant is $1.74/t using this contract basis.

### 21.2.4 Processing Plant and Tailings Management

The operating costs for the processing plant and the tailings management facility are detailed in Table 21.10, below.

**TABLE 21.10**
**BREAKDOWN OF PROCESSING COSTS**

| Component | Cost |
|---|---|
| Equipment Operation | $ 8.00 |
| Supplies | $ 12.00 |
| Labour | $ 5.00 |
| Administration | $ 3.00 |
| Sundry Items | $ 2.00 |
| Filter Plant Operation | $ 1.25 |
| Dry Stack Tailings Placement | $ 1.30 |
| **Total** | **$ 32.55** |

### 21.2.5 General and Administration (G&A) Costs

The estimates for G&A costs encompass all operating costs associated with operating the offices and providing materials and supplies for staff functions. Administration operating costs include costs and taxes for maintaining the property in good standing, land taxes, and resource usage fees (water, etc.).

The total yearly G&A costs are estimated to be approximately US$3.3 million (presented in Table 21.11), of which approximately US$2.17 million is for salaries and benefits. Employee burdens account for approximately 35% of the total salary for each employee.

Annualised site G&A costs are estimated at US$7.69 per tonne of potentially economic mineralisation processed. However, the life-of-mine G&A cost would be US$7.95 per tonne as a result of the partial final year of operations and fixed costs to maintain production.

**TABLE 21.11**
**GENERAL AND ADMINISTRATIVE OPERATING COST COMPONENTS**

| Component | Annual Cost ($US) |
|---|---|
| Salaries & Overhead | $ 2,166,000 |
| Training | $ 10,000 |
| Safety Equipment | $ 5,000 |
| Medical, Health & Safety | $ 50,000 |
| Government Relations | $ 20,000 |
| Power | $ 40,000 |
| Travel & Accommodations | $ 20,000 |
| Marketing | $ 25,000 |
| Legal and Accounting | $ 30,000 |
| Consultants & Vendors | $ 500,000 |
| Shipping, Courier and light freight | $ 30,000 |
| Communications | $ 25,000 |
| Office Supplies | $ 15,000 |
| Computer Supplies | $ 20,000 |
| Light Vehicles Operation | $ 25,000 |
| Roads and Yards Maintenance | $ 30,000 |
| Insurance | $ 100,000 |
| Human Resources | $ 30,000 |
| Bank Costs | $ 10,000 |
| Surface ITC | $ 50,000 |
| Buildings Maintenance | $ 5,000 |
| Electrical Distribution Repair | $ 5,000 |
| Water Supply & Water Treatment | $ 50,000 |
| Office Equipment Leases | $ 12,000 |
| Security Supplies | $ 5,000 |
| Cleaning contract | $ 20,000 |
| Dues & Subscriptions | $ 5,000 |
| PR | $ 20,000 |
| **TOTAL G&A COSTS** | **$ 3,323,000** |

The mine management and administration roster and costs have been estimated in Table 21.12. A total of 16 people would be employed in this area, most of which would be staff positions. They would be responsible for the management, administration, personnel, accounting, purchasing needs, and distribution of material to the operation, site security, health and safety, and environmental issues. The total costs for G&A labour is US$5.01 per tonne of potentially economic mineralisation processed.

**TABLE 21.12**
**G&A MANPOWER COSTS**

| Position | Complement | Annual Salary | Fringe Benefits | Total Cost |
|---|---|---|---|---|
| | | ($US) | 35% | ($US) |
| Mine Manager | 1 | $ 200,000 | 35% | $ 270,000 |
| Mine Superintendent | 1 | $ 175,000 | 35% | $ 236,000 |
| Mill Superintendent | 1 | $ 160,000 | 35% | $ 216,000 |
| Technical Services Superintendent | 1 | $ 160,000 | 35% | $ 216,000 |
| Senior Engineer | 1 | $ 135,000 | 35% | $ 182,000 |
| Accountant | 1 | $ 75,000 | 35% | $ 101,000 |
| Eng/Geo technicians | 2 | $ 90,000 | 35% | $ 243,000 |
| Purchasing/Warehouse Manager | 1 | $ 140,000 | 35% | $ 189,000 |
| Environmental Coordinator | 1 | $ 80,000 | 35% | $ 108,000 |
| Medical Contract | 1 | $ 60,000 | 35% | $ 81,000 |
| Security Guard | 4 | $ 45,000 | 35% | $ 243,000 |
| Site Services | 1 | $ 60,000 | 35% | $ 81,000 |
| **Total** | **16** | | | **$ 2,166,000** |

### 21.2.6 Concentrate Transport Charges

Transportation charges of $40.00 per tonne of concentrate have been included in the cash flow model and are based on $4 handling on site, $12/tonne to transport to port, $4 to handle at port, and $20 to transport by ship to smelter.

### 21.2.7 Project Total Operating Costs

The estimated total average operating cost (excluding smelting and refining) for the Pickett Mountain Mine is approximately $93.08 per tonne. Table 21.13 presents a summary table of life-of-mine average operating costs for each department on a cost per tonne of potentially economic mineralisation basis.

**TABLE 21.13**
**PROJECT TOTAL OPERATING COSTS**

| Department | Cost |
|---|---|
| Underground Mining | $ 47.73 |
| Processing | $ 31.25 |
| Dry Stack Placement of Tailings | $ 1.30 |
| Surface Services | $ 2.63 |
| General and Administration | $ 7.95 |
| Environmental and Sustainable Development | $ 2.21 |
| **Total Cost** | **$ 93.08** |

### 21.2.8 Exclusions

For the purpose of this study, value added taxes and other taxes, along with import duty costs, have not been included. Exploration costs including future infill and definition drilling and all costs associated with areas beyond the property limits have also not been included. In addition, salvage value of the infrastructure at the end of the project life have not been included.

## 22.0 Economic Analysis

The expected cash flow estimates are calculated using the forecast mine plan, operating costs, and capital expenditures incorporating expected long-term metal prices based on industry consensus pricing as of September 2020. (Table 22.1).

**TABLE 22.1**
**COMMODITY PRICING**

| Commodity | Consensus Pricing |
|---|---|
| Zinc | $ 1.15 |
| Copper | $ 3.00 |
| Lead | $ 1.00 |
| Gold | $ 1,500.00 |
| Silver | $ 18.00 |

A summary of the expected parameters used for the financial analysis is presented in Table 22.2.

**TABLE 22.2**
**CASHFLOW MODEL INPUT PARAMETERS**

| Undiluted Mineral Resources ~50/50 Indicate & Inferred | 4,471,000 tonnes at grades of 9.51 % zinc, 1.23% copper, 3.77% lead, .88 g/t gold and 98.67 g/t silver | Average Mill Head Grade: | Payability | Average Long Term Pricing |
|---|---|---|---|---|
| Estimated Mining Dilution | 10% at 0 grade | | | |
| Projected Mining Recovery | 85% | | | |
| Zinc % | | 8.56 | 0.85 | $ 1.15 |
| Copper % | | 1.11 | 0.95 | $ 3.00 |
| Lead % | | 3.40 | 0.95 | $ 1.00 |
| Gold g/t | | 88.80 | 0.95 | $ 1,500 |
| Silver g/t | | 0.79 | 0.93 | $ 18.00 |
| Pre Production Capital, incl Working Capital | $ US 147.4 million | | | |
| Total Sustaining Capital | $ US 100 million | | | |
| Financial Assurance Trust: Reclamation & Closure | $ US 13.7 million | | | |
| Royalties | None | | | |
| Estimated Operating Costs ($/Tonne) | $ US 93.08 /tonne | | | |
| Life of Mine | 9.7 years | | | |

The cash flow analysis has been conducted on the assumption of 100% equity investment and excludes any element or impact of financing arrangements. All exploration and acquisition costs incurred prior to the production decision are also excluded from the cash flows.

Capital expenditures, as shown in the capital section, would be incurred over a two-year period, which is reflected in the discounted cash flow calculations. The cash flows include sustaining capital and capital expenditures contingency of approximately 20%.

Revenue is based on payments for the various metals produced and less the costs for metal sales and shipping and include the deductions that the refiner makes.

The expected cash flow analysis used the metal prices indicated above. The discounted cashflow analysis has been based on 2020 Constant US Dollar values.

The potentially mineable underground resource is estimated to be 4.2 million tonnes at a grade of 8.56% Zn, 1.11% Cu, 3.40% Pb, .79 grams Au/tonne, and 88.8 grams Ag per tonne. This PEA relies on Indicated Mineral Resources (approximately 48.7% of the total resource tonnes) but also Inferred Mineral Resources.

It should be noted that the Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as Mineral Reserves. Metallurgical recoveries and capital and operating cost estimates are to at least PEA level of accuracy. Therefore, there is no guarantee that the economic projections contained in this PEA would be realised.

## 22.1 Taxes

Federal and state corporation and mining taxes, including allowed deductions for tax purposes, were included in the cashflow model.

The U.S. federal corporation tax rate is 21% on operating income after deducting capital expenditures.

The State of Maine Mining Excise Tax is levied on mining projects and applied as presented below.

The excise tax due on each mine site shall be the greater of the following:

1. **Tax on facilities and equipment**. The value of facilities and equipment multiplied by 0.005; or

2. **Tax on gross proceeds.** The gross proceeds multiplied by:

    A. If net proceeds are greater than zero, the greater of the following:

        (1) 0.009; or

        (2) A number determined by subtracting from 0.045 the quotient obtained by dividing:
            (a) Gross proceeds, by
            (b) Net proceeds multiplied by 100.

    B. If net proceeds are equal to or less than zero, then 0.009.

In the case of the Pickett Mountain Project, the applicable excise tax calculation is 2.2 tax on gross proceeds calculation 2.

## 22.2 Financial Returns

The overall level of accuracy of this study is approximately ±40%.

The Project expected investment and returns, based on the expected cash flow parameters, are shown in Table 22.3.

**TABLE 22.3**
**EXPECTED PROJECT RETURNS**

| | Pre-Tax | After Tax |
|---|---|---|
| Undiscounted Net Revenue | 626.6 million | 626.6 million |
| Undiscounted Total Cash Flow | 462.5 million | 390.8 million |
| NPV (5%) | 305.2 million | 255.5 million |
| NPV (8%) | 238.1 million | 198.3 million |
| IRR | 40% | 37% |
| Payback Period | 2.4 Years | 2.4 Years |

Results indicate that at the expected parameters and metals prices, the Project is viable.

## 22.3 Sensitivity Analysis

Sensitivity analyses were performed for metal prices, capital expenditures, operating costs, mined grades, smelter charges, and recoveries with ranges up to 20% positive and negative variations. The Project is most sensitive to changes in metals prices and reasonably sensitive to changes in all the other variables. The results of the sensitivity analysis at ±20% are presented in Table 22.4 and Table 22.5.

**TABLE 22.4**
**NPV 8% DISCOUNT SENSITIVITY ANALYSIS**

| Parameter | Pre-Tax NPV 8% ($M) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | -20% | -15% | -10% | -5% | 0% | 5% | 10% | 15% | 20% |
| **Mined Grade** | $104 | $137 | $171 | $204 | $238 | $272 | $306 | $339 | $373 |
| **Recovery** | $106 | $139 | $172 | $205 | $238 | $271 | $304 | $337 | $369 |
| **Smelter Charges** | $271 | $262 | $254 | $246 | $238 | $230 | $222 | $214 | $205 |
| **Metal Price** | $74 | $115 | $156 | $197 | $238 | $279 | $320 | $361 | $402 |
| **Operating Costs** | $285 | $273 | $261 | $250 | $238 | $226 | $215 | $203 | $191 |
| **Capital Costs** | $276 | $267 | $257 | $248 | $238 | $228 | $219 | $209 | $200 |

**TABLE 22.5**
**PRE-TAX IRR SENSITIVITY ANALYSIS**

| Parameter | Pre-Tax IRR (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | -20% | -15% | -10% | -5% | 0% | 5% | 10% | 15% | 20% |
| Sensitivity | 23 | 28 | 32 | 36 | 40 | 44 | 48 | 51 | 55 |
| Mined Grade | 24 | 28 | 32 | 36 | 40 | 43 | 47 | 50 | 54 |
| Recovery | 43 | 42 | 42 | 41 | 40 | 39 | 38 | 37 | 36 |
| Smelter Charges | 19 | 25 | 30 | 35 | 40 | 44 | 49 | 53 | 57 |
| Metal Price | 45 | 44 | 42 | 41 | 40 | 38 | 37 | 36 | 34 |
| Operating Costs | 23 | 28 | 32 | 36 | 40 | 44 | 48 | 51 | 55 |
| Capital Costs | 52 | 48 | 45 | 42 | 40 | 37 | 35 | 33 | 31 |

The NPV and IRR sensitivities to variations in key parameters are depicted graphically in Figure 22.1 and Figure 22.2. The IRR is most sensitive to variations in metal prices and mined grades and less sensitive to capital and operating costs.

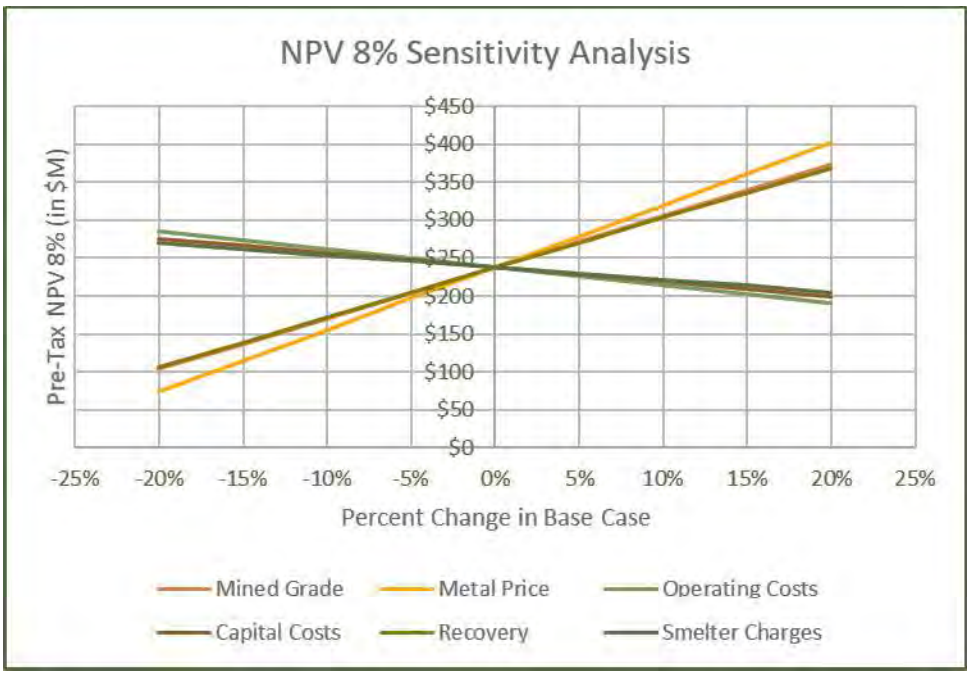



**Figure 22.1 NPV at 8% Discount Sensitivity Analysis**

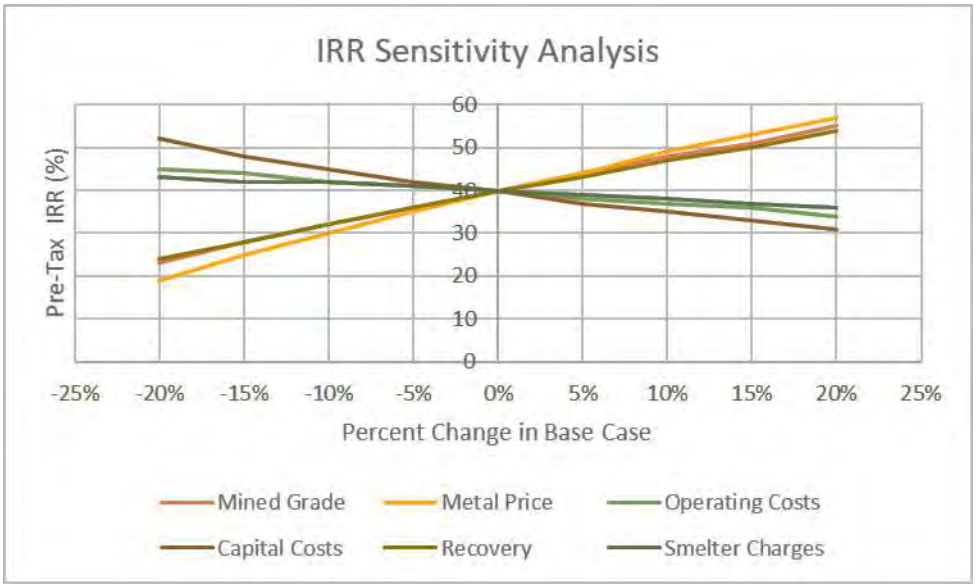



**Figure 22.2 IRR Sensitivity Analysis**

# 23.0 Adjacent Properties

There are no adjacent properties to the Pickett Mountain Project included in this study.

# 24.0 Other Relevant Data

There is no other relevant data.

# 25.0 Interpretation and Conclusions

The Pickett Mountain deposit is a typical volcanogenic massive sulphide deposit, with upper quartile grades. The deposit lies near the top of a variably altered, generally fragmental, felsic volcanic sequence with evidence of at least two periods of hydrothermal activity and base metal deposition. Two lenses of massive sulphide, West and East Lenses, comprise the Mineral Resource. The two sulphide lenses are separated by a short strike length zone of Z-folding, which results in a 50m to 80m horizontal displacement where fold-repetition of the massive sulphide lenses have been observed.

In addition to the East and West Lenses, a high-grade lens of footwall massive sulphide mineralisation (FW Zone) was discovered, approximately 150mstratigraphically below the East Lens. Interpretation of geology indicates that this FW Zone can traced along strike and is open both along strike and up plunge. More testing of this horizon is required.

This PEA has identified a diluted mineral resource of 4.2 million tonnes at 8.56% Zn, 1.11% Cu, 3.4% Pb, 0.79 g/t Au, and 88.8 g/t Ag. This resource is comprised of 50% Indicated Resources and 50% Inferred Resources. It should be noted that the Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as Mineral Reserves. Therefore, there is no guarantee that the economic projections contained in this PEA would be realised.

The deposit would be mined by underground mining methods with metals extracted in a processing plant custom built for the purpose. The mine site infrastructure facilities would be minimised but include a processing plant, small surface shop, warehouse, office complex, water treatment facility, dry stack tailings facility, and transformer and power distribution. Water for the project is assumed for this study to be provided from a well(s) near to the Project, initially, then mainly recycled within the project site.

The mine would operate at 432,000 tonnes per annum and produce $1.36 billion in cash flow during the life of the mine.

Based on the study results, the conclusions of AMPL are:

1. The project provides positive returns based on the parameters and metal prices used in this study and should be developed further with the aim of bringing the deposit to production.

2. The proposed project would be considered a small- to medium-sized underground mining operation, which can be developed for production at a reasonable cost in a near-term horizon, provided regulatory approval and permits are acquired.

3. The mined grade of potentially economic mineralisation is an important variable for the success of the operation as are operating costs. Operating management efforts during mine production must be focused on these parameters.

4. The scoping level test work has indicated that a sequential flotation process will produce marketable-grade copper, lead, and zinc concentrates. Arsenic and antimony levels were high in copper concentrates produced in open-cycle and locked-cycle tests. Additional geo-metallurgical test work will provide additional information on the impurities in the marketable-grade copper concentrate to determine if penalties need to be paid. In addition, blending of ores from different areas in the mine will keep impurities (As/Sb) below penalty levels.

5. The following conclusions can be drawn based on the historical and current scoping level metallurgical studies:

    - The sequential flotation process is a process of choice for recovering marketable-grade concentrates of copper, lead, and zinc that include in each, quantities of previous metals.

    - Blending of material into the mill and/or final copper concentrate may be required to maintain low levels of arsenic and antimony, below the penalty limits for the concentrate.

    - Metal recoveries of 78% to 88% for copper, lead, and zinc are expected in the selected flowsheet while maintaining high quality concentrates.

    - Further testing is needed to optimise metal recoveries and reagent quantities in order to maximise revenue and reduce Capex and Opex for the milling circuit.

The Project will be required to first obtain, from the Maine LUPC, approval of a rezoning petition that will allow for mining in this unorganised township. The petition was submitted and has been accepted by the LUPC as complete for its review. Based on initial soil and wetland field surveys in addition to desktop studies as described in the petition, it was concluded by Wood that the preliminary designs of the proposed project would have no undue impact on the natural resources and could be completed in a manner that would fit harmoniously within the surrounding area, and therefore, could satisfy the goals and specific requirements of the LUPC.

The socio-economic analysis completed for the petition indicated there is adequate local capacity to provide municipal services and a sufficient labor pool to be employed and trained as employees. Wolfden correspondence and presentations with the towns proximal to the project resulted in concurrence letters from these towns in support of the project and that it would not pose an undue burden on municipal services provided by these communities and that other purchased services (solid waste, communications, power) had adequate capacity.

Following a rezoning approval, Wolfden will need to obtain a Maine Metallic Mining Permit from the MEDEP under the Maine Chapter 200 rules. The Chapter 200 rules with respect to metallic mines, only allow for underground mining methods and require tailings disposal as dry stacked tailings, in lined facilities, to be closed with a final cover of equal hydraulic performance. It is technically and financially feasible for the project to meet these two requirements. Review of the requirements for mine design, mine operation, mine closure, water collection and treatment, and reclamation and environmental monitoring, did not identify technical or operational requirements that could not be met by a well-designed and responsibly managed project. The future Baseline Characterisation Studies needed to support an MEDEP Permit application are being developed and discussed with the MEDEP.

As part of Chapter 200 rules, the MEDEP will require that a financial assurance trust fund is established, prior to the issuance of a mining permit. In accordance with Section 17 of the Chapter 200 rules, the project will need to continuously maintain a financial assurance trust, as a condition of the mining permit, as determined by MEDEP that addresses all concerns related to closure, reclamation, post-closure maintenance and monitoring, and potential corrective actions that the mining operation and any associated waste material could pose an unreasonable threat to public health and safety or the environment. The financial assurance trust must include sufficient funds for the following:

a) The cost to investigate all possible releases of contaminants at the site, monitor all aspects of the mining operation, close the mining operation in accordance with the closure plan, conduct treatment activities as necessary for all fluids and wastes generated by the mining operation and those post closure for a minimum of 100 years, implement remedial activities for all possible releases and maintenance of structures and waste units as if these units have released contaminants to the groundwater and surface water, conduct corrective actions for potential environmental impacts to groundwater and surface water resources as identified in the environmental impact assessment and conduct all other necessary activities at the mine site in accordance with the environmental protection, reclamation and closure plan; and

b) The cost to respond to a worst-case catastrophic mining event or failure, including, but not limited to, the cost of restoring, repairing, and remediating any damage to public facilities or services, to private property, or to the environment resulting from the event or failure.

A filter cake TMF sized to contain the projected life of mine filtered tailings within the siting constraints identified can be constructed. Contact water from the TMF can be collected in an adequately sized pond constructed at the base of the TMF on the south side of the facility. The TMF would have a maximum elevation of 380m, which is approximately the elevation of the tree tops, as measured from the ground surface at the topographic divide at the south side of the facility. There is potential for expansion of the TMF using the land to the south and there is flexibility for phased construction and progressive reclamation of the TMF.

# 26.0 Recommendations

It is recommended that infill drilling should continue with the aim of upgrading the Inferred Resources to Indicated Resources and to better define the fold zone between the East and West Lenses. As well, follow-up drilling of the FW Lens and step-out drilling around the East and West Lens and regional drill targets is required in order to determine if additional resources can be delineated.

Metallurgical test work should be undertaken to optimise the process parameters for the proposed process flowsheet, including confirmation that the process flowsheet is capable of processing variable ores from the mine, determining if the metal recoveries can be improved, and determine whether the variable ores respond to mechanical sorting technologies.

Perform sufficient test work to size equipment for the planned throughput. Some test work may be required at the vendor's facility (*i.e.*, regrind mill sizing, thickener size, etc.).

Perform a detailed rock mechanics analysis for stope geometry and mine design including oriented core geotechnical drilling.

Continue to advance the project toward production by undertaking an advanced exploration program in parallel with finalising the project design and capital requirements. The goal of the Advanced Exploration Program will be to confirm resources with the objective of converting Mineral Resources to Mineral Reserves.

Complete a geochemical characterisation of simulated processed tailings for possible metal leaching and acid rock drainage (MI/ARD) potential.

It is recommended that Wolfden proceeds with the rezoning and mine permitting process, using contacts it has established with LUPC and MEDEP and engage with them in a proactive and collaborative fashion. Aligning with the State of Maine on how to meet legislative requirements for financial assurance trust fund should be prioritised. Future feasibility studies and designs should seek to avoid and minimise impacts to environmental, natural, cultural, scenic, and recreational resources to the extent possible. While the current mine development plan for treated water is subsurface infiltration, going forward Wolfden should consider other alternatives to provide greater flexibility and redundancy for the management of re-infiltration of treated water, if soil site conditions warrant. These alternatives should, at a minimum, consider spray irrigation, which is an established method for treated waters in the State of Maine and which could be designed to operate year-round.

Further studies are recommended to advance the tailings facility design including geotechnical and hydrogeological investigations including laboratory testing to confirm site conditions, identify any potential geologic hazards, characterise foundations and groundwater conditions, and identify suitable borrow sources for construction fill. Tailings characterisation testing is recommended to better define the geochemical, physical, settling, and filtration properties to validate the TMF design criteria. Site specific precipitation and evaporation data should be collected and a site-specific water balance model performed to confirm collection pond sizing and discharge water volumes. A grading plan should be developed that optimises the cut/fill balance for the TMF base grade. Consider amending the closure cover if it can be demonstrated that the compacted tailings have an equivalent permeability and do not pose a chemical stability risk.

All recommendations should be performed as part of a follow up Pre-Feasibility Study or Feasibility Study. The cost to complete a Pre-Feasibility or Feasibility Study for the Pickett Mountain Project is estimated to be between US$3 million to US$5 million.

# 27.0 References

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Scully, M.V., 1988. Geology and Petrochemistry of the Mount Chase Massive Sulfide Prospect, Penobscot County, Maine; MSc Theses, University of Missouri, Rolla, Missouri, 121 p.

Williams, H. 1978. Appalachian Orogen in Canada; Can. J. Earth Sci., Vol 16, p.792-807.

Wolfden Mt. Chase LLC, Petition to Rezone Portion of Township 6, Range 6 Penobscot County, Maine for Development of an Underground Metallic Mineral Deposit; Submitted to: Maine Land Use Planning Commission, January 26, 2020.

Wolfden Mt. Chase LLC, Revised Petition to Rezone Portion of Township 6, Range 6 Penobscot County, Maine for Development of an Underground Metallic Mineral Deposit; Submitted to: Maine Land Use Planning Commission, June 30, 2020.

Wolfden Resources Corporation, April 28, 2020, Annual Information Form for the year ended December 31, 2019, Sedar filing.

# CERTIFICATE OF QUALIFICATIONS

I, Finley J. Bakker, P. Geo., as a Professional Geoscientist and Consultant, residing at 4798 Andy Road, Campbell River, British Columbia, V9H 1C6, Canada, do hereby certify that:

1) I graduated with a BSc. Honours in Geology from McMaster University in 1979.
2) I am a member of the Association of Professional Engineers and Geoscientists of British Columbia APEGBC (1991) (Registration No. 18639).
3) I have worked as a geologist for a total of 41 years since my graduation from university.
4) I have read the definition of "qualified person," as set out in National Instrument 43-101 ("**NI 43-101**") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101), and past relevant work experience, I am a "qualified person" for the purposes of NI 43- 101.
5) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
6) My relevant experience for the purpose of the Technical Report is:
   a) Chief Geologist at four mines;
   b) I have held the positions of Senior Resource Geologist, Exploration Manager, and Superintendent of Technical Services;
   c) I have undertaken Resource calculations for 40 years;
   d) I have worked on a number of deposit types including VMS, skarn, epigenetic, and porphyry deposits and have specifically worked at and on Massive Sulphide deposits for 26 years;
   e) I have been involved with commodities including copper, lead, zinc, gold, silver, REE, tungsten and iron, and molybdenum; and
   f) I have used MineSight/Compass/Hexagon software used in calculating the Mineral Resource for 32 years.
7) I am responsible for the preparation of Sections 1.0 and 14.0 of the technical report titled ""Preliminary Economic Assessment Pickett Mountain Project," Penobscot County, Maine, USA"
8) I have had prior involvement with the property that is the subject of the Technical Report and have not completed a personal inspection of the property that is the subject of the Technical Report.
9) At the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
10) I am independent of the issuer applying all of the tests in Section 1.5 of NI 43-101. I have read NI 43-101 and Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance with that instrument and form.
11) I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public Company files on their websites accessible by the public, of the Technical Report.

Dated this 29th day of October 2020

Finley J. Bakker, P.Geo.

# CERTIFICATE OF QUALIFICATIONS

I, Jerome Walton Grant, M.Sc., P. Geo, a consulting geologist with residence and business address at Box 627, Durham, Ontario, N0G 1R0, Canada do hereby certify that:

1) I have practiced my profession as a geologist in the private sector since 1981 in the gold and base- metal sectors of the mineral exploration industry.
2) I completed Geological Engineering, Mineral Exploration Option degree at Queen's University, Kingston, Ontario in 1985 and a Master of Science degree in geology at Queen's University in 1995.
3) I am a Professional Geoscientist – a Practicing Member of the Association of Professional Geoscientists of Ontario (APGO).
4) Over my career I have conducted GIS compilation, geological mapping, surface sampling and diamond drill programs at numerous locations in Canada and beyond, including VMS exploration at Kidd Creek and Hackett River.
5) I have read the definition of "qualified person" set out in National Instrument 43-101 ("**NI 43-101**") and certify that, by reason of my education, experience and affiliation with a professional association, I am a "qualified person" for the purposes of NI 43-101.
6) This certificate applies to the technical report titled This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
7) I am responsible for the preparation of Sections 8.0 to 13.0 of the Technical Report.
8) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
9) I conducted a personal inspection and worked on the Pickett Mountain Property for 6 weeks ending November 29, 2018, mapping and compiling geological, geochemical, geophysical, and the drill hole database.
10) I have had no prior involvement with the property that is the subject of the Technical Report.
11) I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.
12) I am independent of the issuer applying all of the tests in Section 1.5 of NI 43-101. There were no circumstances that were or could be seen to interfere with my judgement in preparing the Technical Report.
13) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance with that instrument and that form.
14) I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated this 29th day of October 2020

Jerry Grant, M.Sc., P. Geo.

# CERTIFICATE OF QUALIFICATIONS

I, Brian LeBlanc, B.Sc., P. Eng., residing at 781 Community Hall Road, Thunder Bay, Ontario, Canada, do hereby certify that:

1) I am President and a Principal of A - Z Mining Professionals Limited.
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of the Haileybury School of Mines as a Mining Technician (1981). I have also obtained a Bachelor of Science degree in Mining Engineering from Michigan Technological University (1986).
4) I am licensed by the Professional Engineers Ontario (License No. 90427972).
5) I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("**NI 43-101**") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43- 101.
6) My relevant experience for the purpose of the Technical Report is:
   a) Extensive and progressively more senior engineering and operational duties at base metals, gold and nickel mining operations and development projects.
   b) 13 years of experience directing and overseeing several scoping level, pre-feasibility level, and feasibility level studies for mines and mining companies.
   c) Mill Operator – Giant Yellowknife Mines, 1974 – 1975
   d) Crusher Operator/Screening Plant Operator/Loadout Operator/Surveyor – Steep Rock Iron Mines Ltd., 1976 - 1979
   e) Mine Planner/Chief Surveyor – Nanisivik Mines Ltd., 1981 - 1984
   f) Mining Engineer/Underground Supervisor/Mine General Foreman/Technical Services Superintendent/Mine Superintendent – Williams Mine, 1986 - 2003
   g) Manager of Mining – Kinross' Kubaka Mine (Russia), 2003 - 2004
   h) Technical Services Superintendent – Lac Des Isles Mines, 2004 - 2006
   i) Project Superintendent – Redpath Indonesia, 2006 - 2007
   j) Project Manager for Ontario – North American Palladium Ltd., 2007 - 2010
   k) General Manager/Vice President/President – NordPro Mine & Project Management Services Ltd, 2010 - 2014
   l) President, A – Z Mining Professionals Limited, February 2014 to Present
7) I assisted in preparation of the Technical Report and Peer Review for Sections 1.0, 16.0, and 18.0 to 26.0. I co-authored and am responsible for Sections 16.0 and 21.0 to 26.0 of the Technical Report.
8) I have not completed a personal inspection of the Property that is the subject of the Technical Report.
9) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.
10) I am independent of the issuer applying all of the tests in Section 1.5 of NI 43-101.
11) I have not had prior involvement with the Property that is the subject of the Technical Report.
12) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance therewith.

Dated this 29th day of October 2020

Brian LeBlanc, B.Sc., P. Eng.

# CERTIFICATE OF QUALIFICATIONS

I, Eric Hinton, residing at 27 Claremont Drive, Niverville, Manitoba R0A 0A2, Canada, do hereby certify that:

1) I am a Professional Mining Engineer.
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of Queen's University at Kingston in 1988 with a Bachelor of Science in Mining Engineering.
4) I am licensed by the Association of Professional Engineers and Geoscientists of the Province of Manitoba (License No. 33054).
5) I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("**NI 43-101**") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101.
6) My relevant experience for the purpose of the Technical Report is:
   a) Since 1988, I have been working in the mining industry as a mining engineer, mining researcher and mine consultant (32 years).
   b) I have worked in and consulted on base metal mines that were bulk tonnage operations as well as narrow vein ventures for 15 years.
7) I assisted in preparation of the Technical Report and Peer Review for Sections 1.0, 16.0, 18.0, 19.0, and 21.0 to 26.0 of the Technical Report. I co-authored and am responsible for Sections 16.0, 18.0, 21.0, and 22.0 of the Technical Report.
8) I have not completed a personal inspection of the Property that is the subject of the Technical Report.
9) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.
10) I am independent of the issuer applying all the tests in Section 1.5 of NI 43-101.
11) I have not had prior involvement with the Property that is the subject of the Technical Report.
12) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance therewith.

Dated this 29th day of October 2020

Eric Hinton, P. Eng.

# CERTIFICATE OF QUALIFICATIONS

I, Ron C. deGagne, P. Geo. residing at 99 Dow Drive, Copper Cliff, Ontario, P0M 1N0, Canada, do hereby certify that:

1) I am a geoscience professional employed by Environmental Applications Group (EAG) Inc.
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of Sir Sandford Fleming College, Ontario with a technology diploma in Earth Science (1981) with continuous geoscience working experience since 1995. I am a geoscientist currently licensed by the Professional Geoscientists of Ontario (License No 0557).
4) I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101), and past relevant work experience, I fulfill the requirements to be a "Qualified Person" for the purposes of NI 43-101.
5) My relevant experience for the purpose of the Technical Report is:
   c) Environmental Technologist (Sudbury), Abandoned Mine Assessments, DST Consulting Engineers (1995-2002)
   d) Senior Geologist, (Sudbury) Wood Environment & Infrastructure Solutions Inc., Mine Waste Geochemistry and Abandoned Mine Assessments (2002-2020)
   e) Senior Geoscientist (Sudbury), Environmental Applications Group (EAG) Inc., Mine Waste Geochemistry (2020 - Present)
6) I have not visited the Property that is the subject of this Technical Report.
7) I am responsible for reviewing Section 20.0 and co-authoring Section 26.0 of this Technical Report.
8) I am independent of the Vendor and the Property.
9) I have not had prior involvement with the Project that is the subject of this Technical Report.
10) I have read NI 43-101 and Form 43-101F. Section 20.0 of this Technical Report has been prepared in compliance therewith.
11) As of the effective date of this Technical Report, to the best of my knowledge, information and belief, Section 20.0 of the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 29th day of October 2020

Ron C. deGagne, P. Geo.

# CERTIFICATE OF QUALIFICATIONS

I, Frank Palkovits, residing at 26 Windsor Crescent, Sudbury, ON, do hereby certify that:

1) I am a Mining Engineer, P.Eng.
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of Laurentian University (1988)
4) I am licensed by the Professional Engineers Ontario BY NI 43-101 (License No. 90276379).
5) I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("**NI 43-101**") and certify that, by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I am a "qualified person" for the purposes of NI 43-101.
6) My relevant experience for the purpose of the Technical Report is: 40 years industry experience with 20 years in operating mining companies with increasing roles of responsibility up to and including Chief Engineer, and 20 years in consulting and EPCM projects in mine backfill and tailings management. I have worked on numerous polymetallic mines having many similar characteristics with this project.
   a) 40 years
7) I completed Section 18.22 of the Technical Report and contributed to Section 21.1.10 (Sustaining Capital for Tailings Expansion), and Section 21.2.7 (Project Total Operating Costs).
8) I have not completed a personal inspection of the Property that is the subject of the Technical Report.
9) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed in order to make the Technical Report not misleading.
10) I am independent of the issuer applying all the tests in Section 1.5 of NI 43-101.
11) I have not had prior involvement with the Property that is the subject of the Technical Report.
12) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance therewith.

Dated this 29th day of October 2020

Frank Palkovits

# CERTIFICATE OF QUALIFICATIONS

I, Deepak Malhotra, Ph.D., of Lakewood, Colorado, do hereby certify that:

1) I am currently employed as President of Pro Solv, LLC with an office at 15450 W. Asbury Avenue, Lakewood, Colorado, 80228.
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of Colorado School of Mines in Colorado, USA (Masters of Metallurgical Engineering in 1973 and Ph. D. in Mineral Economics in 1978). I am a registered member in a good standing of the Association of Society of Mining and Metallurgical Engineers (SME) and a member of the Canadian Institute of Mining and Metallurgy (CIM). I have 48 years of experience in the area of metallurgy and mineral economics.
4) I have read the definition of "qualified person" set out in National Instrument 43-101 (NI43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.
5) I am responsible for Sections 13.0, 17.0 and parts of Sections 1.0, 19.0, 21.0, 25.0, 26.0, and 27.0 of the Technical Report.
6) I have not completed a personal inspection of the Property that is the subject of the Technical Report.
7) As of the effective date of the Technical Report and the date of this certificate, to the best of knowledge, information and belief, this Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
8) I am independent of the Issuer and related companies applying all of the tests in Section 1.5 of the NI 43-101.
9) I have not had prior involvement with the property that is the subject of the Technical Report.
10) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance therewith.

Dated this 29th day of October 2020

Deepak Malhotra, Ph. D.

# CERTIFICATE OF QUALIFICATIONS

I, David Ritchie, M.Eng., of Brampton, Ontario, Canada, do hereby certify that:

1) I am currently employed as Managing Principal of SLR Consulting (Canada) Ltd. with offices at 55 University Avenue, Suite 501, Toronto, Ontario, Canada, M5J 2H7
2) This certificate applies to the technical report titled "Preliminary Economic Assessment Pickett Mountain Project" Penobscot County, Maine, USA, located at: 68.468°W Longitude 46.134°N Latitude (the "**Technical Report"**), and it is effective September 14, 2020 with a filing date of October 29, 2020.
3) I am a graduate of Ryerson Polytechnic University, Toronto, Canada (Bachelor of Engineering (Civil) in 1995) and University of Western Ontario (Master of Engineering (Geotechnical) in 2000). I am a registered member in a good standing of the Professional Engineers Ontario. I have 25 years of experience in the area of tailings management.
4) I have read the definition of "qualified person" set out in National Instrument 43-101 (NI43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.
5) I am responsible for Section 18.22, part of Section 18.22.1 and Section 18.22.2 through 18.22.7 and parts of Sections 1.10, and 21.1.10 and 26.0 of the Technical Report.
6) I have not completed a personal inspection of the Property that is the subject of the Technical Report.
7) As of the effective date of the Technical Report and the date of this certificate, to the best of knowledge, information and belief, this Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
8) I am independent of the Issuer and related companies.
9) I had limited involvement with conceptual tailings management options in 2019 for the property that is the subject of the Technical Report.
10) I have read NI 43-101, Form 43-101F1 and the Technical Report, and the Technical Report has been prepared in compliance therewith.

Dated this 29th day of October 2020

David Ritchie, M.Eng.

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 14-B: September 2020 Update Letter to PEA Report

December 26, 2022

Mr. Jeremy Ouellette, P. Eng.
Vice President Project Development
Wolfden Resources Corporation

Mr. Ouellette:

Wolfden Resources Corporation (Wolfden) has asked A-Z Mining Professionals Ltd. (AMPL) to review the economic model constructed for the Preliminary Economic Assessment (PEA) for the Pickett Mountain Project, Penobscot County Maine, filed October 29, 2020 to evaluate the economic impact of relocating the processing plant and tailings management facility (TMF) to an off-site location. As the Engineer of Record, I have reviewed the economic model and made the following adjustments to the capital and operating costs:

a) The capital costs of constructing the processing plant and TMF have not been changed. Note that a solar facility is being considered by the current design team. This will be a cost savings driver and will not negatively impact the economics of the project.

b) An additional $5.69/tonne has been included in operating costs for haulage from the site to the new processing plant location as per a quote provided to AMPL by Wolfden. A second plant location site, 15 miles further from the mine site is also being considered. The haulage costs would be expected to increase slightly to the second location, but should have only a minimal effect on the project economics.

c) Costs have been included for a second water treatment plant, one at the mine site and one at the new location of the processing facility.

d) Costs related to operating spray irrigation and snowmaking systems compared to infiltration galleries will reduce the capital costs of the project while maintaining comparable operating costs. It is considered a conservative approach to keep the current capital costs for discharging treated water as related to capital infrastructure.

e) All other costs remain the same.

f) The approach to the relocation of the processing plant and TMF is considered to be conservative regarding the following:

    i. There is an opportunity to save on construction costs for the TMF if relocated to more level terrain.

ii. Both water treatment plants have been fully costed as per the quote provided by Suez Water Technologies and Solutions. The water treatment plant being proposed for the relocated processing plant and TMF is simplified and more cost effective compared to the Suez design proposed in the 2020 PEA and therefore AMPL considers the economics to be conservative. In addition, the second plant, at the mine site, will be smaller and more cost effective and it is likely that the same labor component can operate both plants. This would reduce overall costs for water treatment.

iii. The cost for ore transport included in the model is provided from a local contractor. An opportunity to reduce costs exists should Wolfden decide to buy their own fleet of trucks and become an owner/operator for ore haulage.

The following Table shows a comparison of the economics between the 2020 PEA and relocating the processing facility.

| PRE-TAX NPV | 2020 PEA | Relocated Plant |
|---|---|---|
| Discounted at 5 % / year | $ 305,181,000 | $ 283,182,000 |
| Discounted at 8 % / year | $ 238,056,000 | $ 219,737,000 |
| Discounted at 15 % / year | $ 132,537,000 | $ 120,078,000 |
| PRE-TAX IRR | 40% | 38% |
| | | |
| AFTER-TAX NPV | | |
| Discounted at 5 % / year | $ 255,533,000 | $ 237,017,000 |
| Discounted at 8 % / year | $ 198,299,000 | $ 182,718,000 |
| Discounted at 15 % / year | $ 108,105,000 | $ 97,262,000 |
| AFTER-TAX IRR | 37% | 35% |

As can be seen, the additional costs of relocating the plant will have a minimal effect on the economic viability of the Project. The After Tax IRR drops by 2% and the After Tax 8% Discounted NPV changes by less than 10%. The Project still remains extremely robust and provides an excellent return on investment.

Please note that no adjustment has been made for the increase in the metals pricing since the PEA was completed. Current and forecasted metal prices would significantly increase project returns.

Regards,

Brian LeBlanc, P.Eng.
President
A-Z Mining Professionals Ltd.

LICENSED PROFESSIONAL ENGINEER
26/12/22
B. C. LeBLANC
PROVINCE OF ONTARIO

# EXHIBIT 15.0 LOCATION REQUIREMENTS

This exhibit is not applicable to this application.

# EXHIBIT 16.0 HARMONIOUS FIT AND NATURAL CHARACTER

## 16.1 VISIBILITY ANALYSES

### 16.1.1 Visibility within 3 Miles

Stantec conducted a Viewshed Analysis of the Project Area from roadways, scenic byways, major waterbodies, coastal wetlands, permanent trails, and public property within 3 miles. See **Exhibit 10 – Surrounding Uses & Anticipated Impacts** for a description of the potential impacts of the 3-mile visibility on existing uses. In general, geomorphology, site and surrounding topography, and forest cover provides a visual screen of the project from most vantage points. Additional visual assessments will be conducted as part of the MDEP Chapter 200 permitting process.

#### 16.1.1.1 Methodology

The Viewshed Analysis of visibility within 3 miles of the Project Area was conducted using ArcGIS Spatial Analyst and 10-meter USGS digital elevation models.[8] Visibility was calculated based on the 120-foot-tall headframe, because it is the Project's tallest feature. The analysis included publicly available mapped roadways, scenic byways, major waterbodies, coastal wetlands, permanent trails, and public property. There are no scenic byways, coastal wetlands, or State Parks within 3 miles of the Project Area. Data for ATV, snowmobile, and hiking trails within the 3-mile radius were obtained from public databases.[9,10,11,12,13] An additional trail located north of the Project Area and used by members of nearby Shin Pond Village that is not on public databases was identified through local outreach.

Ground level elevation is established from the 10-meter USGS digital elevation models with no consideration of land use type or forest canopy height that may obscure both the headframe and viewing location. This is a conservative analytical framework because it does not consider the undisturbed 400-foot-wide forested buffer proposed around the project or potential for screening from other forest vegetation. Visibility was determined by a line-of-sight analysis from the proposed re-zone boundary to each cell of the digital elevation model within a 3-mile radius. As an alternative viewshed analysis, forested areas identified in the 3-mile radius from the National Landcover Database[14] were analyzed since forest structure would limit the distance that a ground observer could see. An assumed canopy height of 40 feet was added to the ground level elevation.

[8] https://www.maine.gov/geolib/catalog.html
[9] https://www.gpstrailmasters.com/content/goomap/atv-map.html
[10] https://www.mainetrailfinder.com/trails/trail/iat-matagamon-to-houlton
[11] https://www.alltrails.com/explore/map/mount-chase-0cd60ef
[12] https://webapps2.cgis-solutions.com/mainesnowmobile/
[13] https://katahdinmaine.com/wp-content/uploads/2019/01/KACC-SnowMap2019-WEB-1.pdf
[14] https://www.usgs.gov/centers/eros/science/national-land-cover-database

#### 16.1.1.2 Results

Results of both Viewshed Analyses are shown in **Figure 16-1** and **Figure 16-2**. In general, geomorphology, site and surrounding topography, and forest cover will provide a visual screen of the project from most vantage points.

The headframe has potential visibility from the following locations under the conservative ground level elevation only analysis:

- The snowmobile/ATV trail immediately south of the Project Area
- Pickett Mountain Pond
- Northern shore of Pleasant Lake
- Northern shore of Mud Lake
- Eastern shore of Tote Road Pond
- Northern face and summit of Mount Chase (summit based on field observations)

With consideration of forested areas within the 3-mile radius area of analysis, potential visibility of the headframe is reduced to the following:

- The snowmobile/ATV trail immediately south of the Project Area
- Pickett Mountain Pond
- Northern shore of Pleasant Lake
- Summit of Mount Chase (based on field observations)

### 16.1.2 Line of Sight Analysis of Pleasant Lake

TJD&A Landscape Architects and Planners (TJD&A) completed an additional line-of-site analysis from Pleasant Lake (**Attachment 16-A**). This study focused on visibility of the headframe and Project solar components from the water and a cluster of four camps along the north shore of Pleasant Lake. The analysis indicates the solar array will not be visible from the water or camps and there may be limited visibility of the headframe due to screening vegetation. The effects of distance, terrain, and vegetation will screen (or partially screen) all other Project components. TJD&A concluded that the headframe structure may be partially visible over the tree line but will not dominate the landscape when viewed from Pleasant Lake and the immediate shoreline.

## 16.2 NOISE ASSESSMENT

WSP conducted a noise assessment of the mining operation, which modeled sound levels of mining equipment and vehicles with potential to generate significant cumulative sound levels (**Attachment 16-B**).

The assessment took the approach of comparing cumulative impacts of noise sources at a series of Points of Reference - including seasonal camps at Pleasant Lake and recreational use locations - against the most conservative noise levels required by MDEP in Chapter 375 Site Location of Development Regulation for Control of Noise and the LUPC in Chapter 10. The Noise Assessment indicates that the predicted sound levels from the Project are all within the most conservative of these regulatory limits. At Wolfden's property boundary, predicted sound levels from the Project ranged from 25 to 44 dBa, which is similar to the sound experienced in a silent study room or a soft whisper.[15]

## 16.3 NATURAL CHARACTER

The Project's assessment of effects to the natural character of the existing surroundings is based on the history, existing uses, and expected future uses of the area.

### 16.3.1 History, Current Uses, and Expected Future Uses of the Project and Surrounding Areas

The Project and surrounding areas are predominantly commercial forests that were logged within the last 10 years and are generally in vegetative regrowth. A series of access roads maintained by logging companies penetrate the forested areas, allowing access by forestry equipment such as skidders and logging trucks. A network of logging access roads and remnants of old and recent skidder trails are present throughout the Project Area. There are no existing structures in the Project Area. Commercial logging is expected to continue in surrounding areas.

Numerous streams and wetlands are located in the Project Area and surrounding lands (see **Exhibit 6 – Structures, Features, and Uses** for additional detail). Several lakes and ponds are located outside of the Project Area including Pickett Mountain Pond and Pleasant Lake.

Special natural areas were not observed during site reconnaissance for the wetland delineation (see **Exhibit 6 – Structures, Features, and Uses** for additional detail). The MNAP prepared an environmental site review and identified no rare botanical features in the Project Area based on available data (see **Exhibit 26 – Rare of Special Plant Communities and Wildlife Habitat** for additional information).

### 16.3.2 Impact to Natural Character

The Project is not expected to negatively impact the area from increased sound levels or visibility. As modeled by Wood, cumulative sound levels are expected to be below the most stringent MDEP and LUPC thresholds. As modeled by Stantec and TJD&A, tree cover and topography obstruct the view from most surrounding areas.

The Project has been designed to fit in with the existing surroundings in the following ways.

[15] US Occupational Safety and Health Administration (OSHA). Updated 04/28/2022. OSHA Technical Manual (OTM) Section III: Chapter 5 Noise. Available at: https://www.osha.gov/otm/section-3-health-hazards/chapter-5

- A 400-foot-wide undisturbed area along the outer-edge of Project area and within the rezone area will be included.
- Structures and facilities have been sited to avoid streams and wetlands.
- Lighting will be less than 160 watts and housed in downward facing full cut-off fixtures to minimize light pollution.
- The below ground operation results in a small footprint when compared to a surface mine.
- After mine operation ceases, the site will be restored to its pre-mining state, except for the solar area, which will be decommissioned at the end of its life pending approval by the utility to continue operations post mining. All buildings and equipment will be removed. The site will be restored to natural contours and revegetated.

The low sound and noise impacts and harmonious project design elements combine to achieve a Project with insignificant impacts that fits in well with the surrounding area of predominantly commercial logging forests and access roads.

# EXHIBIT 16 FIGURES

Figure 16-1: 3-Mile Viewshed Analysis Using Ground Elevation Data

Figure 16-2: 3-Mile Viewshed Analysis Considering Forest Cover and 40-foot Canopy Heights

# EXHIBIT 16 ATTACHMENTS

Attachment 16-A: Line of Sight Analysis from Pleasant Lake

Attachment 16-B: Noise Assessment

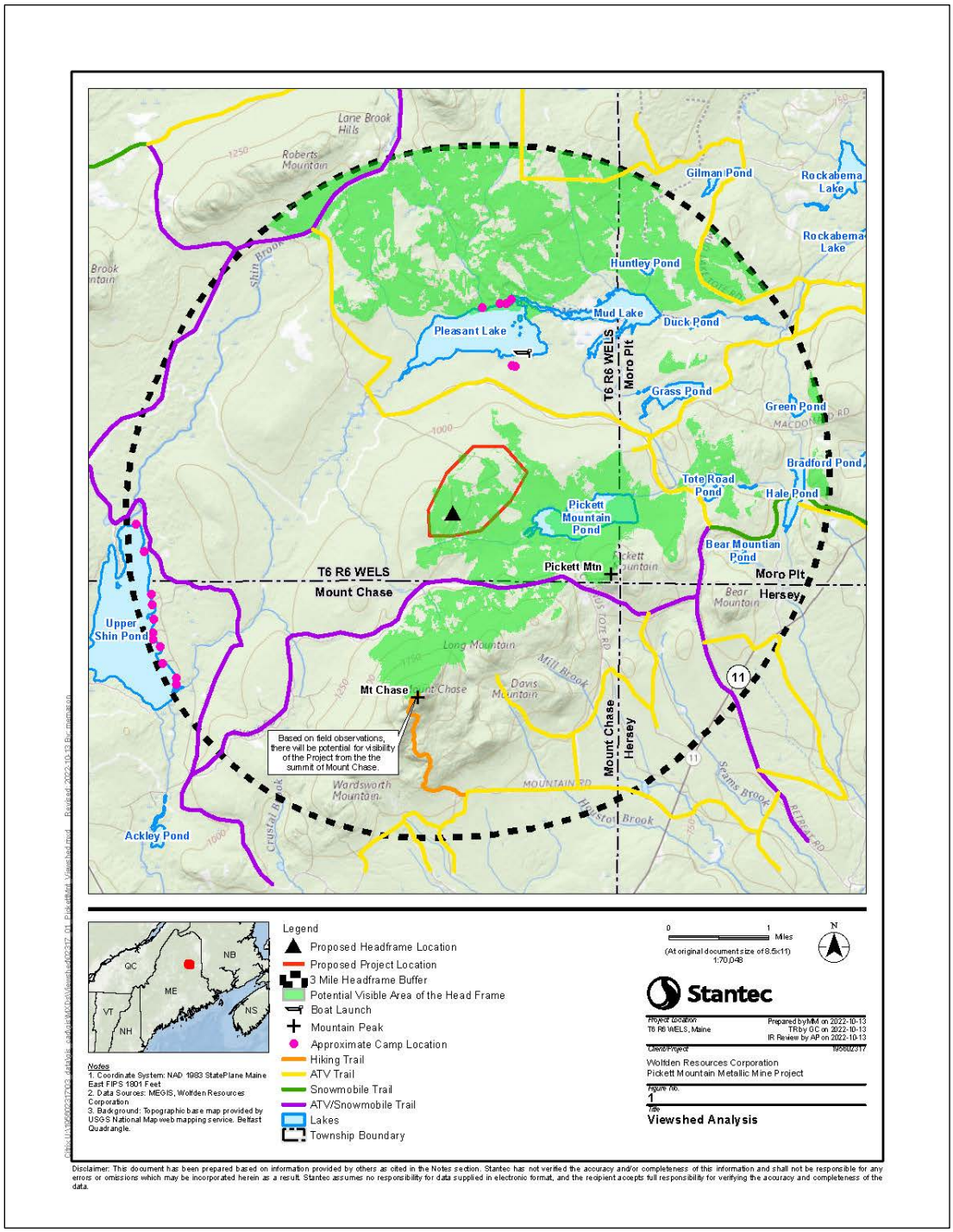



**Figure 16-1: 3-Mile Viewshed Analysis Using Ground Elevation Data.**

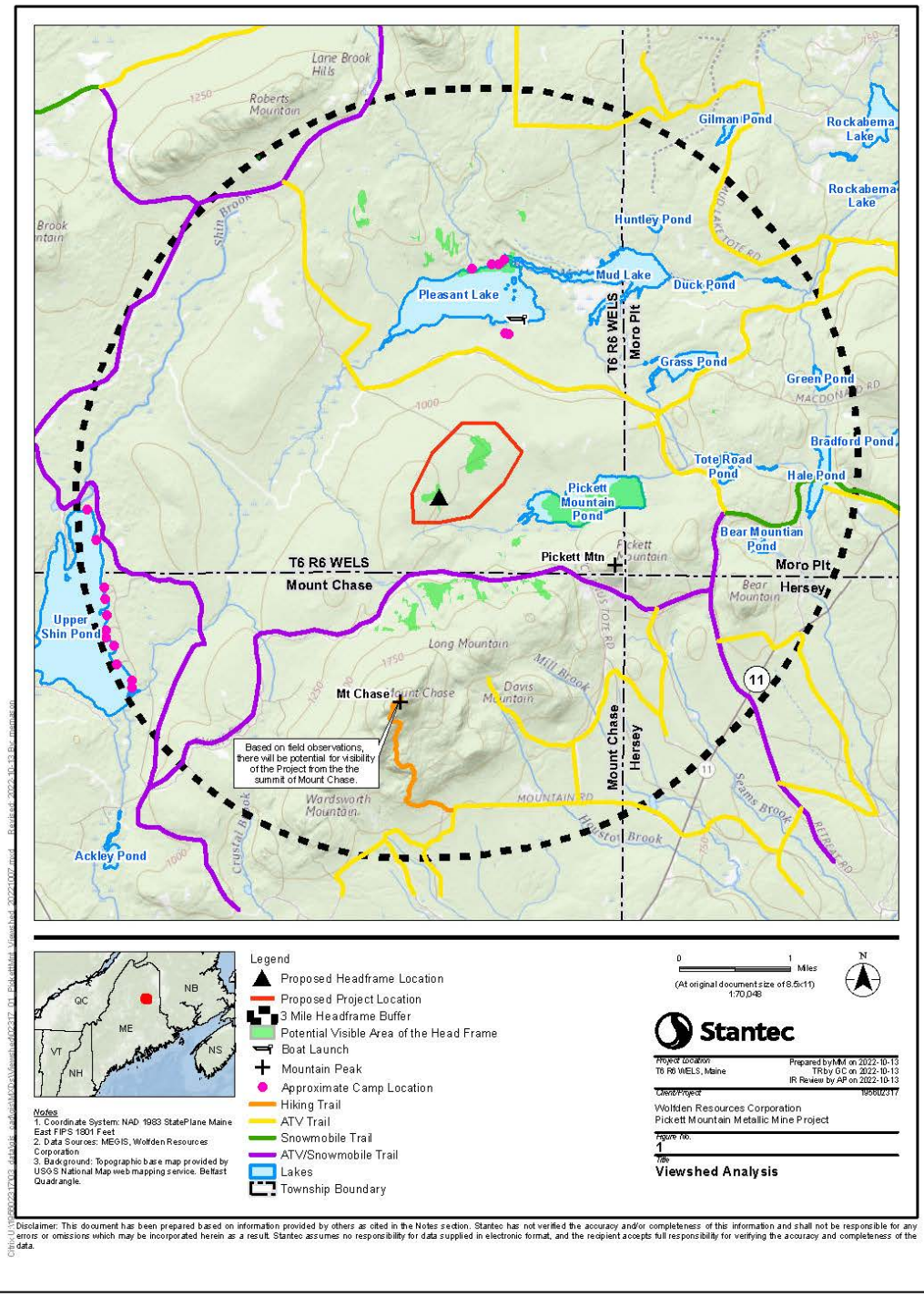



**Figure 16-2: 3-Mile Viewshed Analysis Considering Forest Cover and 40-foot Canopy Heights.**

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 16-A: Line of Sight Analysis from Pleasant Lake

tjd&a | Landscape Architects & Planners

October 13, 2022

TO: Brooke Barnes / Stantec

FR: Steve Thompson / TJD&A

**RE: Proposed Pickett Mountain Metallic Mine Project in T6 R6 WELS, Maine**
**PLEASANT LAKE SIGHT-LINE ANALYSIS**

TJD&A was retained by Stantec to provide sight-line analysis of Pickett Mountain Metallic Mine Project (Project) components in the surrounding area to determine potential Project visibility from specific locations. This study focused on visibility from the water and a cluster of camps on Pleasant Lake in T6 R6 WELS. This memo and an attached sight-line analysis summarize our methodology and findings.

## METHODOLOGY

To determine the degree of potential visibility along sightlines from Pleasant Lake, a Digital Terrain Model (DTM) and Digital Surface Model (DSM) was processed at a three foot resolution from LIDAR Point Cloud data available from National Mapper[1]. The DSM model, which includes both vegetation and structures, was used to determine where existing vegetation surrounding the proposed Project may block or filter views of the Project components.

The sight-line analysis focused on determining the potential for visibility of two Project components: (1) the headframe, measuring approximately 120 feet and (2) a representative point from the proposed solar array. In order to provide a conservative assessment of visibility, the point used for the solar array was from the highest point within the proposed array area. Solar panels were assumed to have a design height of 12 feet above ground. Using ESRI ArcPro software, section lines were created from the Pleasant Lake surface (5-feet above the water line) and from the cluster of camps along the lake shoreline (5-feet above the surface data). The length of the section lines are approximately 1.5 to 2 miles between the selected viewpoints and the proposed infrastructure.

[1] U.S. Geological Survey, 20190501, USGS Lidar Point Cloud ME Eastern B1 2017 19TEM540106 LAS 2019: U.S. Geological Survey. (Data collected in 2017)

**CONCLUSION**

The sight-line analysis of the headframe indicates only limited visibility of the structure due to intervening vegetation when viewed from Pleasant Lake and shoreline camps. The sight-line analysis of the proposed solar array indicates that vegetation will completely screen views of the proposed solar panels from the lake and shoreline camps.

Based on the sight-line analysis described above, it is our conclusion the Project as proposed will likely not have an unreasonable adverse visual impact on Pleasant Lake and shoreline camps. The effects of distance, terrain, and vegetation will screen (or partially screen) all Project components. It is likely that the proposed solar array will be screened completely. The headframe structure may be partially visible over the tree line, but will not dominate the landscape when viewed from Pleasant Lake and the immediate shoreline.

# PLEASANT LAKE SIGHT-LINE ANALYSIS

**PICKETT MOUNTAIN PROJECT, T6 R6 WELS, Maine**

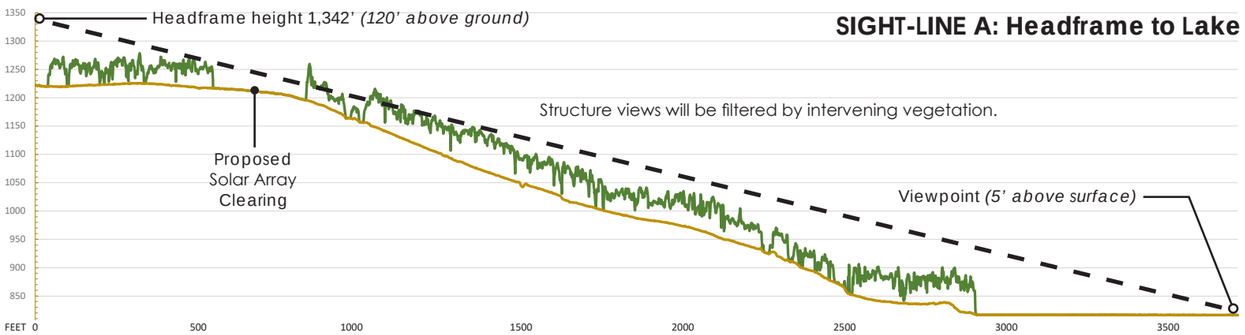
**October 13, 2022**

tjd&a

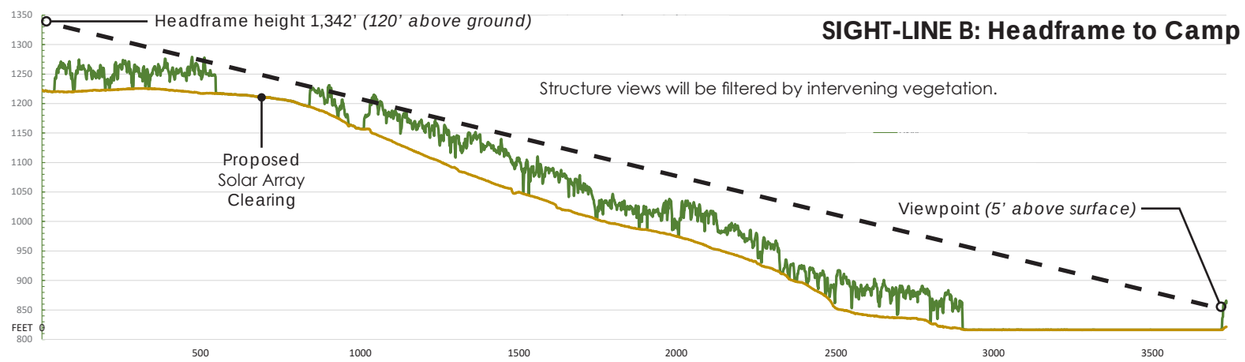
## *SIGHT-LINES*

*DSM (Vegetation)* *DTM (Terrain)*

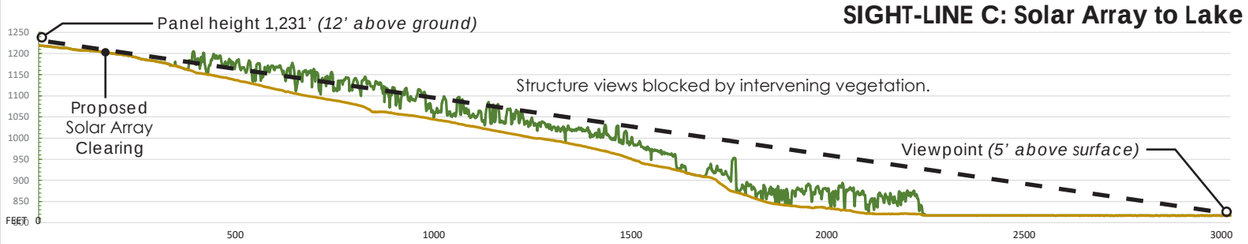
### SIGHT-LINE A: Headframe to Lake



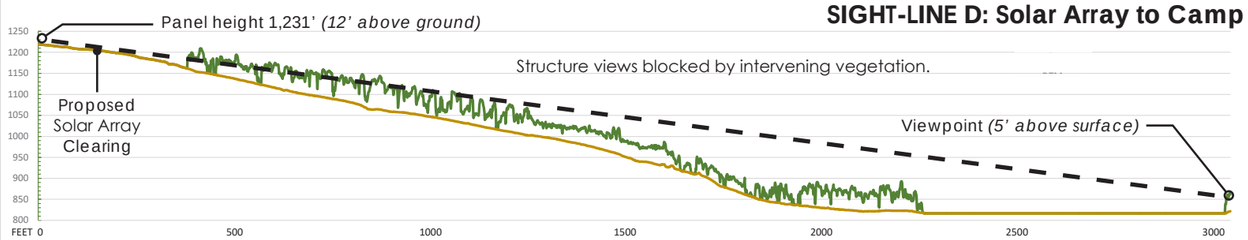

### SIGHT-LINE B: Headframe to Camp



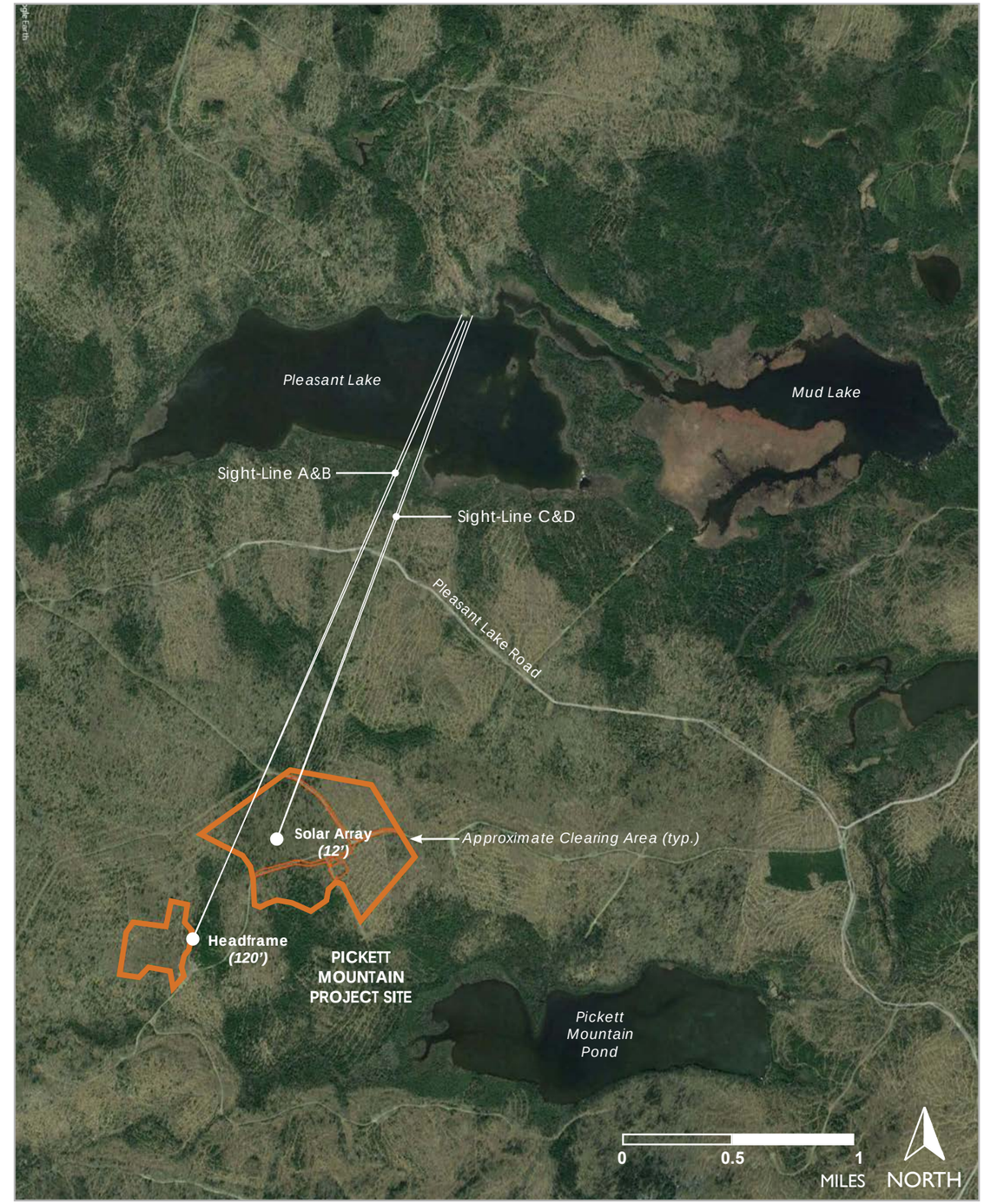

### SIGHT-LINE C: Solar Array to Lake




### SIGHT-LINE D: Solar Array to Camp




## *CONTEXT MAP*



**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 16-B: Noise Assessment

Wood Group Asset Integrity Solutions, Inc.
Vibration Dynamics and Noise (VDN)
118, 4242 – 7 Street SE, Calgary
Alberta T2G 2Y8
Canada
T: 403-245-5666
**www.woodplc.com/vdn**

# Technical Memorandum

| | | | |
|---|---|---|---|
| **To:** | Jeremy Ouellette, Wolfden Resources Corporation | **Date:** | October 12, 2022 |
| **From:** | Juan Vences – Acoustics & Vibration Analyst, Wood VDN | | |
| **CC:** | Henrik Olsen, Principal Consultant – Acoustics & Vibration, Wood VDN | | |
| | Mike Cyca, Service Lead Americas – Noise, Wood VDN | | |
| | Peter Baker, Senior Program Manager – WPS USA Environment and Infrastructure, Inc. | | |
| **Ref:** | Noise Model – Pickett Mountain – Wolfden Resources Corporation | | |
| **Re:** | Noise Assessment Report | | |

## 1.0 INTRODUCTION

Wood Environment & Infrastructure Solutions (Wood), has been retained by Stantec to support Wolfden Resource Corporation's Pickett Mountain Project ("Project"). Wood's Vibration, Dynamics and Noise (VDN) team was engaged to prepare the noise model for this project.

This memorandum presents the results of the VDN's team noise modelling as well as an assessment of the noise modelling results against the applicable noise criteria for the Project.

This memorandum takes into account the noise assessment requirements for the Project identified in the letter from the State of Maine, Department of Agriculture, Conservation & Forestry: Land Use Planning Commission (LUPC) [1]. Recommendations from the Third-Party Peer Review TPPR for revisions to the noise study have been taken into consideration in this memorandum.

## 2.0 PROJECT DESCRIPTION

The Project is located in Northern Maine in Township 6, Range 6 of Penobscot County, approximately 4.4 miles west of state Highway 11. The land that the Project site is located on is currently zoned by LUPC as a General Management subdistrict (M-GN) [4]. Figures which provide information regarding the Project location, surrounding land uses and the site layout are provided in Appendix A.

The mine only operation will produce an estimated 1200 tonnes per day (tpd) of ore. of the ore material will be hauled off site using 80,000lbs trucks 12 hours per day. The site and associated activities are planned to operate 24 hours per day.

## 3.0 NOISE SOURCE SUMMARY

Given the current stage of the Project, only preliminary information is available with respect to the mining equipment selection and usage. Six (6) types of sound source have been identified as significant (i.e., as potentially emitting sound at a level where their cumulative impacts could be of concern) at the site for the operations phase and are summarized as follows:

- Two (2) diesel fueled electrical power generator sets (CAT C27 or similar, only one is expected to be in operation and the other one as back up);
- Two (2) ventilation fans (Hurley HVT axial fan, 72", approximately 300 horsepower);
- One (1) front-end loader (Caterpillar 930 or similar);
- One (1) backfill plant;
- Surface haul trucks (Volvo VNL 860 or similar) that will transport the mined ore rocks

  from mine site to off-site processing facility (only day operation hours, 7am to 7pm);

  and
- Two (2) truck haul routes inside the facility for:
  - Underground haul truck from portal to stockpile (Caterpillar AD30 or similar); and
  - Surface haul truck (Volvo VNL 860 or similar).

The hourly truck traffic count for the truck haul route was calculated based on the expected volume of daily material movement and the typical haul truck capacity. Sound emission values for the equipment were predicted using either manufacturer data based on the preliminary equipment selections, or reference levels published in the Roadway Construction Noise Model (RCNM) User's Guide [5].

A summary of the noise sources considered in the assessment is provided in Table 3-1, and the associated manufacturer specifications can be found in Appendix B. An aerial view of the noise source locations is shown in Figure 1 in Appendix C.

**Table 3-1: Noise Source Summary**

| Noise Source | Sound Power Level [dBA] |
|---|---|
| Generator [1, 2] | 125 |
| Ventilation fan [3] | 117 |
| Loader [1] | 101 |
| Backfill Plant [4] | 115 |
| Underground haul truck [1, 5] | 105 |
| continues on next page | |

| Noise Source | Sound Power Level [dBA] |
|---|---|
| Surface haul truck inside Facility [4, 5] | 109 |
| Surface haul truck *outside* Facility [4, 5] | 121 |

Notes:

1. Sound power levels obtained from manufacturer specifications of the preliminarily selected (or similar) equipment.
2. Sound power level for gensets considering typical "Cummings" industrial/commercial exhaust silencer values.
3. Sound power level estimated based on the ASHRAE Handbook [6] with the following assumption:
   - Hub ratio 0.6  0.8.
   - Flowrate 200,000 cubic feet per minute (cfm).
   - Static pressure 2 inches water column (in. w.c.).
   - Fan power 300 hp.
4. Sound power levels estimated based on levels published in the RCNM User's Guide [3].
5. Sound power levels shown for truck routes represent the levels for line sources (as moving point sources) with the hourly truck traffic count and estimated operation speed taken into account.

## 4.0 POINT OF RECEPTION (POR) SUMMARY

The nearest property boundary from the site is approximately 750 meters (2,500 feet) to the south near Fire Road C. The property boundary to the north is approximately 4,000 m (2.5 miles) away from the site, and the boundaries to the west and east are approximately 1,500 m (1 mile) away.

Six residential properties with seasonal dwellings have been identified on the southern and northern shore of Pleasant Lake. Three points of reception (POR) locations were selected to represent the identified residences, the closest of which is approximately 1,200 m (4,000 ft) away from the site to the north, on the south side of Pleasant Lake.

Recreational uses have also been identified around the site. These include nearby ponds and lakes such as Pickett Mountain Pond, Tote Road Pond, Grass Pond, Mud Lake, Pleasant Lake, and Upper Shin Pond. Six recreational use POR locations, with varying distances from the site, were selected as representative of the recreational land uses around the site. The recreational POR located closest to the site is near the Pickett Mountain Pond and approximately 350 m (1,100 ft) away.

Noise levels were assessed at the identified PORs as well as at Wolfden's property boundaries. One representative POR was selected at each of the four cardinal directions.

Table 4-1 provides a summary of the selected representative receptors, including UTM coordinates and ground elevation. For this study an assumed height of 1.5 m (5 ft) above ground was used for all receptors which corresponds to the average height of a first-storey outside window. An aerial view of the receptor locations in relation to the Project can be found in Figure 1 in Appendix C.

**Table 4-1: Point of Reception Summary**

| POR | | UTM Coordinates (UTM 19N) | | Ground Elevation [m] | Height Above Ground [m] |
|---|---|---|---|---|---|
| ID | Type | Easting [m] | Northing [m] | | |
| POR01 | Residential | 541830.6 | 5111505.1 | 256.7 | 1.5 |

| POR | | UTM Coordinates (UTM 19N) | | Ground Elevation [m] | Height Above Ground [m] |
|---|---|---|---|---|---|
| ID | Type | Easting [m] | Northing [m] | | |
| POR02 | Residential | 541647.8 | 5112524.8 | 251.5 | 1.5 |
| POR03 | Residential | 541338.4 | 5112425.0 | 250.0 | 1.5 |
| POR04 | Recreational use | 541997.1 | 5108830.5 | 318.8 | 1.5 |
| POR05 | Recreational use | 544812.3 | 5109532.8 | 308.0 | 1.5 |
| POR06 | Recreational use | 543820.8 | 5110691.3 | 284.0 | 1.5 |
| POR07 | Recreational use | 543037.1 | 5111629.8 | 250.0 | 1.5 |
| POR08 | Recreational use | 540007.8 | 5111270.6 | 250.0 | 1.5 |
| POR09 | Recreational use | 536223.1 | 5107006.7 | 243.0 | 1.5 |
| POR-PB-N | Property Boundary - North | 541038.9 | 5114065.6 | 313.5 | 1.5 |
| POR-PB-S | Property Boundary - South | 541302.2 | 5108056.5 | 377.9 | 1.5 |
| POR-PB-W | Property Boundary - West | 538657.5 | 5109574.7 | 264.1 | 1.5 |
| POR-PB-E | Property Boundary - East | 543547.1 | 5109623.9 | 325.2 | 1.5 |

## 5.0 APPLICABLE GUIDELINES

The noise guideline and sound limits applicable for the Project are described in the Maine Department of Environmental Protection (DEP) Site Location of Development regulations for Control of Noise (Chapter 375.10) [5] and LUPC Chapter 10 (01-672 CMR 10.25, F). LUPC most conservative standard noise guideline match with DEP guidelines. The recreational use locations are not defined as "protected locations" under the regulatory definition. There are no specific Chapter 375.10 or LUPC limits that apply to these areas. To be conservative, the limit is assumed to the same as the limit for residential locations in quiet areas. They are included in this analysis to provide information for LUPC to evaluate under Chapter 12(4)(B), no undue impact on existing uses. Table 5-1 provides a summary of the noise criteria specified in DEP's Chapter 375.10 guidelines.

**Table 5-1: Sound Pressure Level Limits**

| Location | 7:00 AM to 7:00 PM | 7:00 PM to 7:00 AM |
|---|---|---|
| Property line of the development or contiguous property | 75 dBA | 75 dBA |
| Protected location in a commercial/ transportation/industrial area | 70 dBA | 60 dBA |
| Protected location NOT in a commercial/transportation/industrial area | 60 dBA | 50 dBA |
| Protected location in a quiet area [1] | 55 dBA | 45 dBA |

Notes:
1. This refers to areas where the daytime pre-development ambient hourly sound level at a protected location is equal to or less than 45 dBA and/or the nighttime pre-development ambient hourly sound level at a protected location is equal to or less than 35dBA.

Based on the information presented in Table 5-1 and in association with the receptor types listed in Table 4-1, the noise guidelines and limits established for the identified PORs are summarized in Table 5-2.

**Table 5-2: Sound Pressure Level Limits for Identified PORs**

| POR | 7:00 AM to 7:00 PM | 7:00 PM to 7:00 AM |
|---|---|---|
| Residential PORs, 01-03 | 55 dBA [1] | 45 dBA [1] |
| Recreational use PORs, 04-09 | 55 dBA [1] | 55 dBA |
| Property Boundary (PB) | 75 dBA | 75 dBA |

Notes:
1. Based on a review of the area surrounding the Project site, it is assumed, as a conservative approach, that sound levels at nearby protected locations meet the criteria for quiet areas. Nighttime limit of 45dBA applies only to areas within 500 feet of the living or sleeping quarters [5].

## 6.0 ACOUSTIC ASSESSMENT

### 6.1. Methodology

The sound impact assessment for the Project was completed using a noise prediction software package (CadnaA), published by Datakustik GmbH and configured to implement the ISO 9613-2 [8] environmental noise propagation algorithms. It allows the creation of complex acoustical models and predicts noise levels at specific receptors due to sound emissions from a specific source(s). The modelling takes into account the following factors:

- Source sound power level and directivity;
- Distance attenuation;
- Source-receptor geometry, including heights and elevations;
- Barrier effects of the building and surrounding topography; and
- Ground and air (atmospheric) attenuation.

Topographical data for the site and surrounding area was provided and used to create a terrain model for the assessment. Based on the sound power data presented in Table 3-1, noise levels induced from the Project were calculated at the selected receptors. All noise sources were assumed to operate simultaneously to model the predictable worst-case scenario.

### 6.2. Modelling Results

Table 6-1 lists the noise levels predicted at each of the PORs as well as at the property boundaries. The levels predicted for daytime and nighttime periods are the same at each of the receptors as the site is expected to operate 24 hours per day, except for trucks hauling material off-site during nighttime.

A noise contour map was also generated and presented in Figure 2 of Appendix C to show the noise levels of the area surrounding the site. The contours corresponding to the established noise limits of 75 dBA (daytime/nighttime), 55 dBA (daytime) and 45 dBA (nighttime) are highlighted on the map.

A review of the results presented in Table 6-1 and Figure 2 indicated that the predicted sound levels are within all applicable regulatory limits.

**Table 6-1: Noise Levels Summary**

| POR | Daytime (7:00 AM to 7:00 PM) | | | Nighttime (7:00 PM to 7:00 AM) | | |
|---|---|---|---|---|---|---|
| | Limit [1] [dBA] | Predicted Level [dBA] | Meets applicable limits [Yes/No] | Limit [1] [dBA] | Predicted Level [dBA] | Meets applicable limits [Yes/No] |
| POR01 | 55 | 33 | Yes | 45 | 29 | Yes |
| POR02 | 55 | 33 | Yes | 45 | 32 | Yes |
| POR03 | 55 | 34 | Yes | 45 | 33 | Yes |
| POR04 | 55 | 47 | Yes | 55 | 45 | Yes |
| POR05 | 55 | 51 | Yes | 55 | 29 | Yes |
| POR06 | 55 | 42 | Yes | 55 | 33 | Yes |
| POR07 | 55 | 37 | Yes | 55 | 37 | Yes |
| POR08 | 55 | 36 | Yes | 55 | 35 | Yes |
| POR09 | 55 | 19 | Yes | 55 | 19 | Yes |
| POR-PB-N | 75 | 27 | Yes | 75 | 25 | Yes |
| POR-PB-S | 75 | 42 | Yes | 75 | 42 | Yes |
| POR-PB-W | 75 | 32 | Yes | 75 | 32 | Yes |
| POR-PB-E | 75 | 44 | Yes | 75 | 36 | Yes |

Notes:
1. Noise limits specified in Table 5-2

## 7.0 CONCLUSIONS

The noise impacts associated with the Project operations were assessed through predictive acoustic modelling. The sound level limits established in the Chapter 375.10 of the DEP regulations were used as the criteria for the impact assessment. These thresholds also match with the LUPC's most conservative sound level limits. Should more details of the Project become available at further stages of the development, the assessment may need to be updated to reflect the latest development progress.

The acoustic assessment indicated that the noise levels from Project operations are expected to meet the applicable daytime and nighttime DEP limits.

## 8.0 CLOSURE

This memorandum presents the noise assessment conducted for the proposed Picket Mountain Project for the Wolfden Resources Corporation.

Should you have any questions regarding this memorandum, please do not hesitate to contact the undersigned.

Sincerely,
**Wood Group Asset Integrity Solutions, Inc.**

Juan Vences, M.Sc., E.I.T.
Acoustics and Vibration Analyst

Henrik Olsen, INCE
Principal Consultant - Acoustics & Vibration

c.c.

## 9.0 REFERENCE

[1] State of Maine, Department of Agriculture, Conservation & Forestry, Land Use Planning Commission, "Letter to Wolfden Mt. Chase, LLC, ZP 779, Pickett Mountain Mine," September 12, 2020.

[2] MAINE LAND USE PLANNING COMMISSION, "LAND USE DISTRICTS AND STANDARDS," 2019.

[3] U.S. Department of Transportation, Federal Highway Administration, "FHWA Roadway Construction Noise Model User's Guide," 2006.

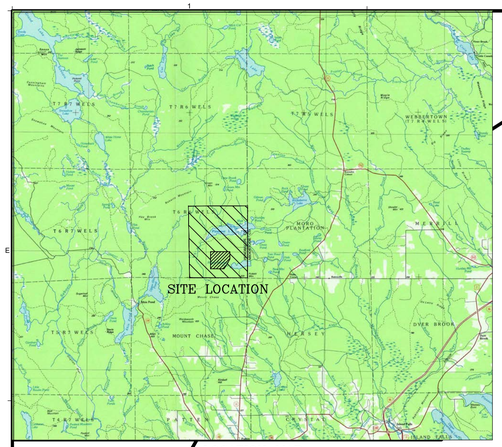
[4] American Society Of Heating, Refrigeration, & Air Conditioning Engineers, Inc., "HVAC Applications, Chapter 42 - Sound and Vibration Control," 1991.

[5] Maine Department of Environmental Protection (DEP), "Site Location of Development, Chapter 375, No Adverse Environmental Effect Standard of Site Location Law".

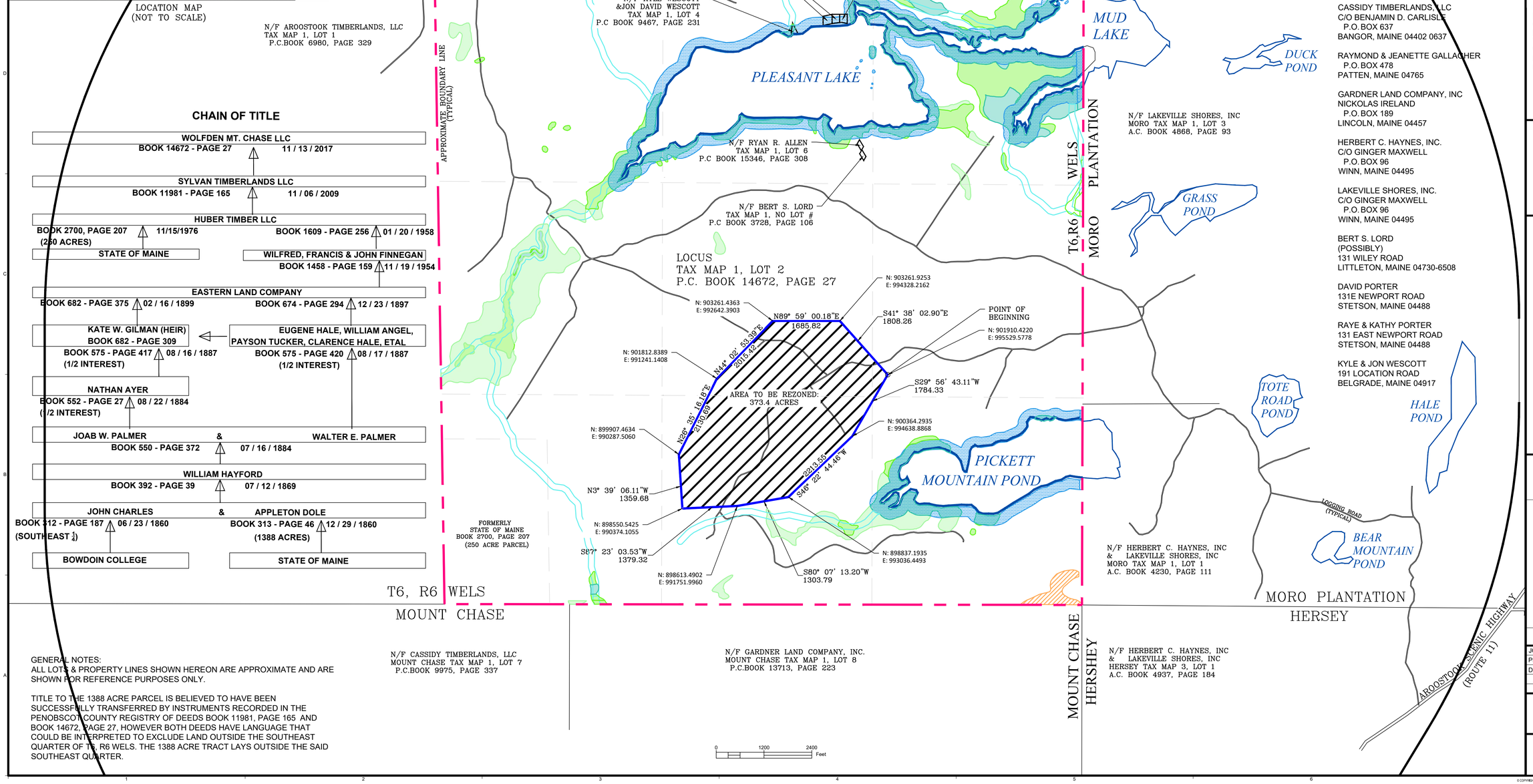
[6] International Organization for Standardization, "ISO-9613-2. Acoustics – Attenuation of Sound during propagation outdoors. Part 2 – General method of calculation," 1996.

# Appendix A

## Project Drawings




LOCATION MAP
(NOT TO SCALE)




## CHAIN OF TITLE

- **WOLFDEN MT. CHASE LLC** — BOOK 14672 - PAGE 27 — 11 / 13 / 2017
- **SYLVAN TIMBERLANDS LLC** — BOOK 11981 - PAGE 165 — 11 / 06 / 2009
- **HUBER TIMBER LLC** — BOOK 2700, PAGE 207 (250 ACRES) — 11/15/1976
  - **STATE OF MAINE**
  - **WILFRED, FRANCIS & JOHN FINNEGAN** — BOOK 1458 - PAGE 159 — 11 / 19 / 1954
- **EASTERN LAND COMPANY** — BOOK 682 - PAGE 375 — 02 / 16 / 1899; BOOK 674 - PAGE 294 — 12 / 23 / 1897
  - **KATE W. GILMAN (HEIR)** — BOOK 682 - PAGE 309
    - **BOOK 575 - PAGE 417** (1/2 INTEREST) — 08 / 16 / 1887
    - **NATHAN AYER** — BOOK 552 - PAGE 27 (1/2 INTEREST) — 08 / 22 / 1884
      - **JOAB W. PALMER** & **WALTER E. PALMER** — BOOK 550 - PAGE 372 — 07 / 16 / 1884
        - **WILLIAM HAYFORD** — BOOK 392 - PAGE 39 — 07 / 12 / 1869
          - **JOHN CHARLES** & **APPLETON DOLE**
            - **BOOK 312 - PAGE 187** (SOUTHEAST ¼) — 06 / 23 / 1860
              - **BOWDOIN COLLEGE**
            - **BOOK 313 - PAGE 46** (1388 ACRES) — 12 / 29 / 1860
              - **STATE OF MAINE**
  - **EUGENE HALE, WILLIAM ANGEL, PAYSON TUCKER, CLARENCE HALE, ETAL** — BOOK 575 - PAGE 420 (1/2 INTEREST) — 08 / 17 / 1887

GENERAL NOTES:
ALL LOTS & PROPERTY LINES SHOWN HEREON ARE APPROXIMATE AND ARE SHOWN FOR REFERENCE PURPOSES ONLY.

TITLE TO THE 1388 ACRE PARCEL IS BELIEVED TO HAVE BEEN SUCCESSFULLY TRANSFERRED BY INSTRUMENTS RECORDED IN THE PENOBSCOT COUNTY REGISTRY OF DEEDS BOOK 11981, PAGE 165 AND BOOK 14672, PAGE 27, HOWEVER BOTH DEEDS HAVE LANGUAGE THAT COULD BE INTERPRETED TO EXCLUDE LAND OUTSIDE THE SOUTHEAST QUARTER OF T6, R6 WELS. THE 1388 ACRE TRACT LAYS OUTSIDE THE SAID SOUTHEAST QUARTER.

ZONING LEGEND
- P-GP: GREAT POND
- P-SG: SOILS AND GEOLOGY
- P-SL2: SHORELAND - 75'
- PWL1: WETLANDS OF SPECIAL SIGNIFICANCE
- PWL2: SCRUB-SHRUB WETLANDS
- PWL3: FORESTED WETLANDS

ABUTTING LAND OWNER ADDRESSES:

RYAN R. ALLEN
8 KNOTTA WAY
NAPLES, MAINE 04055

AROOSTOOK TIMBERLANDS, LLC.
P.O. BOX 5777
SAINT JOHN, NEW BRUNSWICK
E2L 4M3, CANADA

CASSIDY TIMBERLANDS, LLC
C/O BENJAMIN D. CARLISLE
P.O. BOX 637
BANGOR, MAINE 04402 0637

RAYMOND & JEANETTE GALLAGHER
P.O. BOX 478
PATTEN, MAINE 04765

GARDNER LAND COMPANY, INC
NICKOLAS IRELAND
P.O. BOX 189
LINCOLN, MAINE 04457

HERBERT C. HAYNES, INC.
C/O GINGER MAXWELL
P.O. BOX 96
WINN, MAINE 04495

LAKEVILLE SHORES, INC.
C/O GINGER MAXWELL
P.O. BOX 96
WINN, MAINE 04495

BERT S. LORD
(POSSIBLY)
131 WILEY ROAD
LITTLETON, MAINE 04730-6508

DAVID PORTER
131E NEWPORT ROAD
STETSON, MAINE 04488

RAYE & KATHY PORTER
131 EAST NEWPORT ROAD
STETSON, MAINE 04488

KYLE & JON WESCOTT
191 LOCATION ROAD
BELGRADE, MAINE 04917

wood.
Environment & Infrastructure Solutions, Inc.
511 Congress St, Suite 200, Portland ME 04101
P: (207) 775-5401 F: (207) 772-4762 www.woodplc.com

PROJECT
WOLFDEN RESOURCES CORPORATION
1100 RUSSELL STREET
THUNDER BAY, ONTARIO
CANADA, P7B 5N2

AUGUST 2022

DEED SKETCH OF BOUNDARY
FOR WOLFDEN MT CHASE LLC
T6, R6, WELS, MAINE

| REV | REVISION ISSUE DESCRIPTION | DATE |
|---|---|---|
| #3 | REZONE BOUNDARY | 08-23-22 |
| #2 | GENERAL REVISION | 05-08-20 |
| #1 | ADDITIONAL DATA | 12-23-19 |

JOB NO. 3617197478:
PROJECT MANAGER
DRAWN BY WJW

SHEET 1
OF
1

FIG 6-2

NOT FOR CONSTRUCTION

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WOLFDEN

# Attachment K

## LEGEND

- Area Proposed for Rezoning
- 3 Mile Buffer

DEVELOPMENT SUBDISTRICTS

- D-CI: Commercial Industrial
- D-GN: General
- D-RS: Residential

MANAGEMENT SUBDISTRICTS

- M-GN: General

PROTECTION SUBDISTRICTS

- P-FP: Flood Prone
- P-FW: Fish and Wildlife
- P-GP: Great Pond
- P-RR: Recreation
- P-SG: Soils and Geology
- P-SL2: Shoreland - 75'
- P-WL1: Wetlands of Special Significance
- P-WL2: Scrub-shrub Wetlands
- P-WL3: Forested Wetlands

NOTE: No fragile mountain areas, public lands or registered critical areas within a three-mile radius of the mining area.

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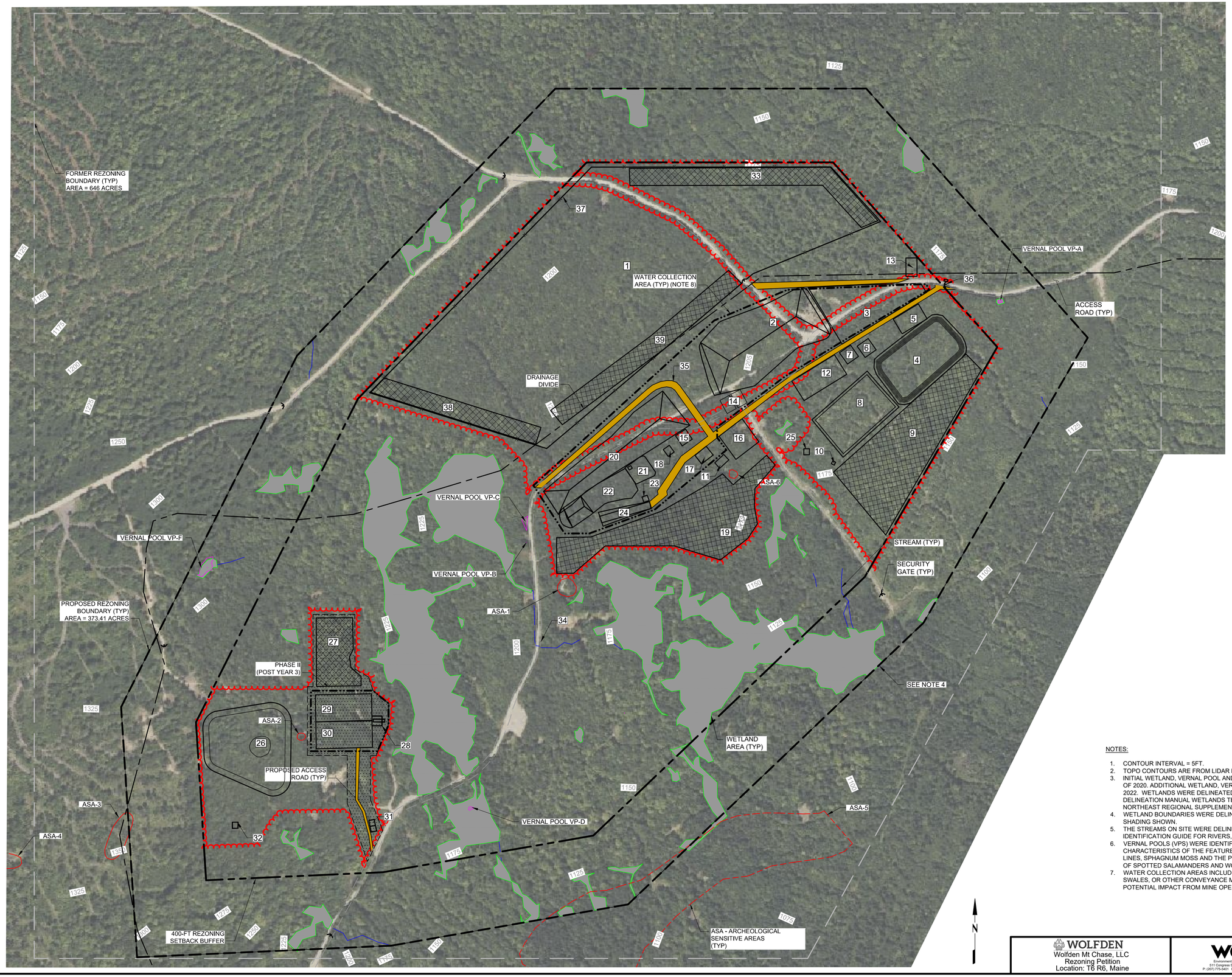
N

0 900 1,800 Feet

Prepared/Date: BRP 08-29-22 | Checked/Date: MAP 08-29-22




| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACLITY |
| 6 | ELECTRICAL SUBSTATION |
| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
| 8 | POST-TREATMENT WATER STORAGE POND |
| 9 | INFILTRATION GALLERY #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | INFILTRATION GALLERY #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | INFILTRATION GALLERY #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | INFILTRATION GALLERY #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | INFILTRATION GALLERY #5 |
| 39 | INFILTRATION GALLERY #6 |

LEGEND:

- 1125 MAJOR CONTOURS
- 1124 MINOR CONTOURS
- STREAM
- EXISTING SITE ROAD
- VERNAL POOLS
- ASA - ARCHEOLOGICAL SENSITIVE AREAS
- 400-FEET REZONING SETBACK BUFFER
- PROPOSED REZONING
- OLD REZONING
- WETLAND
- 14 FACILITIES DESIGN
- WATER COLLECTION AREA
- INFILTRATION GALLERY
- PHASE II (POST YEAR)
- PROPOSED SITE ROAD
- DRAINAGE DIVIDE
- X SECURITY FENCE
- SECURITY GATE
- CLEARING LIMIT

NOTES:

1. CONTOUR INTERVAL = 5FT.
2. TOPO CONTOURS ARE FROM LIDAR DATA (NOAA.GOV), MARCH 2021.
3. INITIAL WETLAND, VERNAL POOL AND STREAM DATA WERE COLLECTED BY WOOD AND OTHERS IN MAY-JUNE OF 2020. ADDITIONAL WETLAND, VERNAL POOL, AND STREAM DATA WERE COLLECTED BY STANTEC-JUNE OF 2022. WETLANDS WERE DELINEATED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL WETLANDS TECHNICAL REPORT (Y-87-1) AND THE NORTH CENTRAL AND THE NORTHEAST REGIONAL SUPPLEMENT (ERDC/EL TR-12-1).
4. WETLAND BOUNDARIES WERE DELINEATED WITHIN THE REZONE BOUNDARY AND MAY CONTINUE BEYOND THE SHADING SHOWN.
5. THE STREAMS ON SITE WERE DELINEATED FOLLOWING THE NATURAL RESOURCE PROTECTION ACT (NRPA) IDENTIFICATION GUIDE FOR RIVERS, STREAMS, AND BROOKS (DANIELSON, 2018).
6. VERNAL POOLS (VPS) WERE IDENTIFIED ON MAY 17, MAY 18, AND MAY 28, 2020, BASED ON PHYSICAL CHARACTERISTICS OF THE FEATURES INCLUDING ISOLATED WATER BODIES, WATER STAINED LEAVES, WATER LINES, SPHAGNUM MOSS AND THE PRESENCE OF HYDROPHYTIC VEGETATION AS WELL AS EGG MASS COUNTS OF SPOTTED SALAMANDERS AND WOOD FROGS WERE COLLECTED.
7. WATER COLLECTION AREAS INCLUDE AREAS WHERE STORMWATER RUNOFF IS COLLECTED BY BERMS, SWALES, OR OTHER CONVEYANCE METHODS AND TREATED AT THE WATER TREATMENT FACILITY DUE TO POTENTIAL IMPACT FROM MINE OPERATIONS.

0 125 250 500
SCALE IN FEET

Prepared/Date: WJW 08/26/22
Checked/Date: MAP 08/26/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wood.
Environment & Infrastructure Solutions, Inc.
511 Congress St., Suite 200, Portland ME 04101
P: (207) 775-5401 F: (207) 772-4762 www.woodplc.com

CONCEPTUAL
SITE PLAN
Project 3617-22-7547
Figure 2-1

C:\Users\wilson.whitten\OneDrive - Wood PLC\Projects\Wolfden Resources\8.0 Drawings\Design 2022\Sheets\Figure 2-1_Conceptual Site Plan.dwg Fri, 26 Aug 2022 - 9:29am wilson.whitten

# Appendix B

# Manufacturer

# Data

SANDVIK

# SANDVIK TH430
# UNDERGROUND TRUCK

# RELIABLE AND PRODUCTIVE

## Designed for the underground

The TH430 is a reliable, hard-working dump truck specifically designed for underground conditions. With its robust structure, compact size and fit-for-purpose components, the truck is tailored to meet the productivity targets in challenging environments. The truck's new heavy-duty axles, using limited slip differentials to maintain traction, improve availability and reduce total costs of ownership.

## High payload capacity and ramp speeds

Equipment low own weight, 30 tonne payload capacity and high ramp speeds enable increased productivity. The standard Tier 2 engine with a gross power of 310 kW makes it the most powerful mining truck in its size class. Low own weight and high power enable high tramming speed up a decline, shortening cycle times. High engine peak torque and torque rise allow less downshifting and better acceleration, while the transmission automatic gear shifting and torque converter lock-up ensure fast speeds. Peak torque delivered at low engine rpm improves fuel economy and reduces noise.

## Maximum utilization of rated payload

To ensure maximum utilization of the rated payload on every trip, the TH430 can be equipped with Sandvik's Integrated Weighing System (IWS) for trucks. For an accurate result, the IWS considers the environmental temperature and the truck's inclination angle, and it is equipped with three-point measurement of the weight in the box. Real time weighing and signal lights – red, orange and green – advise the loader operator to ensure the rated capacity is reached before moving forward. In addition to accurately measuring the payload when loading the box, the IWS records the results to My Sandvik Digital Services Knowledge Box™. The Knowledge Box™ can transfer this production monitoring data through Wi-Fi connection for access via My Sandvik internet portal. Alternatively, data can be downloaded manually in the operator's compartment onto a USB stick.

## Full range of box options

Sandvik dump boxes are designed with extra volume; using a 90% fill factor in the box selection ensures the truck can be loaded to its full 30 tonne capacity, and reduces spillage during tramming. The smooth box design improves material flow when dumping. Reinforced steel structures use wear resistant steel for extended box lifetime.
Optional ejector box is available for backfilling and unloading in areas of restricted dump height.

# SUPERIOR OPERATOR ENVIRONMENT & SAFETY

**PREMIUM ERGONOMICS**

The modern cabin of the TH430 offers premium operator ergonomics. Low noise levels in the cabin, comfortable seat with low frequency pneumatic suspension to perfectly match the operator weight, adjustable steering wheel (tilt and telescopic) and arm rests as well as air conditioning system supplying fresh air; all help to reduce operator fatigue.

**FOR OPERATOR SAFETY**

The cabin uses dust and noise resistant upholstery materials, is ROPS and FOPS certified to protect the operator in case of roll over or falling objects, has laminated safety glass windows, emergency exits, and illuminated cabin entrance with three-point contact handles and anti-slip steps. The door system features a magnetic interlock switch, which automatically applies brakes when the cabin door is opened.

**EXCELLENT VISIBILITY**

A 5.7" LCD color display with adjustable contrast and brightness has all the needed information and alarms on one display, giving the operator more time to keep eyes on the road. Large windows and mirrors provide good visibility from the cabin, supported by efficient, adjustable LED lights as standard. To further improve operator visibility, the truck is equipped with reversing and right-hand side cameras as standard. For cold conditions, an optionally available cold conditions package helps to keep windows and mirrors free of ice and mist.

**FIRE SAFETY**

Significant efforts have been put to achieve top-level fire safety in the TH430. These include e.g. isolation of combustibles and ignition sources, heat insulation on exhaust manifold and turbo, and insulated exhaust pipe.

For fire suppression, Eclipse™ from Sandvik is available as an option. The Eclipse™ equipped with Sustain fire suppression agent is a sustainable choice, as it is the world's first fluorine-free fire suppression liquid for mobile equipment. For environmental conditions where the temperature may drop under zero, the Eclipse™ Extreme provides fire protection.

# DATA & CONNECTIVITY

Equipped with Sandvik Intelligent Control System as standard, the TH430 answers to today's demands for data, connectivity and digitalization.

**KNOWLEDGE BOX™**

The Knowledge Box™ onboard the TH430 transfers monitoring data through a Wi-Fi connection to the My Sandvik internet portal for visualization of fleet health, productivity and utilization.

**OPTIMINE®**

OptiMine® is the most comprehensive solution for optimizing underground hard rock mining production and processes. It integrates all assets and people - including Sandvik and non-Sandvik equipment - delivering descriptive and predictive insights to improve operations. OptiMine® is interoperable and able to connect to any system and technology, including Newtrax IoT devices, providing a real-time view of mining operations. It is an open and scalable modular suite that gives you flexibility to expand and work with a full range of equipment, systems and networks.

**PROXIMITY DETECTION SYSTEM INTERFACE**

A Proximity Detection System (PDS) interface option is also available on the TH430 for mines to interface with their site PDS system. The PDS interface offers easy installation and connection to the Sandvik Intelligent Control System with the capability to slow down and stop the truck on the signal from a PDS system.

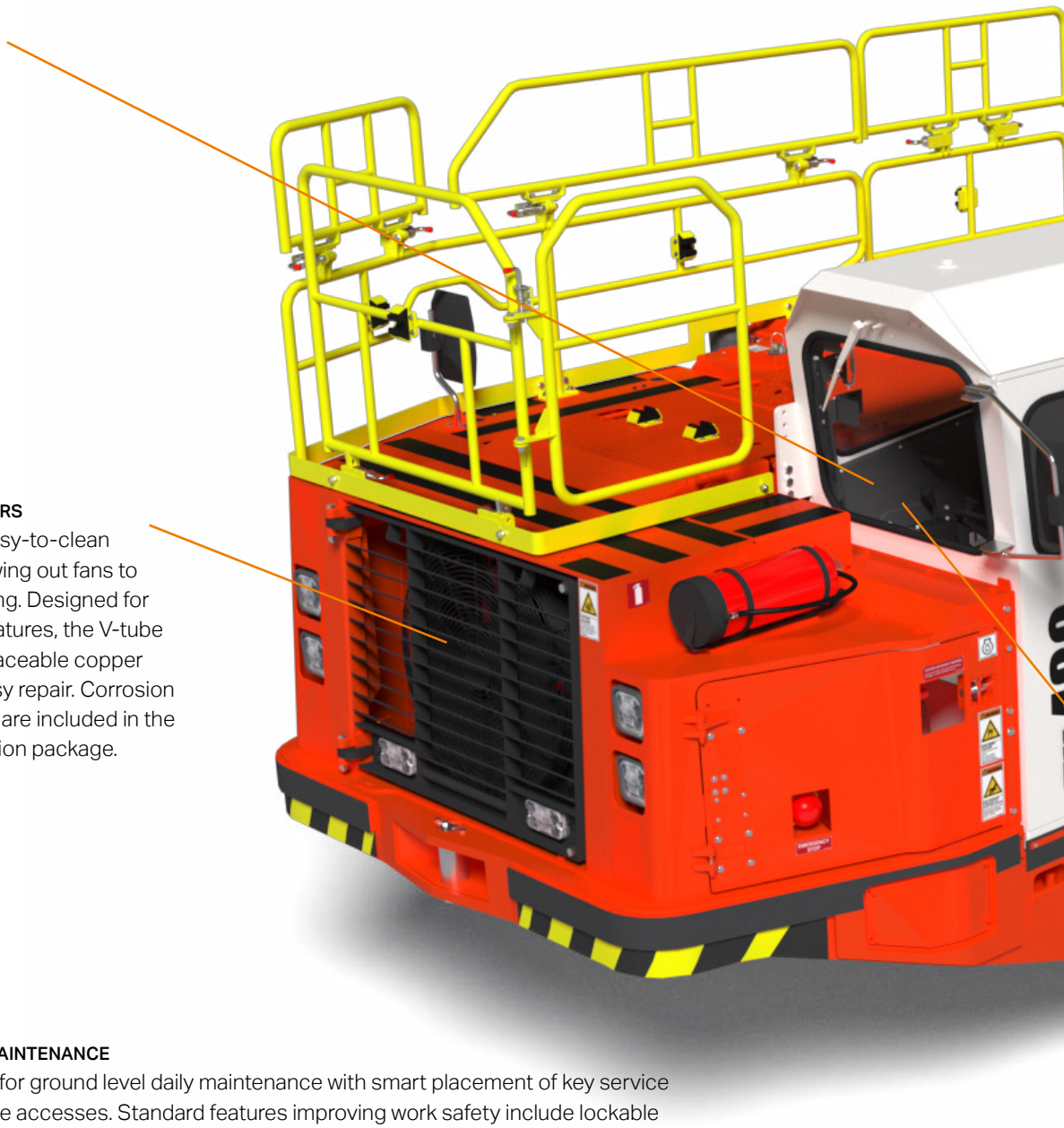
**MY SANDVIK DIGITAL SERVICE SOLUTIONS 365**

My Sandvik Digital Service Solutions are designed to help you maximize your productivity, operational efficiency and safety. Once activated, the Knowledge Box™ on board the TH430 collects and transfers equipment data into easy-to-use knowledge about your fleet's performance in the form of dashboards.

# EASE OF MAINTENANCE

**SMART MAINTENANCE**

To minimize the need to move around the machine or use special tools, the 5.7" touch screen color display in the operator's compartment provides service information, easy system diagnostics and alarm log files, as the Sandvik Intelligent Control System monitors the equipment health and provides early warnings. The control system user interface is available in 17 different languages.
An automatic brake test with diagnostics and logging can also be performed from the display.



**EASY TO CLEAN COOLERS**

The TH430 has an easy-to-clean engine cooler with swing out fans to allow effective cleaning. Designed for high ambient temperatures, the V-tube radiator features replaceable copper tubes for fast and easy repair. Corrosion resistant brass tubes are included in the optional harsh condition package.

**GROUND LEVEL DAILY MAINTENANCE**

The truck is designed for ground level daily maintenance with smart placement of key service areas and maintenance accesses. Standard features improving work safety include lockable main switch, articulation lock, box support and wheel chocks, among others. An efficient Power Core engine filter is housed well within the frame for impact protection, and it utilizes an ejector valve system for increased filter lifetime. An optional fast filling system for fuel and oils increases equipment availability by reducing fueling time by up to 80% as well as eliminating fuel and oil spills.

**SAFETY ON TOP**

When getting to the top of the truck is necessary, the access system with 3-point contact high contrast handles and anti-slip steps provides steady grip. The top covers are perforated to reduce risks for slipping, and where perforation is not practical, anti-slip tapes are fitted.

Further, the truck can be equipped with rails to improve safety on top of the equipment. The rails are folded down for driving and set up for service work. Safety rails are recommended for all conditions.

**MAINTENANCE KITS AND PERFORMANCE FLUIDS**

Tailor-made maintenance kits include all relevant parts and other materials for planned maintenance.

Sandvik Performance Fluids preserve the machine's high performance. Smooth operation throughout its lifetime can be ensured with Sandvik Long-Life Engine, Transmission and Hydraulic Oils, which are available in different viscosity grades.

**OPTIMIZED GREASE CONSUMPTION**

The standard Automatic Central Lubrication System optimizes grease consumption and extends the life of the bushes and bearings. Activated by Sandvik Intelligent Control System when park brake is released, hard to reach areas are well lubricated and service time is reduced.

# LOW COST OF OWNERSHIP

**ROBUST AND RELIABLE POWERTRAIN**
This truck is equipped with new heavy-duty axles to improve availability, extend axle lifetime and reduce total costs of ownership. Compared to the previous model, the new axles provide higher spindle capacity, higher drive head torque capacity, and higher wheel bearing capacity.

**FEA OPTIMISED FRAMES**
The TH430 welded steel box structures used in the frame provide strong resistance to shock loads and are optimized to reduce stresses and extend frame lifetime. The frames are computer designed using Finite Element Analysis (FEA) and made of high strength structural steel for superior strength to weight ratio.

**LONGLIFE STEEL PIPING**
Extensive use of hydraulic steel piping throughout the truck delivers longer lifetime and easier maintenance access than hydraulic hoses.

**SUPERIOR BRAKING POWER**
As all Sandvik trucks, also the TH430 is equipped with spring applied hydraulic release brakes for safer braking. An automatic electric retarder is available as an option to prevent brake hydraulics from heating and to reduce brake wear. Further, top speeds can be reduced by an optional gear limiting to improve safety in narrow tunnels and on rough roads.

**FUEL EFFICIENT TIER 2 ENGINE FOR HIGH ALTITUDES**
A robust 310 kW Tier 2 Volvo engine with catalytic purifier and muffler delivers long engine lifetime in underground conditions. This fuel efficient 13 litre engine is also calibrated for use in high altitude conditions to maintain performance, low emissions and reliability.

**LOW EMISSION TIER 4I ENGINE**
For areas where Ultra Low Sulphur fuel is available, 315kW Tier 4i engine from Volvo offers low MSHA and CANMET ventilation rates. This engine's exhaust after treatment system consists of a selective catalytic reduction system (SCR) using diesel exhaust fluid to reduce emissions of nitrogen oxides. The SCR delivers compliance with Tier 4i emission regulations, without sacrificing performance or fuel efficiency.

**EFFICIENT COOLING FOR INCREASED PERFORMANCE**
Separate brake, hydraulic and transmission cooling provides increased performance in hot conditions. A more efficient cooling circuit leads to lower oil temperatures, reducing stress on the system, extending component lifetimes, and minimizing oil leaks.

# SANDVIK 365 PARTS & SERVICES

**PROUDLY KEEPING YOU ON TRACK!**

Sandvik 365 Parts & Services offer a variety of possibilities to enhance your truck's performance. As an OEM, we provide the best-suited choices to preserve your machine's high performance throughout its lifetime. These consist of highly skilled service specialists supporting you 365 days a year, all using Sandvik Genuine parts and components complemented by a range of robust tools. In addition, you get to enjoy the benefits of advanced digital services and a global infrastructure dedicated to keeping your Sandvik fleet on track.

**BENEFIT FROM OUR 365 SOLUTIONS**

Our Sandvik 365 Parts & Service solutions will enable your equipment to function safely at peak condition and allow you to achieve the most demanding production targets. Our aftermarket portfolio attends all possible needs throughout your equipment's lifecycle, ranging from the most basic and traditional offerings to the most sophisticated ones.

**YOUR EQUIPMENT UPTIME IS OUR FOCUS – SANDVIK 365 COMPONENT SOLUTIONS**

We have all your key components available to you under our various commercial offerings to suit your needs. Whether you have an ad-hoc failure or you are planning your maintenance in advance – we can assist, manage your components to maximize your uptime.

**MAXIMIZE YOUR PRODUCT LIFETIME WITH SANDVIK 365 REBUILD SOLUTIONS**

One of the most effective ways to optimize equipment lifecycle lies in the quality and range of the Sandvik Rebuild Solutions. Planning and executing rebuilds at optimal intervals helps you keeping your equipment's operating cost and productivity on track. A rebuild by the manufacturer can optimize your total cost of ownership (TCO) and increase the level of predictability around our fleet lifecycle.

**CHOOSE FROM OUR RANGE OF SERVICE AGREEMENTS**

With Sandvik Service Agreements, you can improve productivity and minimize unplanned downtime by making use of our expertise, systems and processes. They can be adapted to the specific level of support you require – helping you proactively manage your fleet and avoid any unexpected surprises.

**GAIN PRODUCTIVITY THROUGH CONNECTIVITY**

365 My Sandvik Digital Service solutions will provide you with visualization of fleet utilization, productivity, safety and health on 24/7 basis. The digital service dashboards can be accessed through the My Sandvik customer portal, where you can subscribe to My Sandvik Insight or Productivity. This way, My Sandvik Digital Service Solutions enable you to minimize unplanned downtime and set exact targets for improvement.

# TECHNICAL SPECIFICATION SANDVIK TH430

The TH430 is a reliable, hard-working dump truck specifically designed for underground conditions. With its robust structure, compact size and fit-for-purpose components, the truck is tailored to meet the productivity targets in challenging environments. The truck's new heavy-duty axles, using limited slip differentials to maintain traction, improve availability and reduce total costs of ownership.

The truck is equipped as standard with an enclosed and air conditioned cabin for increased operator safety and comfort. The cabin uses dust and noise resistant upholstery materials and is ROPS and FOPS certified to protect the operator in case of roll over or falling objects.

Equipped with Sandvik Intelligent Control System and a 5,7" dispaly as standard, the TH430 answers to today's demands for data, connectivity and digitalization. The touch screen color display in the cabin provides service information, easy system diagnostics and alarm log files, as the Sandvik Intelligent Control System monitors the equipment health and provides early warnings.

The TH430 is an ideal choice for:
- Ramp or level production haulage in medium sized mines
- Mine development projects in medium and large mines
- Tunneling projects with restricted headroom
- Three pass loading with LH410 loader

| CAPACITIES | |
|---|---|
| Maximum payload capacity (SAE heaped 2:1) | 30 000 kg |
| Standard dump box | 14.5 m³ |
| Dump box range | 14 - 18 m³ |

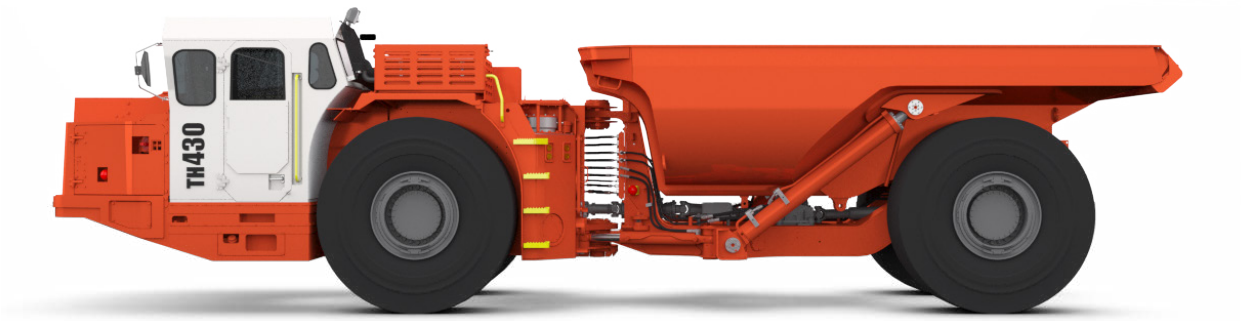
| SPEEDS (LEVEL/LOADED) with Volvo TAD1342VE Tier 2 | |
|---|---|
| 1st gear | 6.6 km/h |
| 2nd gear | 11.7 km/h |
| 3rd gear | 20.5 km/h |
| 4th gear | 36.6 km/h |

| DUMP BOX MOTION TIMES & MOVEMENTS | |
|---|---|
| Discharging time | 14 sec |
| Dumping angle | 61° |

| OPERATING WEIGHTS * | |
|---|---|
| Total operating weight | 29 500 kg |
| Front axle | 21 900 kg |
| Rear axle | 7 600 kg |

| LOADED WEIGHTS * | |
|---|---|
| Total loaded weight | 59 500 kg |
| Front axle | 29 200 kg |
| Rear axle | 30 300 kg |

* Unit weight is dependent on the selected options



### OPERATIONAL CONDITIONS AND LIMITS

| | |
|---|---|
| Environmental temperature | From -20°C to +50°C |
| Standard operating altitude | With engine Volvo TAD1342VE from -1500 m to +2000 m at 25 °C without rated power derate |
| Standard operating altitude | With engine Volvo TAD1362VE from -1500 m to +1000 m at 25 °C without rated power derate |

### REQUIREMENTS AND COMPLIANCE

| |
|---|
| Compliance with 2006/95/EC Low voltage directive |
| Compliance with 2004/108/EC Electromagnetic compatibility directive |
| Compliance with 2006/42/EC Machinery directive (Equipment for EU area, achieved with relevant options) |
| Design based on EN 1889-1. Machines for underground mines. Mobile machines working underground. Safety. Part 1: Rubber tyred vehicles. |
| Design based on MDG 15. Guideline for mobile and transportable equipment for use in mines. (Equipment for Australia, achieved with relevant options) |
| Electrical system based on IEC 60204-1. Safety of machinery – Electrical equipment of machines – Part 1: General requirements |
| CONTAINS FLUORINATED GREENHOUSE GASES (closed cabin option)<br>Refrigerant R134a under pressure max 38 bar/550 PSI:<br>Filled weight: 2,0 kg<br>CO2e: 2,860 tons<br>GWP: 1430<br>Information based on the F Gas Regulation (EU) No 517/2016 |

## POWER TRAIN

### ENGINE

| | |
|---|---|
| Diesel engine | Volvo TAD1342VE Tier 2 |
| Output | 310 kw (416 hp) @ 2100 rpm |
| Torque | 2005 Nm @ 1260 rpm |
| Number of cylinders | In-line 6 |
| Displacement | 12.8 l |
| Cooling system | Liquid cooled |
| Combustion principle | 4-stroke, direct injection, turbo, after cooler |
| Air Filtration | Dry type |
| Electric system | 24 V |
| Emissions | Tier 2, Euro Stage II |
| Ventilation rate (Ultra low sulphur diesel) | MSHA 18,500 CFM Ventilation Rate |
| Particulate index (Ultra low sulphur diesel) | MSHA Particulate Ventilation Index 10,500 CFM |
| Exhaust system | Catalytic converter with muffler |
| Average fuel consumption at 50% load | 39 l/h |
| Fuel tank refill capacity | 530 l |

### TRANSMISSION

| |
|---|
| Fully automatic transmission with electric remote shifting system. Four forward and two reverse gears. |
| Dana 6000 Series |

### CONVERTER

| |
|---|
| Dana C8000 Series with Lock up |

### AXLES

| | |
|---|---|
| Front axle | Kessler D102 series spring applied hydraulic operated brakes, equipped with standard differential, oscillation |
| Rear axle | Kessler D102 series, standard differential, fixed |

### TIRES

| | |
|---|---|
| Tire size (Tires are application approved. Brand and type subject to availability.) | 26.5 R 25 E4 ** |

## HYDRAULICS

| |
|---|
| Filling pump for hydraulic oil |
| Door interlock for brakes |
| Oil cooler for hydraulic and transmission oil capability up to 50°C ambient temperature |
| ORFS fittings |
| Hydraulic oil tank capacity 265 l |
| Sight glass for oil level, 2 pcs |

### STEERING HYDRAULICS

Fully hydraulic, center articulad, power steering with two double acting cylinders. Closed-center system with a load sensing piston type pump and pilot operated orbital wheel steering.

| | |
|---|---|
| Steering main valve | Pilot operated |
| Steering hydraulic cylinders | 100 mm, 2 pcs |
| Steering pump | Variable displacement piston pump |

### DUMP BOX HYDRAULICS

Fully hydraulic system, equipped with variable displacement piston pump. Oil flows to box hydraulic system from the steering hydraulics. Oil flow from the brake circuit pump is divided to the brake system and oil cooler motor.

| | |
|---|---|
| Hydraulic pump | Variable displacement piston pump |
| Control valve | Solenoid operated |
| Main valve | Solenoid operated |
| Cylinders | 140 mm, 2 pcs |

### BRAKES

Service brakes are spring applied; hydraulically operated multi disc wet brakes on all wheels. Two independent circuits: one for the front and one for the rear axle. Service brakes also function as an emergency and parking brake. Brake system performance complies with requirements of EN ISO 3450, AS2958.1 and SABS 1589.

| |
|---|
| Neutral brake |
| Automatic brake activation system, ABA |
| Electrically driven emergency brake release pump |
| Foot operated brake pedal, fully modulated |
| Brake oil tank capacity 76 l |

## OPERATOR'S COMPARTMENT

The TH430 cabin uses dust and noise resistant upholstery materials and is ROPS and FOPS certified to protect the operator in case of roll over or falling objects. The cabin includes illuminated entrance with three-point contact handles and anti-slip steps, as well as emergency exits. In addition, the cabin is mounted on rubber mounts to reduce whole body vibration.

### CABIN

| |
|---|
| ROPS certification according to EN ISO 3471 |
| FOPS certification according to EN ISO 3449 |
| Sealed, air conditioned, over pressurized, noise suppressed closed cabin |
| Sound absorbent material to reduce noise |
| Safety glass windows |
| Cabin mounted on rubber mounts to the frame to reduce vibrations |
| Air conditioning unit located outside the cabin to reduce noise inside the cabin |
| Cyclone pre-filter for A/C device |
| Adjustable steering wheel |
| No high pressure hoses in the operator's compartment |
| Inclinometers to indicate operating angle |
| Emergency exit |
| Floor washable with water to reduce dust |
| Three-point contact access system with replaceable and colour coded handles and steps |
| 12 V output for communication radio connection |
| Remote circuit breaker switch |

### OPERATOR'S SEAT

| |
|---|
| Low frequency suspension |
| Height adjustment |
| Adjustment according to the operator's weight |
| Fore-aft isolation |
| Padded and adjustable arm rests |
| Adjustable lumbar support |
| Selectable damping |
| Two-point seat belt |

### MEASURED VIBRATION LEVEL

Whole body vibration was determined while operating the truck in a simulated working cycle consisting of loading, unloading and driving with and without load. The value is determined applying standards EN 1032 and ISO 2631-1.

| | |
|---|---|
| Maximum r.m.s. value $a_w$ [m/s$^2$], driving with load | 0,64 |
| $VDV_W$ over 15 min period [m/s$^{1.75}$], driving with load | 5,9 |

### MEASURED SOUND LEVEL

The sound pressure level and sound power level at the operator's compartment have been determined in stationary conditions on high idle and at full load, with engine Volvo TAD1342VE.

| | |
|---|---|
| Sound pressure level $L_{pA}$ [dB re 20 µPa] | 81 dB |
| Sound power level $L_{WA}$ [dB ew 1 p W] | 117 dB |

### CONTROL SYSTEM, DASHBOARD AND DISPLAYS

| |
|---|
| Sandvik Intelligent Control System |
| Critical warnings and alarms displayed as text and with light |
| 5.7" display with adjustable contrast and brightness |
| Instrument panel with illuminated switches |
| My Sandvik Digital Services Knowledge Box™ on-board hardware |

## FRAME

### REAR AND FRONT FRAME

| |
|---|
| High strength structure with optimized material thicknesses. Reduced own weight for higher overall hauling capacity and long structural lifetime. Welded steel construction. |
| Central hinge with adjustable lower bearing |
| Tanks are part of the frame structure |
| Automatic central lubrication |

## ELECTRICAL EQUIPMENT

### MAIN COMPONENTS

| | |
|---|---|
| Alternator | 24 V, 150 A |
| Batteries | 2 X 12V, 950 CCA |
| Starter | 24 V, 7kW |
| Driving lights | LED lights:<br>4 pcs in front<br>2 pcs in rear |
| Working lights | LED lights:<br>1 pc in rear of cabin<br>1 pc in side of unit |
| Parking, brake and indicator (blinkers) lights | LED lights:<br>2 pcs in front<br>2 pcs in rear |
| Control system | 5,7" Color display, 3 modules, inbuilt system diagnostics |
| Reverse alarm (CE) | |
| Flashing beacon | |
| Reverse camera | |

## INCLUDED SAFETY FEATURES

| FIRE SAFETY |
|---|
| Portable fire extinguisher, 12 kg (CE) |
| Hot side - cold side design |
| Isolation of combustibles and ignition sources |
| Heat insulation on exhaust manifold, turbo, and isolated exhaust pipe |

| ENERGY ISOLATION |
|---|
| Lockable main switch, ground level access |
| Emergency stop push buttons according to EN ISO 13850 |
| Pressure release in the radiator cap |
| Automatic discharge for pressure accumulators (brake system and pilot circuit) |
| Frame articulation locking device |
| Mechanical dump box locking device |
| Wheel chocks and brackets |

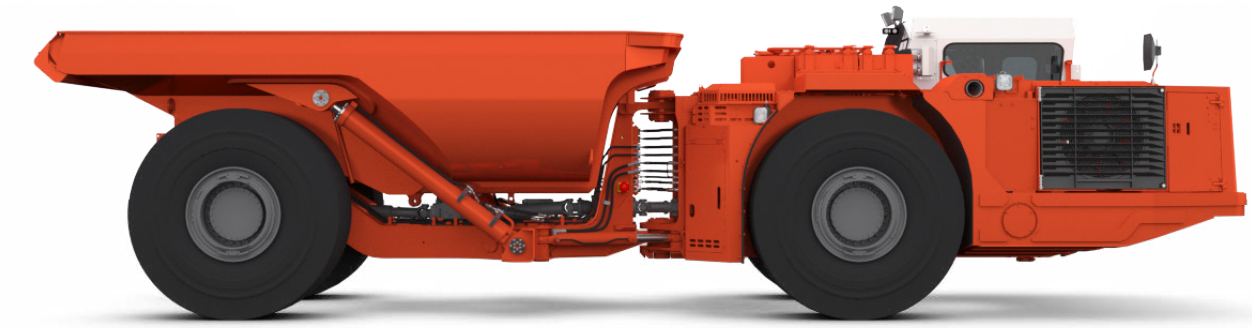
## DOCUMENTATION

| STANDARD MANUALS | |
|---|---|
| Operator's Manual | English and other EU languages |
| Maintenance Manual | English and other EU languages |
| Parts Manual | English |
| Service and Repair Manual | English |
| ToolMan | 2 x USB stick in pdf format, includes all the manuals |
| Decals | English and other EU languages |

## OPTIONS

| |
|---|
| Lower cabin height, 2445 mm |
| Cold climate package (incl. cabin heater, cabin window defroster and side mirrors with defrost system) |
| Cover grills for lamps |
| Gear limit |
| Spare rim 22.00-25/3.0 (for tyres 26.5R25) |
| Electrical retarder TELMA for Volvo TAD1362VE and TAD1342VE engines |
| Harsh conditions package |
| Proximity Detection System Interface |
| Control system tool kit |
| Driving direction lights (red / green) |
| Blue or clear flashing beacon |
| Jump start interface |
| Wiggins quick filling set for fuel and oils (hydraulic, engine and transmission) |
| Wiggins fuel filling system |
| Integrated Weighing System (IWS) |
| CE Declaration of conformity |
| CRN pressure accumulator |
| ANSUL Twin fire suppression system (CE) |
| Fire suppression system Eclipse™ with auto shutdown (CE) |
| Safety rails |
| Emergency steering (CE) |
| Tyre pressure monitoring system |

| OPTIONAL ENGINE | |
|---|---|
| Diesel engine | Volvo TAD1362VE |
| Output | 315 kW (422 hp) |
| Emissions | Euro Stage III B (Tier 4i) |
| Engine brake | No |



## GRADE PERFORMANCE

Volvo TAD1342VE, Tier 2 (3% rolling resistance, with lock-up)

**Empty**

| Percent grade | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.5 | 14.3 | 17.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1:12 | 1:10 | 1:8 | 1:7 | 1:6 | 1:5 |
| 1st gear (km/h) | 6.7 | 6.7 | 6.7 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.5 | 6.5 |
| 2nd gear (km(h) | 12.0 | 11.9 | 11.8 | 11.8 | 11.7 | 11.7 | 11.6 | 11.5 | 11.5 | 11.4 |
| 3rd gear (km/h) | 21.0 | 20.8 | 20.6 | 20.4 | 20.2 | 20.0 | 17.7 | 16.2 | 14.3 | |
| 4th gear (km/h) | 37.4 | 36.8 | 36.2 | 30.5 | 25.7 | | | | | |

**Loaded**

| Percent grade | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.5 | 14.3 | 17.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1:12 | 1:10 | 1:8 | 1:7 | 1:6 | 1:5 |
| 1st gear (km/h) | 6.7 | 6.6 | 6.6 | 6.6 | 6.5 | 6.5 | 6.4 | 6.4 | 6.4 | 5.9 |
| 2nd gear (km(h) | 11.9 | 11.7 | 11.6 | 11.5 | 11.4 | 10.3 | 9.0 | 8.2 | | |
| 3rd gear (km/h) | 20.7 | 20.3 | 18.9 | 15.5 | | | | | | |
| 4th gear (km/h) | 36.5 | 27.9 | | | | | | | | |

Volvo TAD1362VE, Stage III B / Tier 4i (3% rolling resistance, with lock-up)

**Empty**

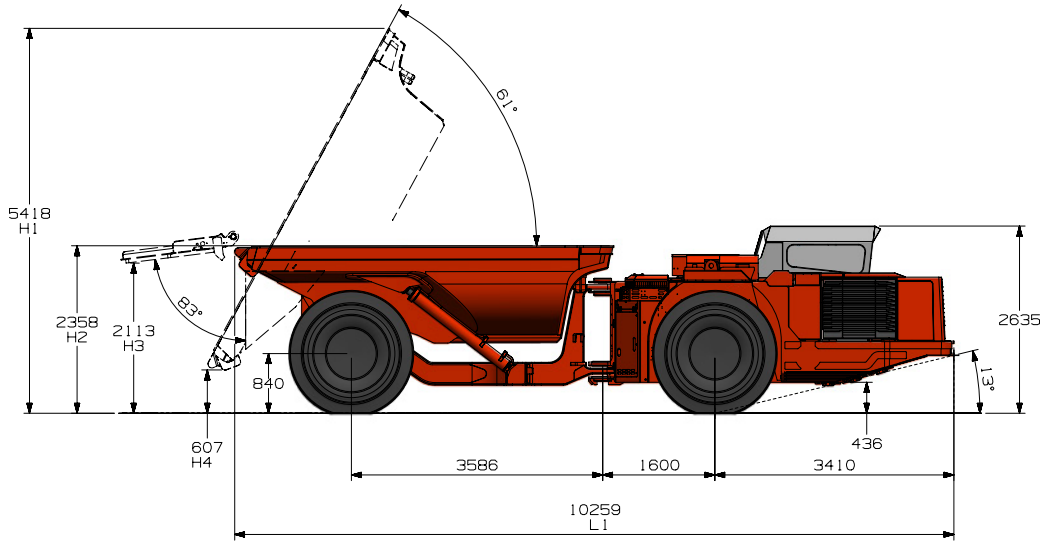
| Percent grade | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.5 | 14.3 | 17.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1:12 | 1:10 | 1:8 | 1:7 | 1:6 | 1:5 |
| 1st gear (km/h) | 6.1 | 6.1 | 6.1 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 5.9 | 5.9 |
| 2nd gear (km(h) | 10.9 | 10.8 | 10.8 | 10.7 | 10.6 | 10.6 | 10.5 | 10.5 | 10.4 | 10.3 |
| 3rd gear (km/h) | 19.1 | 18.9 | 18.7 | 18.5 | 18.3 | 18.1 | 17.0 | 16.2 | 14.4 | |
| 4th gear (km/h) | 34.0 | 33.4 | 32.8 | 30.0 | 25.9 | | | | | |

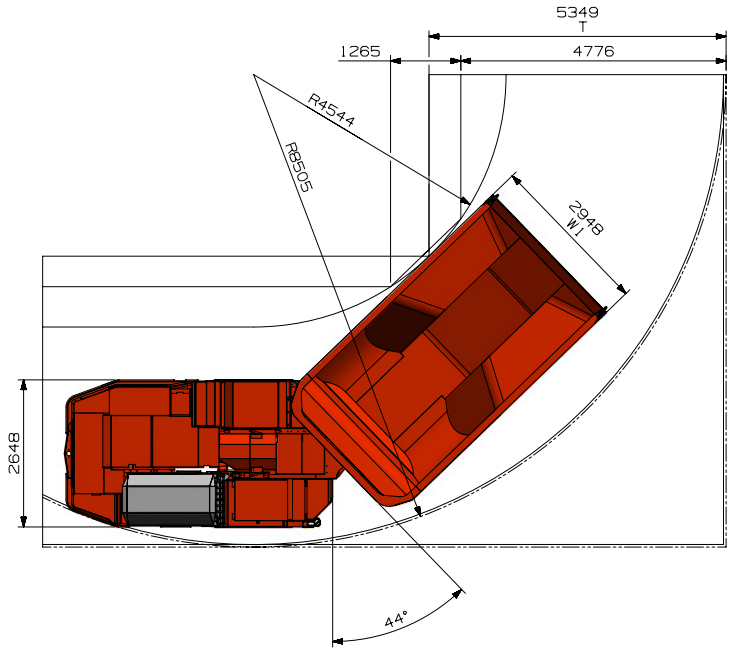
**Loaded**

| Percent grade | 0.0 | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 | 12.5 | 14.3 | 17.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1:12 | 1:10 | 1:8 | 1:7 | 1:6 | 1:5 |
| 1st gear (km/h) | 6.1 | 6.0 | 6.0 | 6.0 | 5.9 | 5.9 | 5.8 | 5.8 | 5.8 | 5.5 |
| 2nd gear (km(h) | 10.8 | 10.7 | 10.5 | 10.4 | 10.3 | 9.8 | 9.0 | 8.2 | | |
| 3rd gear (km/h) | 18.8 | 18.4 | 17.6 | 15.5 | | | | | | |
| 4th gear (km/h) | 33.1 | 27.9 | | | | | | | | |

## DIMENSIONS WITH 14.5 M³ BOX

Dimensions are shown in millimeters and based on standard vehicle configuration (dump box for 2.3 t/m³ material, heaped volume definition with 44 mm tire deflection, unloaded. The dimensions are indicative only.




## AVAILABLE BOXES

With 90% fill factor

| Box capacity (m³) | 14.5 m³ | 16 m³ | 18 m³ | 14 m³ ejector box |
|---|---|---|---|---|
| Material broken density (kg/m³) | 2300 kg/m³ | 2100 kg/m³ | 1900 kg/m³ | 1900 kg/m³ |
| Overall machine length (mm) L1 | 10 260 | 10 400 | 10 450 | 10 450 |
| Dump position height max (mm) H1 | 5 420 | 5 630 | 5 700 | - |
| Dumpbox spillguard (mm) H2 | 2 360 | 2 410 | 2 560 | 2 630 |
| Ejector box tailgate height (mm) H3 | - | - | - | 2 113 |
| Discharge height (mm) H4 | 610 | 450 | 410 | 830 |
| Dumpbox width (mm) W1 | 2 950 | 2 950 | 2 850 | 2 860 |
| Dumpbox turning radius (mm) R1 | 4 540 | 4 540 | 4 600 | 4 600 |
| Minimum turning radius (mm) T | 5 350 | 5 350 | 5 310 | 5 300 |

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# D6/D6 XE

## Track-Type Tractors

# Technical Specifications

## Engine

| | | |
|---|---|---|
| Engine Model | Cat® C9.3B | |
| Emissions | U.S. EPA Tier 4 Final, EU Stage V, Korea Tier 4 Final | |
| Build Number | 20A | |
| Net Power (Rated) – D6 2,200 rpm/D6 XE 1,700 rpm | | |
| ISO 9249/SAE J1349 | 161 kW | 215 hp |
| ISO 9249/SAE J1349 (DIN) | | 219 hp |
| D6 Engine Power (Maximum) – 1,200 rpm | | |
| ISO 14396 | 187 kW | 251 hp |
| ISO 14396 (DIN) | | 254 hp |
| D6 XE Engine Power (Maximum) – 1,400 rpm | | |
| ISO 14396 | 177 kW | 237 hp |
| ISO 14396 (DIN) | | 241 hp |
| Bore | 115 mm | 4.5 in |
| Stroke | 149 mm | 5.9 in |
| Displacement | 9.3 L | 567 $in^3$ |

- The new Cat C9.3B engine features a new high pressure common rail fuel system, simplified engine system electronics, and simplified air system through the removal of the previously used exhaust gas recirculation (EGR) system.
- The XE drive train allows the engine to operate in a tighter rpm range, 1,400-1,700 rpm, which helps extend engine life and provide improved fuel economy. The increased drive train efficiency also allows the machine to provide more engine power to the ground, resulting in greater machine performance.
- Net power advertised is the power available at the engine flywheel when the engine is equipped with a fan, air cleaner, clean emissions module and alternator.
- No derating required up to 2286 m (7,500 ft). Above this, automatic derating occurs.
- All non-road Tier 4 Interim and Final, Stage IIIB, IV and V and Korea Tier 4 Final diesel engines are required to use only ultra-low sulfur diesel (ULSD) fuels containing 15 ppm (mg/kg) sulfur or less. Biodiesel blends up to B20 (20% blend by volume) are acceptable when blended with 15 ppm (mg/kg) sulfur or less ULSD. B20 should meet ASTM D7467 specification (biodiesel blend stock should meet Cat biodiesel spec, ASTM D6751 or EN 14214). Cat DEO-ULS™ or oils that meet the Cat ECF-3, API CJ-4, and ACEA E9 specification are required. Consult your OMM for further machine specific fuel recommendations.
- Diesel Exhaust Fluid (DEF) used in Cat Selective Catalytic Reduction (SCR) systems must meet the requirements outlined in the International Organization for Standardization (ISO) standard 22241.

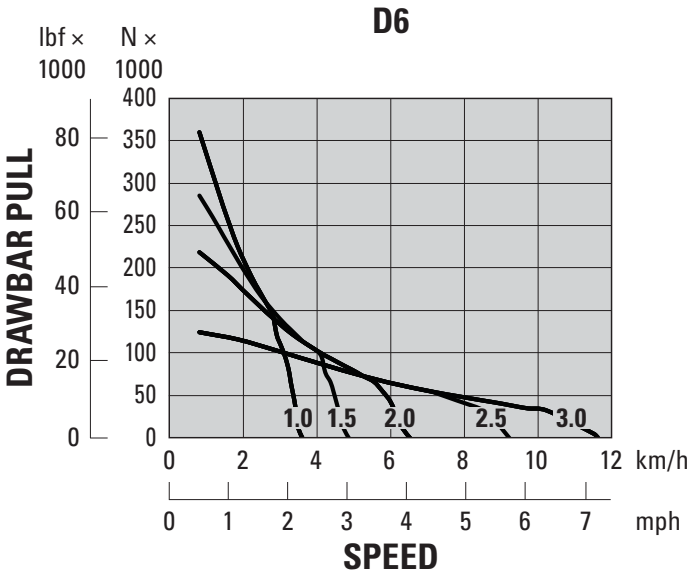
## D6 XE Drive Train

| | |
|---|---|
| Type | Electric Drive |
| Electric Drive System Nominal Voltage | 715 Volts |

# D6/D6 XE Track-Type Tractors Specifications

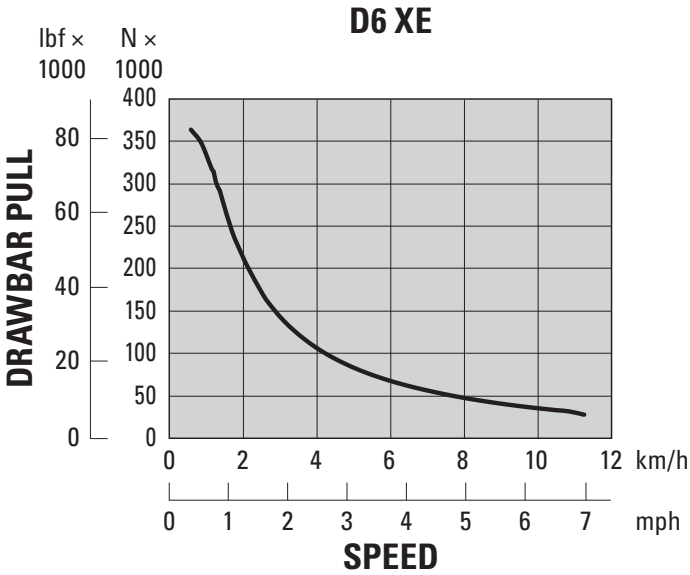
| Maximum Drawbar Power | | |
|---|---|---|
| D6 | 114 kW | 153 hp |
| D6 XE | 119 kW | 160 hp |

| D6 Travel Speed | | |
|---|---|---|
| 1.0 Forward | 3.6 km/h | 2.2 mph |
| 1.5 Forward | 4.9 km/h | 3.0 mph |
| 2.0 Forward | 6.5 km/h | 4.0 mph |
| 2.5 Forward | 9.2 km/h | 5.7 mph |
| 3.0 Forward | 11.7 km/h | 7.2 mph |
| 1.0 Reverse | 3.6 km/h | 2.2 mph |
| 1.5 Reverse | 4.9 km/h | 3.0 mph |
| 2.0 Reverse | 6.5 km/h | 4.0 mph |
| 2.5 Reverse | 8.7 km/h | 5.4 mph |
| 3.0 Reverse | 11.7 km/h | 7.2 mph |




**NOTE:** Usable pull will depend on traction and weight of machine.

| D6 XE Travel Speed | | |
|---|---|---|
| 1.0 Forward | 3.6 km/h | 2.2 mph |
| 1.5 Forward | 4.9 km/h | 3.0 mph |
| 2.0 Forward | 6.5 km/h | 4.0 mph |
| 2.5 Forward | 9.2 km/h | 5.7 mph |
| 3.0 Forward | 11.7 km/h | 7.2 mph |
| 1.0 Reverse | 3.6 km/h | 2.2 mph |
| 1.5 Reverse | 4.9 km/h | 3.0 mph |
| 2.0 Reverse | 6.5 km/h | 4.0 mph |
| 2.5 Reverse | 9.2 km/h | 5.7 mph |
| 3.0 Reverse | 11.7 km/h | 7.2 mph |




**NOTE:** Usable pull will depend on traction and weight of machine.

- The fully automatic D6 4-speed transmission, with lock-up clutch torque divider, continuously optimizes gear and engine speed for the application.
- The D6 XE Electric Drive power train has no gears to shift. The dozer automatically optimizes power and efficiency for the application and provides constant power to the ground.
- Thirty ground speed selections are available for both power trains, from 0.0 to 3.0 in 0.1 increments.

## Hydraulic Controls – Maximum Operating Flows

| | D6 (1,900 rpm engine speed*) | | D6 XE (1,700 rpm engine speed*) | |
|---|---|---|---|---|
| Implement Pump Maximum Flow | 212 L/min | 56 gal/min | 212 L/min | 56 gal/min |
| Steering Pump Maximum Flow | 198 L/min | 52 gal/min | 240 L/min | 63 gal/min |
| Fan Pump Flow at Maximum Fan (1,550 rpm) | 42 L/min | 11 gal/min | — | — |
| Fan Pump Flow at Maximum Fan (1,625 rpm) | — | — | 44 L/min | 12 gal/min |

*Engine speed varies with load and travel speed. A high idle/low working load speed shown.

## Hydraulic Controls – Maximum Operating Pressures

| | | |
|---|---|---|
| Implement Relief* | 27 600 ± 500 kPa | 4,000 ± 73 psi |
| Steering – D6 (89 cc pump)** | | |
| Electronic Relief | 42 500 ± 1000 kPa | 6,168 ± 145 psi |
| System Maximum Relief | 47 800 ± 1000 kPa | 6,938 ± 145 psi |
| Steering – D6 XE (100 cc pump)*** | | |
| Electronic Relief | 44 500 ± 1000 kPa | 6,459 ± 145 psi |
| System Maximum Relief | 47 800 ± 1000 kPa | 6,938 ± 145 psi |

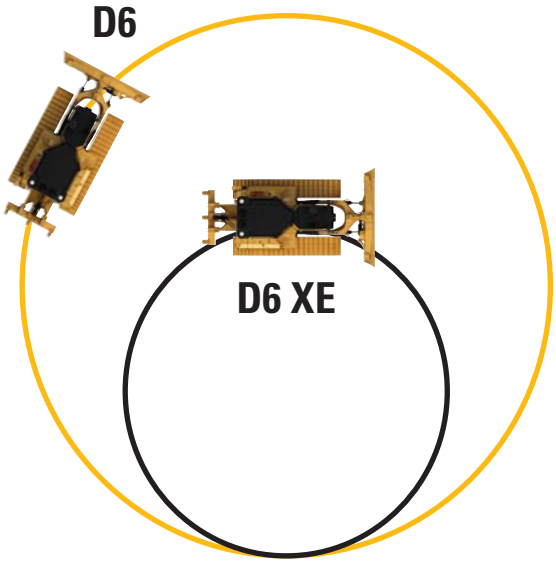
*Implement relief pressure increased over prior model D6 tractors. Consult with your dealer prior to using older vintage or third party implements.

**The same differential steering system is used for both power trains. This system maintains full power to both tracks to provide best-in-class turning with a loaded blade.

***The D6 XE power train utilizes a larger steering pump and enhanced steering controls to provide more steering power, compared to the D6 power train, to turn larger loads and to improve maneuverability. This includes the ability to counter-rotate in gear.

## Steering

The D6 XE power train provides up to a 45 percent steering radius reduction compared to the D6. The D6 XE offers in-gear counter rotation for increased maneuverability.



# D6/D6 XE Track-Type Tractors Specifications

## Configuration Tables – D6/D6 XE

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 22 000 kg | 48,500 lb |
| | Shipping Weight*** | 19 060 kg | 42,020 lb |
| | Ground Pressure (ISO 16754) | 54 kPa | 7.9 psi |
| | Undercarriage (Standard) | 42 Section with 7 Bottom Rollers | |
| 1 | Track Gauge | 1.930 m | 76 in |
| 2 | Width of Maximum Track Shoe | 0.610 m | 24 in |
| 3 | Width over Tracks | 2.540 m | 100 in |
| | Width over Trunnions | 2.692 m | 106 in |
| 4 | Length of Track on Ground | 2.964 m | 116.7 in |
| | Ground Contact Area (ISO 16754) | 3.992 m² | 6188 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.361 m | 14.2 in |
| | Oscillation at Front Idler | 0.103 m | 4.0 in |
| 5 | Machine Height**** | 3.172 m | 124.9 in |
| 6 | Length of Machine without Blade | 4.730 m | 186.2 in |

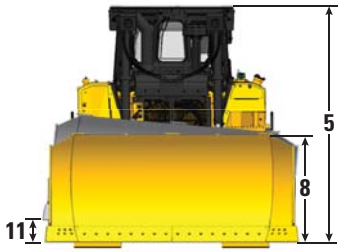
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, 6 SU blade, and calculated per ISO 16754 unless otherwise specified.

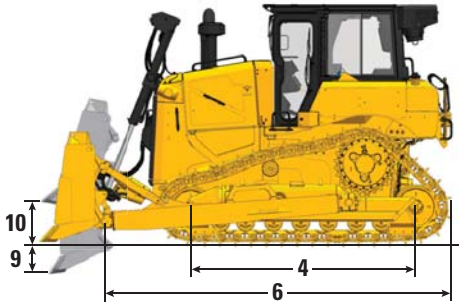
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

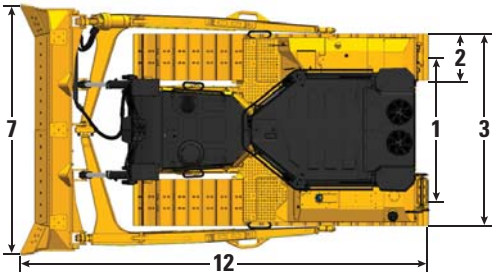
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link™ Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blades

| | Configuration | 6 SU | | 6 SU Landfill | | 6A | |
|---|---|---|---|---|---|---|---|
| | Capacity (ISO 9246) | 5.7 m³ | 7.5 yd³ | 11.2 m³ | 14.6 yd³ | 4.2 m³ | 5.5 yd³ |
| 7 | Width across End Bits | 3.312 m | 10 ft 10.4 in | 3.312 m | 10 ft 10.4 in | 4.389 m | 14 ft 4.8 in |
| | Width without End Bits | 3.246 m | 10 ft 7.8 in | 3.246 m | 10 ft 7.8 in | 4.250 m | 13 ft 11.3 in |
| | Width across End Bits (Blade Angled) | N/A | | N/A | | 3.982 m | 13 ft 0.8 in |
| | Width without End Bits (Blade Angled) | N/A | | N/A | | 3.858 m | 12 ft 7.9 in |
| | Maximum Blade Angle | N/A | | N/A | | 25 degrees | |
| 8 | Height | 1.408 m | 4 ft 7.4 in | 2.027 m | 6 ft 7.8 in | 1.150 m | 3 ft 9.3 in |
| 9 | Dig Depth | 0.502 m | 19.8 in | 0.502 m | 19.8 in | 0.595 m | 23.4 in |
| 10 | Lift Height | 1.180 m | 46.5 in | 1.180 m | 46.5 in | 1.084 m | 42.7 in |
| 11 | Maximum Tilt at Blade Corner | 0.564 m | 22.2 in | 0.564 m | 22.2 in | 0.599 m | 23.6 in |
| | Maximum Tilt Angle | 9.8 degrees | | 9.8 degrees | | 7.8 degrees | |
| | Pitch Adjustment | ±4.2 degrees | | ±4.2 degrees | | N/A | |
| 12 | Length of Machine (Blade Straight) | 5.436 m | 17 ft 10.0 in | 5.436 m | 17 ft 10.0 in | 5.377 m | 17 ft 7.7 in |
| | Length of Machine (Blade Angled) | N/A | | N/A | | 6.418 m | 21 ft 0.7 in |
| | Weight (Blade) | 1373 kg | 3,027 lb | 1592 kg | 3,510 lb | 1253 kg | 2,762 lb |
| | Weight (Blade and Push Arms) | 2608 kg | 5,750 lb | 2827 kg | 6,232 lb | 3394 kg | 7,842 lb |

## Configuration Tables – D6/D6 XE LGP (30 in)

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 22 740 kg | 50,130 lb |
| | Shipping Weight*** | 19 580 kg | 43,165 lb |
| | Ground Pressure (ISO 16754) | 46 kPA | 6.6 psi |
| | Undercarriage (Standard) | 42 Section with 7 Bottom Rollers | |
| 1 | Track Gauge | 2.080 m | 82 in |
| 2 | Width of Maximum Track Shoe | 0.760 m | 30 in |
| 3 | Width over Tracks | 2.840 m | 111.8 in |
| | Width over Trunnions | 2.994 m | 117.9 in |
| 4 | Length of Track on Ground | 2.964 m | 116.7 in |
| | Ground Contact Area (ISO 16754) | 4.990 m² | 7,735 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.361 m | 14.2 in |
| | Oscillation at Front Idler | 0.100 m | 3.9 in |
| 5 | Machine Height**** | 3.172 m | 124.9 in |
| 6 | Length of Machine without Blade | 4.730 m | 186.2 in |

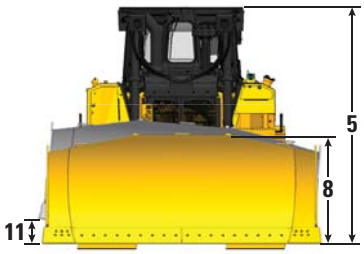
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, 6 SU blade, and calculated per ISO 16754 unless otherwise specified.

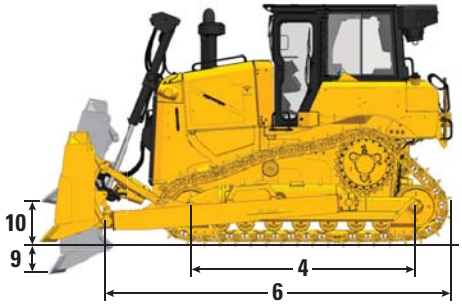
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

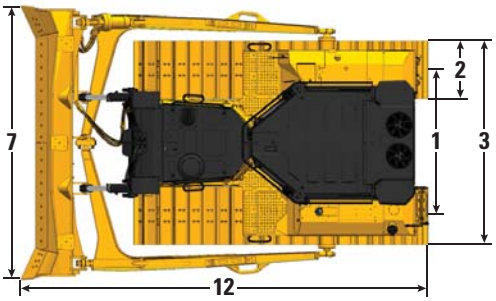
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blades

| | Configuration | 6 SU LGP (30 in) | | 6 SU LGP (30 in) Landfill | | 6A LGP (30 in) | |
|---|---|---|---|---|---|---|---|
| | Capacity (ISO 9246) | 5.8 m³ | 7.6 yd³ | 12.3 m³ | 16.1 yd³ | 4.6 m³ | 6.0 yd³ |
| 7 | Width across End Bits | 3.613 m | 11 ft 10.2 in | 3.613 m | 11 ft 10.2 in | 4.735 m | 15 ft 6.4 in |
| | Width without End Bits | 3.551 m | 11 ft 7.8 in | 3.551 m | 11 ft 7.8 in | 4.596 m | 15 ft 1.0 in |
| | Width across End Bits (Blade Angled) | N/A | | N/A | | 4.295 m | 14 ft 1.1 in |
| | Width without End Bits (Blade Angled) | N/A | | N/A | | 4.172 m | 13 ft 8.3 in |
| | Maximum Blade Angle | N/A | | N/A | | 25 degrees | |
| 8 | Height | 1.408 m | 4 ft 7.4 in | 2.027 m | 6 ft 7.8 in | 1.150 m | 3 ft 9.3 in |
| 9 | Dig Depth | 0.502 m | 19.8 in | 0.502 m | 19.8 in | 0.568 m | 22.3 in |
| 10 | Lift Height | 1.180 m | 46.5 in | 1.180 m | 46.5 in | 1.125 m | 44.3 in |
| 11 | Maximum Tilt at Blade Corner | 0.551 m | 21.7 in | 0.551 m | 21.7 in | 0.640 m | 25.2 in |
| | Maximum Tilt Angle | 8.8 degrees | | 8.8 degrees | | 7.8 degrees | |
| | Pitch Adjustment | ±4.2 degrees | | ±4.2 degrees | | N/A | |
| 12 | Length of Machine (Blade Straight) | 5.436 m | 17 ft 10.0 in | 5.436 m | 17 ft 10.0 in | 5.448 m | 17 ft 10.5 in |
| | Length of Machine (Blade Angled) | N/A | | N/A | | 6.561 m | 21 ft 6.3 in |
| | Weight (Blade) | 1446 kg | 3,188 lb | 1700 kg | 3,748 lb | 1350 kg | 2,976 lb |
| | Weight (Blade and Push Arms) | 2827 kg | 6,232 lb | 2973 kg | 6,554 lb | 3414 kg | 7,527 lb |

# D6/D6 XE Track-Type Tractors Specifications

## Configuration Tables – D6/D6 XE LGP (36 in)

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 23 866 kg | 52,615 lb |
| | Shipping Weight*** | 21 165 kg | 46,660 lb |
| | Ground Pressure (ISO 16754) | 35 kPa | 5.1 psi |
| | Undercarriage (Standard) | 45 Section with 8 Bottom Rollers | |
| 1 | Track Gauge | 2.286 m | 90 in |
| 2 | Width of Maximum Track Shoe | 0.915 m | 36 in |
| 3 | Width over Tracks | 3.200 m | 126.0 in |
| | Width over Trunnions | 3.491 m | 137.4 in |
| 4 | Length of Track on Ground | 3.247 m | 127.8 in |
| | Ground Contact Area (ISO 16754) | 6.505 m² | 10,083 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.411 m | 16.2 in |
| | Oscillation at Front Idler | 0.116 m | 4.6 in |
| 5 | Machine Height**** | 3.222 m | 126.9 in |
| 6 | Length of Machine without Blade | 5.040 m | 198.4 in |

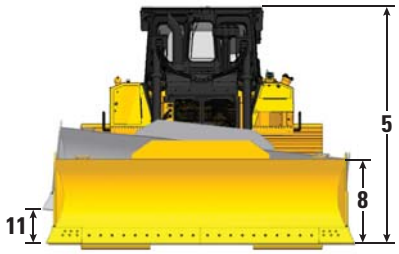
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, 6 S blade, and calculated per ISO 16754 unless otherwise specified.

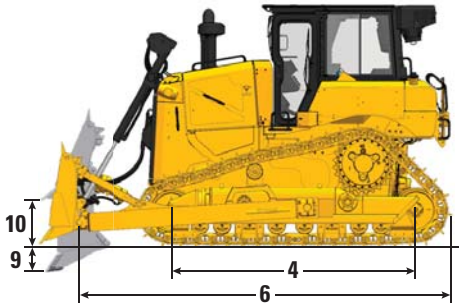
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

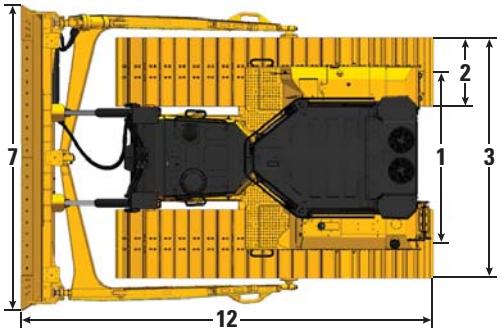
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blades

| | Configuration | 6 S LGP (36 in) | | 6 S LGP (36 in) Landfill | | 6A LGP (36 in) | |
|---|---|---|---|---|---|---|---|
| | Capacity (ISO 9246) | 3.8 m³ | 5.0 yd³ | 9.40 m³ | 12.3 yd³ | 5.0 m³ | 6.5 yd³ |
| 7 | Width across End Bits | 4.063 m | 13 ft 4 in | 4.063 m | 13 ft 4 in | 5.100 m | 16 ft 8.8 in |
| | Width without End Bits | 3.917 m | 12 ft 10.2 in | 3.917 m | 12 ft 10.2 in | 4.961 m | 16 ft 3.3 in |
| | Width across End Bits (Blade Angled) | N/A | | N/A | | 4.626 m | 15 ft 2.1 in |
| | Width without End Bits (Blade Angled) | N/A | | N/A | | 4.502 m | 14 ft 9.2 in |
| | Maximum Blade Angle | N/A | | N/A | | 25 degrees | |
| 8 | Height | 1.108 m | 3 ft 7.6 in | 1.767 m | 3 ft 7.6 in | 1.150 m | 3 ft 9.3 in |
| 9 | Dig Depth | 0.600 m | 1 ft 11.6 in | 0.600 m | 1 ft 11.6 in | 0.719 m | 28.3 in |
| 10 | Lift Height | 1.080 m | 3 ft 6.5 in | 1.080 m | 3 ft 6.5 in | 1.173 m | 46.2 in |
| 11 | Maximum Tilt at Blade Corner | 0.500 m | 1 ft 7.7 in | 0.500 m | 1 ft 7.7 in | 0.689 m | 27.1 in |
| | Maximum Tilt Angle | 8.8 degrees | | 8.8 degrees | | 7.8 degrees | |
| | Pitch Adjustment | ±4.2 degrees | | ±4.2 degrees | | N/A | |
| 12 | Length of Machine (Blade Straight) | 5.483 m | 17 ft 11.9 in | 5.483 m | 17 ft 11.9 in | 5.960 m | 19 ft 6.6 in |
| | Length of Machine (Blade Angled) | N/A | | N/A | | 6.996 m | 22 ft 10.3 in |
| | Weight (Blade) | 1220 kg | 2,690 lb | 1432 kg | 3,157 lb | 1453 kg | 3,203 lb |
| | Weight (Blade and Push Arms) | 2370 kg | 5,225 lb | 2582 kg | 5,692 lb | 3618 kg | 7,976 lb |

## Configuration Tables – D6/D6 XE VPAT

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 22 240 kg | 49,030 lb |
| | Shipping Weight*** | 20 500 kg | 45,195 lb |
| | Ground Pressure (ISO 16754) | 49 kPa | 7.1 psi |
| | Undercarriage (Standard) | 45 Section with 8 Bottom Rollers | |
| 1 | Track Gauge | 2.080 m | 82 in |
| 2 | Width of Maximum Track Shoe | 0.610 m | 24 in |
| 3 | Width over Tracks | 2.690 m | 105.9 in |
| 4 | Length of Track on Ground | 3.247 m | 127.8 in |
| | Ground Contact Area (ISO 16754) | 4.473 m² | 6,933 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.422 m | 16.6 in |
| | Oscillation at Front Idler | 0.112 m | 4.4 in |
| 5 | Machine Height**** | 3.222 m | 126.9 in |
| 6 | Length of Machine without Blade | 5.134 m | 202.1 in |

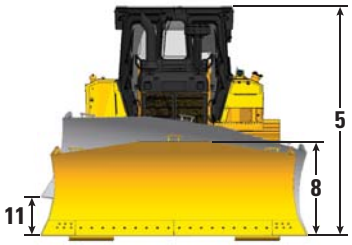
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, VPAT blade, and calculated per ISO 16754 unless otherwise specified.

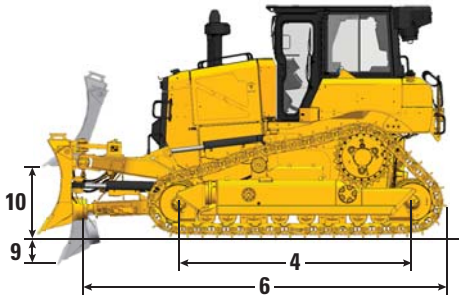
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

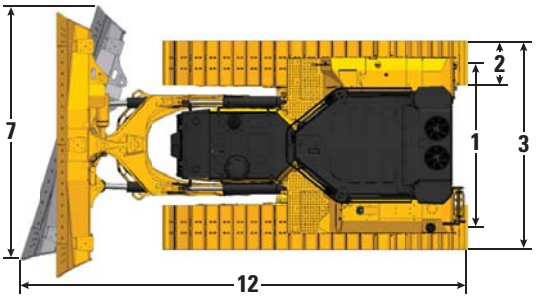
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, C-frame, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blade

| | Configuration | 6 VPAT | |
|---|---|---|---|
| | Capacity (ISO 9246) | 4.1 m³ | 5.4 yd³ |
| 7 | Width across End Bits | 3.680 m | 12 ft 0.9 in |
| | Width without End Bits | 3.570 m | 11 ft 8.6 in |
| | Width across End Bits (Blade Angled) | 3.363 m | 11 ft 0.4 in |
| | Width without End Bits (Blade Angled) | 3.266 m | 10 ft 8.6 in |
| | Maximum Blade Angle | 24.1 degrees | |
| 8 | Height | 1.312 m | 4 ft 3.7 in |
| 9 | Dig Depth | 0.698 m | 27.5 in |
| 10 | Lift Height | 1.131 m | 44.5 in |
| 11 | Maximum Tilt at Blade Corner | 0.576 m | 22.7 in |
| | Maximum Tilt Angle | 9 degrees | |
| | Pitch Adjustment | +3.1/–2.9 degrees | |
| 12 | Length of Machine (Blade Straight) | 5.662 m | 18 ft 6.9 in |
| | Length of Machine (Blade Angled) | 6.365 m | 20 ft 10.6 in |
| | Weight (Blade) | 1414 kg | 3,117 lb |

# D6/D6 XE Track-Type Tractors Specifications

## Configuration Tables – D6/D6 XE LGP VPAT (30 in)

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 22 975 kg | 50,650 lb |
| | Shipping Weight*** | 21 125 kg | 46,575 lb |
| | Ground Pressure (ISO 16754) | 40 kPa | 5.8 psi |
| | Undercarriage (Standard) | 46 Section with 8 Bottom Rollers | |
| | Undercarriage (Optional) | 46 Section with 10 Bottom Rollers | |
| 1 | Track Gauge | 2.286 m | 90 in |
| 2 | Width of Maximum Track Shoe | 0.760 m | 30 in |
| 3 | Width over Tracks | 3.046 m | 119.9 in |
| 4 | Length of Track on Ground | 3.355 m | 132.1 in |
| | Ground Contact Area (ISO 16754) | 5.591 m² | 8,666 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.390 m | 15.4 in |
| | Oscillation at Front Idler | 0.121 m | 4.8 in |
| 5 | Machine Height**** | 3.222 m | 126.9 in |
| 6 | Length of Machine without Blade | 5.134 m | 202.1 in |

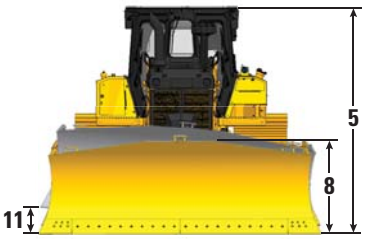
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, VPAT blade, and calculated per ISO 16754 unless otherwise specified.

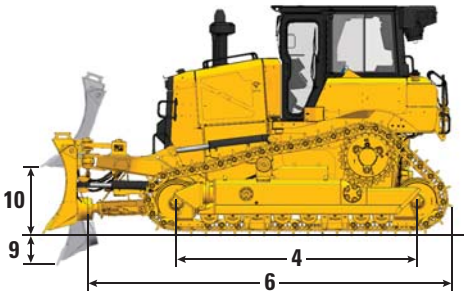
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

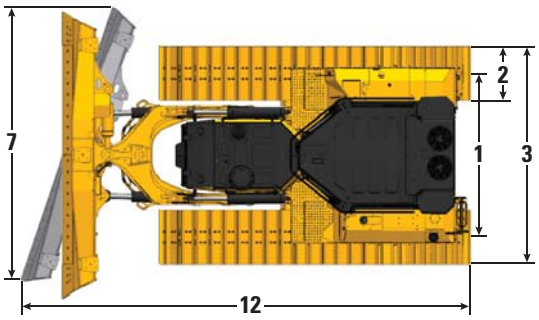
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, C-frame, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blade

| | Configuration | 6 VPAT LGP (30 in) | |
|---|---|---|---|
| | Capacity (ISO 9246) | 4.5 m³ | 5.9 yd³ |
| 7 | Width across End Bits | 4.000 m | 13 ft 1.5 in |
| | Width without End Bits | 3.890 m | 12 ft 9.1 in |
| | Width across End Bits (Blade Angled) | 3.655 m | 11 ft 11.9 in |
| | Width without End Bits (Blade Angled) | 3.554 m | 11 ft 7.9 in |
| | Maximum Blade Angle | 24.1 degrees | |
| 8 | Height | 1.312 m | 4 ft 3.7 in |
| 9 | Dig Depth | 0.698 m | 27.5 in |
| 10 | Lift Height | 1.131 m | 44.5 in |
| 11 | Maximum Tilt at Blade Corner | 0.625 m | 24.6 in |
| | Maximum Tilt Angle | 9 degrees | |
| | Pitch Adjustment | +3.1/–2.9 degrees | |
| 12 | Length of Machine (Blade Straight) | 5.662 m | 18 ft 6.9 in |
| | Length of Machine (Blade Angled) | 6.430 m | 21 ft 1.1 in |
| | Weight (Blade) | 1516 kg | 3,342 lb |

## Configuration Tables – D6/D6 XE LGP VPAT (36 in)

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 23 530 kg | 51,875 lb |
| | Shipping Weight*** | 21 580 kg | 47,575 lb |
| | Ground Pressure (ISO 16754) | 35 kPa | 5.0 psi |
| | Undercarriage (Standard) | 46 Section with 8 Bottom Rollers | |
| | Undercarriage (Optional) | 46 Section with 10 Bottom Rollers | |
| 1 | Track Gauge | 2.39 m | 94 in |
| 2 | Width of Maximum Track Shoe | 0.915 m | 36 in |
| 3 | Width over Tracks | 3.305 m | 130.1 in |
| 4 | Length of Track on Ground | 3.355 m | 132.1 in |
| | Ground Contact Area (ISO 16754) | 6.709 m² | 9,510 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.383 m | 15.1 in |
| | Oscillation at Front Idler | 0.121 m | 4.8 in |
| 5 | Machine Height**** | 3.222 m | 126.9 in |
| 6 | Length of Machine without Blade | 5.134 m | 202.1 in |

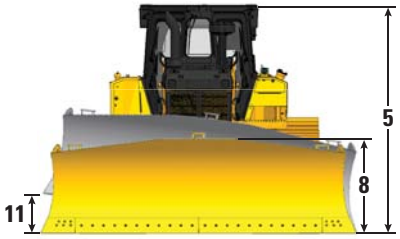
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, VPAT blade, and calculated per ISO 16754 unless otherwise specified.

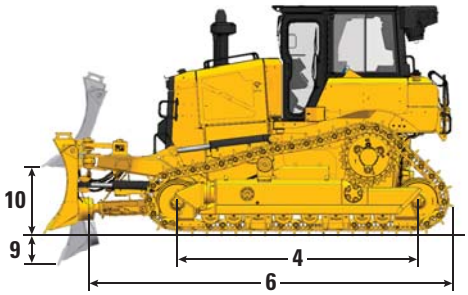
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

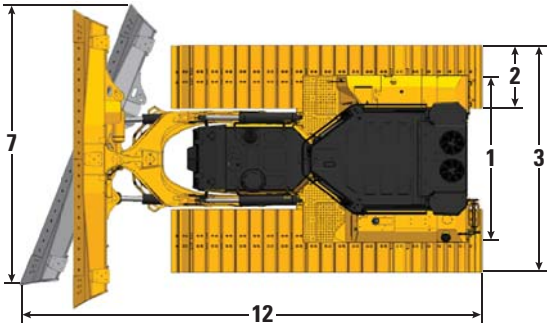
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, tow point, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, C-frame, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and tow point.

****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blade

| | Configuration | 6 VPAT LGP (36 in) | |
|---|---|---|---|
| | Capacity (ISO 9246) | 4.86 m³ | 6.5 yd³ |
| 7 | Width across End Bits | 4.340 m | 14 ft 2.9 in |
| | Width without End Bits | 4.230 m | 13 ft 10.5 in |
| | Width across End Bits (Blade Angled) | 3.966 m | 13 ft 0.1 in |
| | Width without End Bits (Blade Angled) | 3.868 m | 12 ft 8.3 in |
| | Maximum Blade Angle | 24.1 degrees | |
| 8 | Height | 1.312 m | 4 ft 3.7 in |
| 9 | Dig Depth | 0.698 m | 27.5 in |
| 10 | Lift Height | 1.131 m | 44.5 in |
| 11 | Maximum Tilt at Blade Corner | 0.684 m | 26.9 in |
| | Maximum Tilt Angle | 9 degrees | |
| | Pitch Adjustment | +3.1/–2.9 degrees | |
| 12 | Length of Machine (Blade Straight) | 5.662 m | 18 ft 6.9 in |
| | Length of Machine (Blade Angled) | 6.500 m | 21 ft 3.9 in |
| | Weight (Blade) | 1617 kg | 3,565 lb |

# D6/D6 XE Track-Type Tractors Specifications

## Configuration Tables – D6/D6 XE LGP Folding VPAT (30 in) – *EU only*

| | Configuration | D6/D6 XE* | |
|---|---|---|---|
| | Operating Weight** | 22 360 kg | 49,295 lb |
| | Shipping Weight*** | 19 775 kg | 43,595 lb |
| | Ground Pressure (ISO 16754) | 45 kPa | 6.5 psi |
| | Undercarriage (Standard) | 46 Section with 8 Bottom Rollers | |
| | Undercarriage (Optional) | 46 Section with 10 Bottom Rollers | |
| 1 | Track Gauge | 2.286 m | 90 in |
| 2 | Width of Standard Track Shoe**** | 0.660 m | 26 in |
| | Optional Maximum Track Shoe**** | 0.760 m | 30 in |
| 3 | Width over Tracks | 2.946 m | 116.0 in |
| 4 | Length of Track on Ground | 3.355 m | 132.1 in |
| | Ground Contact Area (ISO 16754) | 4.845 m² | 7,510 in² |
| | Track Pitch | 0.2028 m | 7.9 in |
| | Grouser Height (Moderate Service) | 0.065 m | 2.6 in |
| | Ground Clearance | 0.390 m | 15.4 in |
| | Oscillation at Front Idler | 0.121 m | 4.8 in |
| 5 | Machine Height***** | 3.222 m | 126.9 in |
| 6 | Length of Machine without Blade | 5 134 m | 202.1 in |

All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of standard width for configuration, Foldable VPAT blade, and calculated per ISO 16754 unless otherwise specified.

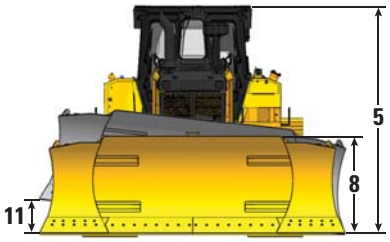
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

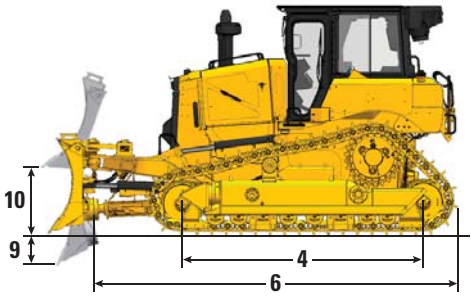
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

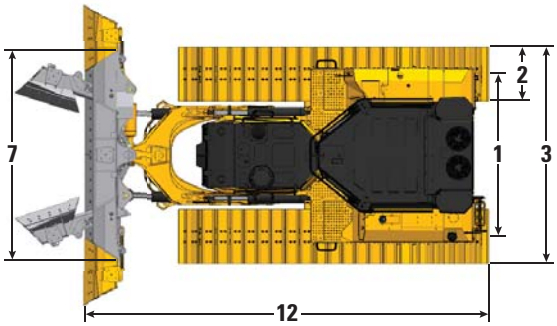
***Shipping weight includes blade lift cylinders, C-frame, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Standard track shoe width ensures 3.0 m shipping width with blade folded. Optional 30 inch track shoes provide lower ground pressure of 42 kPa (6.1 psi). Increases shipping width to 3.046 m (120.0 in).

*****Machine height from tip of grouser to top of Product Link Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.




## Blade

| | Configuration | 6 VPAT LGP Folding (30 in) | |
|---|---|---|---|
| | Capacity (ISO 9246) | 5.2 m³ | 6.8 yd³ |
| 7 | Width across End Bits | 4.229 m | 13 ft 10.5 in |
| | Width without End Bits | 4.115 m | 13 ft 6.0 in |
| | Width of Folded Blade | 2.960 m | 9 ft 8.5 in |
| | Maximum Blade Angle | 24.1 degrees | |
| 8 | Height | 1.312 m | 4 ft 3.7 in |
| 9 | Dig Depth | 0.698 m | 27.5 in |
| 10 | Lift Height | 1.131 m | 44.5 in |
| 11 | Maximum Tilt at Blade Corner | 0.659 m | 26.0 in |
| | Maximum Tilt Angle | 9 degrees | |
| | Pitch Adjustment | +3.1/–2.9 degrees | |
| 12 | Length of Machine (Blade Straight) | 5.662 m | 18 ft 6.9 in |
| | Length of Machine (Blade Angled) | 6.643 m | 21 ft 9.5 in |
| | Weight (Blade) | 2254 kg | 4,969 lb |

## Dimensions – Rear Attachments

Add the following to the total length of the machine when these rear attachments are installed.

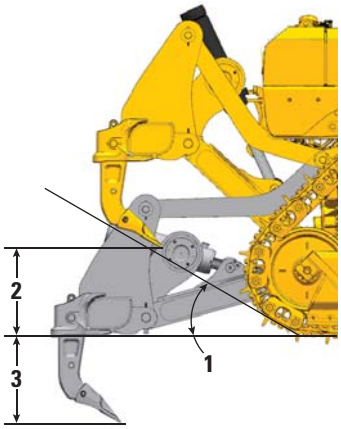
| | | Winch | | Ripper | | Drawbar or Counterweight* | | Waste Striker Box | |
|---|---|---|---|---|---|---|---|---|---|
| Push Arm and Angle Dozers | D6, D6 LGP (30 in) | 441 mm | 17.4 in | 1179 mm | 46.4 in | 249 mm | 9.8 in | 478 mm | 18.8 in |
| | D6 LGP (36 in) | 416 mm | 16.4 in | 1154 mm | 45.4 in | 224 mm | 8.8 in | 453 mm | 17.8 in |
| VPAT Dozers | | 416 mm | 16.4 in | 1154 mm | 45.4 in | 224 mm | 8.8 in | 453 mm | 17.8 in |

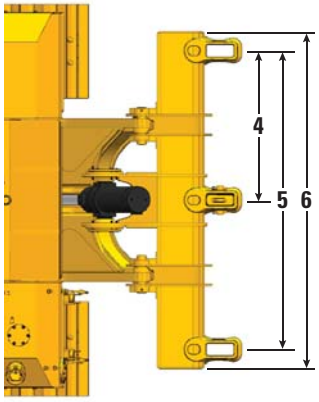
*Drawbar weight 119 kg (262 lb), 331 kg (730 lb) for each counterweight slab. The new D6 dozer design provides improved balance. Counterweights are only recommended with heavier aftermarket blades.

## Ripper

| | | | |
|---|---|---|---|
| | Type | Fixed Parallelogram | |
| | Number of Pockets | 3 | |
| 1 | Ramp Angle | 31 degrees | |
| 2 | Maximum Clearance Raised (under tip) | 664 mm | 26.1 in |
| 3 | Maximum Penetration | 571 mm | 22.5 in |
| 4 | Pocket Spacing | 1000 mm | 39.4 in |
| 5 | Shank Gauge | 2000 mm | 78.8 in |
| | Shank Section | 74 mm × 175 mm | 2.9 in × 6.9 in |
| 6 | Overall Beam Width | 2190 mm | 86 in |
| | Beam Cross Section | 219 mm × 304 mm | 8.8 in × 12 in |
| | Maximum Penetration Force* | 68.8 kN | 15,470 lbf |
| | Pryout Force | 126 kN | 28,350 lbf |
| | Ripper Weight | | |
| | With One Shank | 1550 kg | 3,417 lb |
| | Each Additional Shank | 73 kg | 161 lb |

Specifications based on D6 tractor configuration with Heavy Duty undercarriage, MS shoes, and straight ripper shanks.
*May vary based on configuration and machine weight.



## Winches

The D6 and D6 XE expand industry-leading winch capability with the introduction of available high pressure (27 600 kPa/4,000 psi) hydraulics capable of powering high performance hydraulic winches. These winches provide exceptional controllability for applications that require precise load placement. The D6 retains compatibility with PTO-driven winches for maximum power and efficiency. Winches of both styles are available from Caterpillar for factory or dealer installation, and integrate with the tractor's electronic and control system.

| Tractor Model | D6 | | D6 and D6 XE | |
|---|---|---|---|---|
| Winch Model | PA56 (Low Speed) | | PA85 | |
| Winch Drive | Mechanical | | Hydraulic | |
| Control | Electrical | | Electrical | |
| Operating Weight* | 1582 kg | 3,487 lb | 1530 kg | 3,374 lb |
| Oil Capacity | 43.5 L | 11.5 gal | 19 L | 5 gal |
| Increased Tractor Length | | | | |
| Standard/LGP | 516 mm | 20.4 in | 516 mm | 20.4 in |
| LGP (36 in) | 365 mm | 14.4 in | 365 mm | 14.4 in |
| Drum Diameter | 254 mm | 10 in | 254 mm | 10 in |
| Rope Diameter | | | | |
| Recommended | 22 mm | 0.88 in | 22 mm | 0.88 in |
| Optional | 25 mm | 1 in | 25 mm | 1 in |
| Drum Working Capacity | | | | |
| 22 mm (0.88 in) | 55 m | 180 ft | 55 m | 180 ft |
| 25 mm (1.0 in) | 50 m | 163 ft | 50 m | 163 ft |
| Cable Ferrule Size (O.D. × Length) | 54 mm × 67 mm | 2.1 in × 2.6 in | 54 mm × 67 mm | 2.1 in × 2.6 in |
| Maximum Bare Drum | | | | |
| Line Pull** | 40 700 kg | 89,800 lb | 40 000 kg | 88,000 lb |
| Line Speed*** | 18 m/min | 58 ft/min | 27 m/min | 89 ft/min |
| Maximum Full Drum**** | | | | |
| Line Pull** | 34 600 kg | 76,300 lb | 24 000 kg | 52,800 lb |
| Line Speed*** | 31 m/min | 103 ft/min | 44 m/min | 145 ft/min |

*Operating Weight includes winch, mounting hardware, oil, and recommended wire rope.

**Maximum line pull is lesser of calculated line pull at maximum tractor PTO output torque/hydraulic power or catalog breaking strength of maximum optional size new IWRC IPS wire rope.

***Maximum line speed is calculated no-load line speed at maximum tractor engine PTO output speed or maximum hydraulic power.

****Full drum as defined by SAE J1158.

## Track Shoes

Available as Heavy Duty or SystemOne™. Some track shoes not available in all regions. Please consult your Cat dealer for details.

| | Moderate Service | Extreme Service | Extreme Service Trapezoidal | Self-Cleaning | Quad/ Quad Ready |
|---|---|---|---|---|---|
| **D6/D6 XE – 42 Link** | | | | | |
| 560 mm (22 in) | ✓ | ✓ | | | |
| 610 mm (24 in) | ✓ | ✓ | ✓ | | |
| **D6 LGP/D6 XE LGP – 42 Link** | | | | | |
| 610 mm (24 in) | ✓ | ✓ | ✓ | | |
| 760 mm (30 in) | ✓ | ✓ | ✓ | | |
| **D6 LGP/D6 XE LGP (36 in) – 45 Link** | | | | | |
| 760 mm (30 in) | ✓ | ✓ | ✓ | | |
| 915 mm (36 in) | ✓ | ✓ | ✓ | | HDXL only |
| 1000 mm (39 in) | | | | HDXL only | |
| **D6 VPAT/D6 XE VPAT – 45 Link** | | | | | |
| 610 mm (24 in) | ✓ | ✓ | ✓ | | |
| **D6 LGP VPAT/D6 XE LGP VPAT – 46 Link** | | | | | |
| 610 mm (24 in) | ✓ | ✓ | ✓ | | |
| 660 mm (26 in) | EU only | | | | |
| 760 mm (30 in) | ✓ | ✓ | ✓ | | |
| **D6 LGP VPAT/D6 XE LGP VPAT (36 in) – 46 Link** | | | | | |
| 760 mm (30 in) | ✓ | ✓ | ✓ | | |
| 915 mm (36 in) | ✓ | ✓ | ✓ | | HDXL only |

## Fluid/Refill Capacities

| | | |
|---|---|---|
| Fuel Tank | 341 L | 90 gal |
| DEF Tank | 28 L | 7.4 gal |
| Cooling System – D6 | 63 L | 16.6 gal |
| Cooling System – D6 XE | 77 L | 20.3 gal |
| Engine Crankcase | 24.5 L | 6.5 gal |
| Power Train Oil – D6 | 148 L | 39.1 gal |
| Power Train Oil – D6 XE | 210 L | 55.5 gal |
| Final Drives (each) | 18.2 L | 4.8 gal |
| Roller Frames (each) | 65-85 L | 17.2-22.5 gal |
| Pivot Shaft Compartment | 2.8 L | 0.74 gal |
| Hydraulic Tank Oil | 60 L | 15.8 gal |
| Hydraulic System | 77 L | 20.3 gal |

## Waste Handlers

| | D6/D6 XE* | | D6/D6 XE* LGP (30 in) | | D6/D6 XE* LGP (36 in) | |
|---|---|---|---|---|---|---|
| Operating Weight | 23 662 kg | 52,166 lb | 23 927 kg | 52,751 lb | 25 253 kg | 55,674 lb |
| Shipping Weight** | 21 072 kg | 46,456 lb | 21 229 kg | 46,803 lb | 22 823 kg | 50,317 lb |

Waste Handler operating weight varies by options selected. Published weights for each configuration include Heavy Duty waste undercarriage with shoes of maximum width, waste blade, fuel tank guards, guarded final drives, high debris cab, chassis bars, striker box, full fuel tank, lubricants, and 75 kg (165 lb) operator.

*XE power train adds 273 kg (600 lb) to the published weights.

**Shipping weight is calculated based on operating weight, minus blade/push arms, less operator, and 10% fuel.

## Air Conditioning System

The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a (Global Warming Potential = 1430). The system contains 1.36 kg of refrigerant which has a $CO_2$ equivalent of 1.946 metric tonnes.

## Advanced Cabin Filtration

### Operator Cabin

- Distributed HVAC ducting with automatic temperature control and blower speed provides ultimate operator comfort with less user input.
- Reduced maintenance of the condenser core with automatic reversing fans.
- Cat Advanced Cabin Filtration is standard.

### Cat Advanced Cabin Filtration

- Operator protection from respirable particulate (0.3-10 micron size).
- Sustainably pressurized cab (US Silica compliant).
- Reduced maintenance with longer life, high efficiency filters.
- Protection for all cabin components: electronics, etc.
- Helps meet U.S. Occupational Safety and Health Administration Silica Rule Table 1 requirements for operator cabs.
- Multi-tiered filter offerings for optional efficiency upgrades. Contact Cat dealer for availability.
  - MERV 16 – Standard Equipment
  - HEPA
  - Activated Carbon + HEPA
  - ABEK1 + HEPA

## Standards

### Rollover Protective Structure (ROPS)/ Falling Object Protective Structure (FOPS)

- ROPS meets ISO 3471:2008, FOPS meets ISO 3449:2005 Level II.

### Brakes

- Brakes meet the International Standard ISO 10265:2008.

### Cab

Meets appropriate standards as listed below.

- The average dynamic spectator sound power level when "ISO 6395:2008" is used to measure the value for a machine is shown below. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds.

  NOTE: The dynamic sound power level uncertainty is ± 2 dB(A).

  | | |
  |---|---|
  | D6 | 111 dB(A) |
  | D6 XE | 109 dB(A) |

- The average dynamic operator sound pressure level when "ISO 6396:2008" is used to measure the value for an enclosed cab is shown below. The measurement was conducted at 70% of the maximum engine cooling fan speed. The sound level may vary at different engine cooling fan speeds. The cab was properly installed and maintained. The measurement was conducted with the cab doors and the cab windows closed.

  NOTE: The dynamic operator sound pressure level uncertainty is ± 2 dB(A).

  | | |
  |---|---|
  | D6 | 76 dB(A) |
  | D6 XE | 73 dB(A) |

- Hearing protection may be needed when the machine is operated with an open operator station for extended periods, in a noisy environment, or with a cab that is not properly maintained.
- Sound level information for machines in European Union countries and in countries that adopt the "European Union Directives" is shown below. If equipped, the certification label is used to verify the environmental sound certification of the machine to the requirements of the European Union. The value that is listed on the label indicates the guaranteed exterior sound power level ($L_{WA}$) at the time of manufacture for the conditions that are specified in "2000/14/EC."

  | | |
  |---|---|
  | D6 | 111 dB(A) |
  | D6 XE | 111 dB(A) |

## Standard and Optional Equipment

Standard and optional equipment may vary. Consult your Cat dealer for details.

| | Standard | Optional |
|---|---|---|
| **POWER TRAIN** | | |
| Fully-automatic 4-speed Transmission with Lock Up Clutch (LUC) torque divider | D6 | |
| XE Electric Drive Power Train | D6 XE | |
| Differential Steering System | ✓ | |
| Cat C9.3B diesel engine with turbo, with engine mounted aftertreatment to meet U.S. EPA Tier 4 Final, EU Stage V, Korea Tier 4 Final emission standards | ✓ | |
| Cat C9.3B diesel engine with thermal shield and liquid cooled turbo, with engine mounted aftertreatment to meet U.S. EPA Tier 4 Final, EU Stage V, Korea Tier 4 Final emission standards | | ✓ |
| Engine air precleaner with dust ejection | ✓ | |
| Engine air precleaner with dust ejection and screen for high debris applications | | ✓ |
| Double reduction planetary final drives | ✓ | |
| Double reduction planetary final drives, guarded | | ✓ |
| Automatic ether starting aid | ✓ | |
| Electric fuel priming pump | ✓ | |
| Electronic parking brake | ✓ | |
| Engine air filter with electronic service indicator | ✓ | |
| Fuel water separator with electronic service indicator | ✓ | |
| Jacket water heater, 110V OR 220V based on sales region | ✓ | |
| Diesel Exhaust Fluid (DEF) System – Electronic fill indicator, heated lines/tank | ✓ | |
| **CAT CONNECT TECHNOLOGY** | | |
| Slope Indicate | ✓ | |
| Stable Blade | ✓ | |
| Attachment Ready Option (ARO) | ✓ | |
| Cat GRADE with Slope Assist™ | ✓ | |
| Cat GRADE with 3D | | ✓ |
| Product Link, cellular PLE641 | ✓ | |
| Product Link Elite PLE631 – dual cellular/satellite | | ✓ |

| | Standard | Optional |
|---|---|---|
| **OPERATOR ENVIRONMENT** | | |
| Cab (STD), Fully Redesigned with Integrated ROPS and FOPS, single pane door glass, sliding windows, with Cat Advanced Cabin Filtration | ✓ | |
| Cab (High Debris), Fully Redesigned with Integrated ROPS and FOPS, impact resistant polycarbonate doors, solid side windows for improved sealing, powered precleaner with Cat Advanced Cabin Filtration for improved performance and filter life | | ✓ |
| Cab (Forestry), Fully Redesigned with Integrated ROPS and FOPS, impact resistant polycarbonate doors, sliding windows, with Cat Advanced Cabin Filtration | | ✓ |
| Full-color 254 mm (10 inch) liquid crystal touch screen display | ✓ | |
| Integrated rearview camera | ✓ | |
| Adjustable operator controls/armrests | ✓ | |
| Cloth seat with mechanical adjustable lumbar support | ✓ | |
| Deluxe leather heated/ventilated seat with electronic adjustable lumbar support | | ✓ |
| Cab mounted modular HVAC system with automatic reversing fans. Automatic temperature and blower control with distributed ducting. | ✓ | |
| Viscous cab mounts for improved ride | ✓ | |
| Entertainment radio with Bluetooth® and microphone | ✓ | |
| USB and AUX ports | ✓ | |
| Glove box (removed if Cat GRADE with 3D is selected) | ✓ | |
| Enhanced Cab Storage Solutions | ✓ | |
| Window shades (front and door)* | | ✓ |
| Sound suppressed floor plates with adjustable foot pegs | ✓ | |
| Quick opening floor plate arrangement with sound suppression and adjustable foot pegs* | | ✓ |
| Fifth percentile operator floor plate arrangement* | | ✓ |
| Screen ready, side and rear | ✓ | |
| Operator presence switch | ✓ | |

*Please check with your Cat dealer for availability dates.

*(continued on next page)*

## Standard and Optional Equipment *(continued)*

Standard and optional equipment may vary. Consult your Cat dealer for details.

| | Standard | Optional |
|---|---|---|
| **UNDERCARRIAGE** | | |
| Structurally improved track roller frame designed to allow conversion between HD and S1 | ✓ | |
| Undercarriage with 7 or 8 bottom rollers (configuration dependent) | ✓ | |
| Undercarriage with 10 bottom rollers for fine grading applications | | ✓ |
| Waste undercarriage | | HD UC only |
| Partially guided undercarriage | | ✓ |
| Fully guided undercarriage | | ✓ |
| Heavy Duty (HDXL with DuraLink™) | ✓ | |
| SystemOne track | | ✓ |
| Moderate service track shoes (see chart on page 13) | ✓ | |
| Extreme service track shoes (see chart on page 13) | | ✓ |
| Carrier roller | ✓ | |
| Hydraulically adjustable track | ✓ | |
| Replaceable sprocket rim segments | ✓ | |
| **BLADES** | | |
| Semi-Universal, ARO mounts | | ✓ |
| Semi-Universal, LGP with ARO mounts | | ✓ |
| Semi-Universal, Waste | | ✓ |
| Semi-Universal, LGP Waste | | ✓ |
| Straight blade, LGP with ARO mounts | | ✓ |
| Straight blade, LGP Waste | | ✓ |
| VPAT, ARO mounts | | ✓ |
| VPAT, LGP with ARO mounts | | ✓ |
| VPAT, LGP (36 in) with ARO mounts | | ✓ |
| Foldable VPAT, LGP with ARO mounts | | EU only |
| Angle blade | | NA only |
| Caterpillar Performance cutting edges | | Dealer only |

| | Standard | Optional |
|---|---|---|
| **HYDRAULICS** | | |
| Load sensing hydraulics – dozer lift and tilt | ✓ | |
| Independent steering hydraulics | ✓ | |
| Ripper ready rear hydraulics | D6 | |
| Ripper and winch ready rear hydraulics | D6 XE | D6 |
| Single axis ripper control | ✓ | |
| Dual axis ripper/winch control | | ✓ |
| Hydraulic automatically reversing, zero speed capable cooling fan | ✓ | |
| Electronic Hydraulic lockout switch | ✓ | |
| **ELECTRICAL** | | |
| Lights – 6 LED | ✓ | |
| Premium lights – 12 LED for 360 degree light coverage | | ✓ |
| Backup alarm | ✓ | |
| Integrated beacon warning light (does not impact shipping height) | | ✓ |
| Brushless alternator | ✓ | |
| Brushless alternator, ducted for high debris applications | | ✓ |
| Communication radio ready | ✓ | |
| Converter: two 10 Amp, 12V outlets | ✓ | |
| Diagnostic connector | ✓ | |
| Forward warning horn | ✓ | |
| Fuse panel and main power relay located inside cab | ✓ | |

*(continued on next page)*

## Standard and Optional Equipment *(continued)*

Standard and optional equipment may vary. Consult your Cat dealer for details.

| | Standard | Optional |
|---|---|---|
| **SERVICE AND MAINTENANCE** | | |
| 30-minute cab removal | ✓ | |
| Ecology drains | ✓ | |
| Ecology drains with high speed oil power train and engine oil change | | ✓ |
| Ground level service center with remote electrical disconnect, access light, secondary shutdown switch and hour meter | ✓ | |
| Fuel tank, 341 L (90 gal) | ✓ | |
| Fuel tank, 341 L (90 gal), fast fill ready | D6 XE | D6 |
| Wiggins style fast fill nozzle | | ✓ |
| Mounting provision for grease gun and fire extinguisher | ✓ | |
| Perforated radiator doors, louvered and hinged | ✓ | |
| Rear access ladder | ✓ | |
| Refilling fuel pump | | EU only |
| Removable engine enclosures, perforated and hinged, with under hood work light | ✓ | |
| Removable engine enclosures, sound suppressed and hinged, with under hood work light | | EU only |
| S·O·S℠ sampling ports | ✓ | |
| Shovel holder | ✓ | |
| Maintenance free equalizer bar | ✓ | |
| Certified ISO 14567 tie off points (3) | ✓ | |
| Vandalism protection for fluid compartments and battery box | ✓ | |
| Dedicated shipping tie downs, rear | ✓ | |
| Shipping tie downs, front bracket | | EU only |
| **BATTERIES, STARTERS, ALTERNATORS AND FLUIDS** | | |
| 150 Amp alternator | ✓ | |
| 150 Amp ducted alternator | | ✓ |
| Heavy duty batteries, two maintenance-free 12V (1,400 CCA) (24V system) | ✓ | |
| Heavy duty, 24V starter | ✓ | |
| Extended Life Engine coolant, –37° C (–35° F) | ✓ | |
| Extended Life Arctic engine coolant, –51° C (–60° F) | | ✓ |
| Bio hydraulic oil, –37° C (–35° F) | | EU only |

| | Standard | Optional |
|---|---|---|
| **ATTACHMENTS** | | |
| Drawbar | ✓ | |
| High lift multi-shank ripper with straight or curved shanks | | ✓ |
| Lightweight rear tow point | | ✓ |
| Striker bar box | | ✓ |
| Counterweights (not recommended unless using heavier aftermarket blades) | | ✓ |
| PACCAR PA56 winch, low speed PTO | | D6 |
| PACCAR PA85 winch, variable speed hydraulic | | ✓ |
| PACCAR PA56 winch, standard speed PTO | | D6 Dealer only |
| Allied H6H winch, variable speed hydraulic | | Dealer only |
| Fairlead Assembly; 3-roller, fits PA55, PA56, and PA85 winches | | ✓ |
| Retrofit kit (4th roller); fits PA55, PA56, and PA85 winches | | ✓ |
| **GUARDING AND SCREENS** | | |
| Bottom guards | ✓ | |
| Heavy duty sealed bottom guards | | Push Arm only |
| Heavy duty sealed quick access bottom guards* | | Push Arm only |
| Standard duty grab handles | ✓ | |
| Heavy duty grab handles | | ✓ |
| Open Sweeps guarding | | ✓ |
| Forestry Sweeps guarding with full canopy | | ✓ |
| Hinged rear screen | | ✓ |
| Hinged side screens | | ✓ |
| Fuel tank guard (with or without fast fill) | | ✓ |
| Guards for premium lights, front and side | | ✓ |
| Machine seals for high debris | | ✓ |
| Front and rear striker bars | | Dealer only |

*Please check with your Cat dealer for availability dates.

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

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Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Cat dealer for available options.

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AEXQ2470 (11-2018)
Build Number: 20A
(North America, Europe,
ANZ, Turkey, Korea)

# Small Wheel Loaders

## Aggregate Handler Arrangements

| | 926M Aggregate Handler | 930M Aggregate Handler | 938M Aggregate Handler |
|---|---|---|---|
| **Engine Model*** | Cat® C7.1 ACERT™ | Cat C7.1 ACERT | Cat C7.1 ACERT |
| **Maximum Rated Gross Power:** | | | |
| ISO 14396 | 114 kW (153 hp) | 122 kW (164 hp) | 140 kW (188 hp) |
| ISO 14396 (DIN) | 114 kW (155 hp) | 122 kW (166 hp) | 140 kW (190 hp) |
| **Bucket Capacity** | 2.5 $m^3$ (3.3 $yd^3$) | 2.5-2.7 $m^3$ (3.3-3.5 $yd^3$) | 2.9-3.2 $m^3$ (3.8-4.2 $yd^3$) |
| **Full Turn Tip Load** | 7976 kg (17,580 lb) | 8876 kg (19,563 lb) | 10 647 kg (23,466 lb) |
| **Operating Weight** | 13 128 kg (28,933 lb) | 14 131 kg (31,144 lb) | 16 368 kg (36,075 lb) |

*Engine meets U.S. EPA Tier 4 Final/EU Stage IV emission standards.

# Making Your Choice Easy

**Application Specific Configuration**
*Maximize productivity while keeping operating costs low. Cat Aggregate Handlers are built for sand and gravel applications to maximize profits.*

**Efficiently Powerful**
*Experience Hybrid like, industry leading, fuel efficiency with an intelligent hydrostatic power train. For highest production work, a new Performance Mode will boost the power and hydraulic speed in all ranges to get the job done even quicker.*

**Work Made Easy**
*Move more with Caterpillar's patented quick loading Performance Series buckets and optimized Z-bar linkage. Multi-function work has never been easier with dedicated pumps and a flow sharing implement valve.*

**Enjoy All Day Comfort**
*Have a seat in the M Series Small Wheel Loader and enjoy whisper quiet sound levels, all around visibility and seat mounted joystick controls. The large spacious cab combined with Caterpillar's exclusive hydraulic cylinder dampening make this the most comfortable seat on your job site.*

**Customize Your Experience**
*Modify individual preferences with Caterpillar's industry first Power Train Modes. Fine tune machine performance with adjustments at your fingertips through the soft touch buttons and optional secondary display.*

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*Environmental and customer friendly – up to 95% recyclable content by weight*

**The Cat 926M, 930M and 938M Aggregate Handlers set a new standard for productivity, fuel efficiency and comfort. A high torque, low speed C7.1 ACERT engine works in concert with an intelligent hystat power train to deliver fuel efficiency as standard. The optimized Z-bar loader linkage combined with long wear life Performance Series buckets delivers improved payloads and bucket longevity. Extremely low sound levels, large spacious cab and intuitive controls keep you working comfortably all day and even all night! Experience the new industry benchmark.**

# Application Specific Configuration

Maximize performance and productivity while minimizing operating costs.

### Increased Payload

Additional counterweight improves stability without reducing ground clearance or departure angle to maximize performance.

### Long Life Sand and Gravel Buckets

Performance Series Buckets deliver higher fill factors and better material retention for significant productivity and fuel efficiency improvements. The buckets feature a long floor, open throat, curved side bars and additional serviceable wear plates including corner guards.

### Protect your Power Train

Increase your fording depths with optional elevated breathers. Remote mounted high on the machine for the front and rear axles and hydrostatic gear box. Allows settling pond clean out without contamination.

# Customize Your Experience

Make it yours.

**Work as one with your machine** by customizing the controls.

## Flexible Power Train

A smooth, stepless electronically controlled hydrostatic transmission provides adjustable power to the ground with excellent groundspeed control and customizable feel.

- **Select your Power Train Mode:**
  - Torque Converter (TC) for smooth rollout.
  - Hystat for aggressive engine braking.
  - Default mode which blends the best of Hystat and Torque Converter characteristics.
- **Reduce tire wear** using Rimpull control which enables you to match available tractive power to underfoot conditions.
- **Set Directional Shift Response,** soft and smooth for material handling applications or sharp for aggressive operation.

## Adjustable Electro Hydraulic Controls

Easily customize the hydraulic performance through secondary display to optimize your efficiency.

- **Optimize hydraulic modulation** with Fine Mode control when working with forks.
- **Quicker hydraulic response** for fine grading at speed and quick functions through Lift and Tilt response settings.
- **Fully adjustable ride control** activation speed along with 3rd function auxiliary flow for powering a broom.

## Operator Profiles and Coded Start

- The M Series Wheel Loaders remember your personal settings with unique operator codes to make this machine truly yours and keep it secure on the job site.

# Efficiently Powerful

## Experience hybrid like fuel efficiency with more power when you need it.

### Intelligent Power Management

The Caterpillar exclusive Intelligent Power Management system monitors operator input and power availability to keep the machine working at peak efficiency.

### Power on Demand

A choice of Power Modes allows you to choose between maximum fuel efficiency or boosted power along with increased hydraulic speed to get your job done faster.

### Standard Power Mode

- Saves up to 10% fuel while running at an efficient 1,600 rpm.
- Recommended for load and carry to maximize fuel efficiency.
- Power-by-range logic increases power in speed Range 4 automatically to maximize travel speed and grade climbing performance.
- Reduces cab sound levels down to a whisper quiet 64 dB(A) typical.

### Performance Power Mode

- Enabled at the push of a button (HP+)
- Boosts engine power by up to 10% in all speed ranges.
- Boosts engine speed by over 12%.
- Increases hydraulic cycle times and productivity.

## Six Cylinders of Efficient Power

The Cat C7.1 ACERT engine provides cleaner, quieter operation while delivering superior performance and durability through a high torque, low speed design. The engine meets Tier 4 Final and Stage IV emission standards with a Clean Emissions Module that is designed to manage itself so you can concentrate on your work.

- **No downtime for regeneration** with a passive low temperature system that keeps you on the job.
- **Fit for Life Diesel Particulate Filter** that is designed to exceed the engine overhaul life.
- **Extended fluid fill intervals** with minimal use of Diesel Exhaust Fluid (DEF) with up to four fuel tank fills per DEF fill.
- **Configurable auto idle shut down** based on time and ambient temperature to further reduce fuel burn and keep operating costs low.
- **Spark arrester performance as standard** – Meets the performance requirements of EN 1834-1.2000 (section 6.4.2 Visual Test).

## Power to the Ground

Lock up and go with fully locking front differential axles that can be engaged on the move at full torque with the pull of a trigger on the seat mounted joystick. Maximize your traction with optional Limited Slip Differential on the rear axle to keep you climbing.

Independent service brakes on front and rear axles provide robust stopping performance while a push button electronic park brake allows you to safely secure the machine with ease.

# Work Made Easy

Getting the job done.

### Optimized Z-bar Linkage

The Caterpillar patented and optimized Z-bar linkage combines the digging efficiency of a traditional Z-bar with integrated tool carrier capabilities for great performance and versatility.

- **Perfect Parallelism** functionality available in Fork Mode gives truly predictable performance while high tilt forces throughout the working range help you safely and confidently handle loads with precise control.
- **Visibility** to bucket corners and fork tips at ground level remain excellent while sight lines at maximum lift are improved with a Generation II lift arm design.

## Quick Loading, Performance Series Buckets

Performance Series Sand and Gravel Buckets deliver up to 10% higher fill factors and better material retention for significant productivity and fuel efficiency improvements. The buckets feature a longer floor to take a bigger bite of the pile, an open throat to heap higher and curved side bars to help with material retention. Wear plates on the sides and bottom maximize bucket life in abrasive aggregate rehandling applications.

## Smooth and Predictable Multi-Function Performance

M Series machines feature an electro-hydraulic control system that is governed by the Intelligent Power Management system for peak efficiency. The load-sensing, variable flow system senses work demand and adjusts flow and pressure to match the operators request.

- **Multi-Function without compromise** through Caterpillar's exclusive dedicated hydraulic systems featuring three pumps.
  - 1st pump for Intelligent Hydrostatic drive
  - 2nd pump for implements
  - 3rd pump for steering system

Drive, lift and steer simultaneously with smooth, predictable control. The M Series simply does what you ask it to.

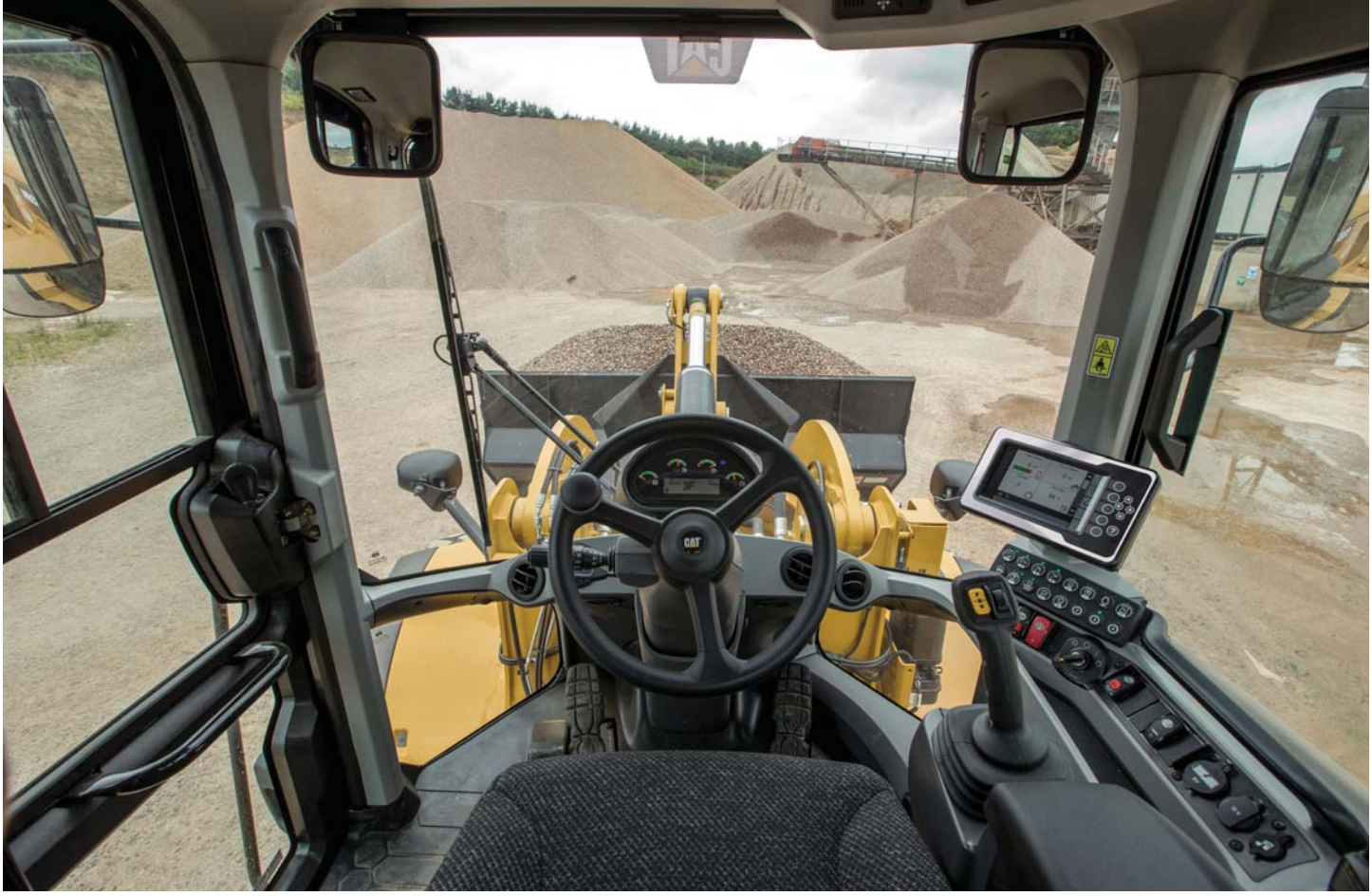
- **Programmable in-cab kick-outs** are easy to set on the go for tilt, lower and lift. This feature is ideal for applications where the work cycle is repeatable allowing you to quickly return to programmed set points maximizing cutting edge life.
- **Fine tune hydro-mechanical performance** with fully adjustable 3rd function flow through the secondary display (when equipped) for a perfect marriage between machine and attachments.

# Enjoy All Day Comfort

Best seat on the job site.

### Have a Seat and Experience:

- **Seat-mounted controls** featuring a low effort joystick for lift and tilt functions along with integrated Forward/Neutral/Reverse switch, differential lock trigger and optional third and fourth auxiliary functions.
- **Superior all around visibility** with single piece front windshield, new parabolic external mirrors, redesigned Generation II linkage and clean hydraulic lines routing.
- **Automatic climate control** with heated rear glass and external mirrors for a quick defrost.
- **Fully adjustable controls** including steering column, joystick and seat suspension.
- **Information at a glance** with large primary LCD display and full color secondary display.
- **An extra eye on the job site** with rear view camera and optional integrated rear object detection.
- **A heated and cooled seat** option for added comfort in a wide range of climates.



## An easy day at work with:

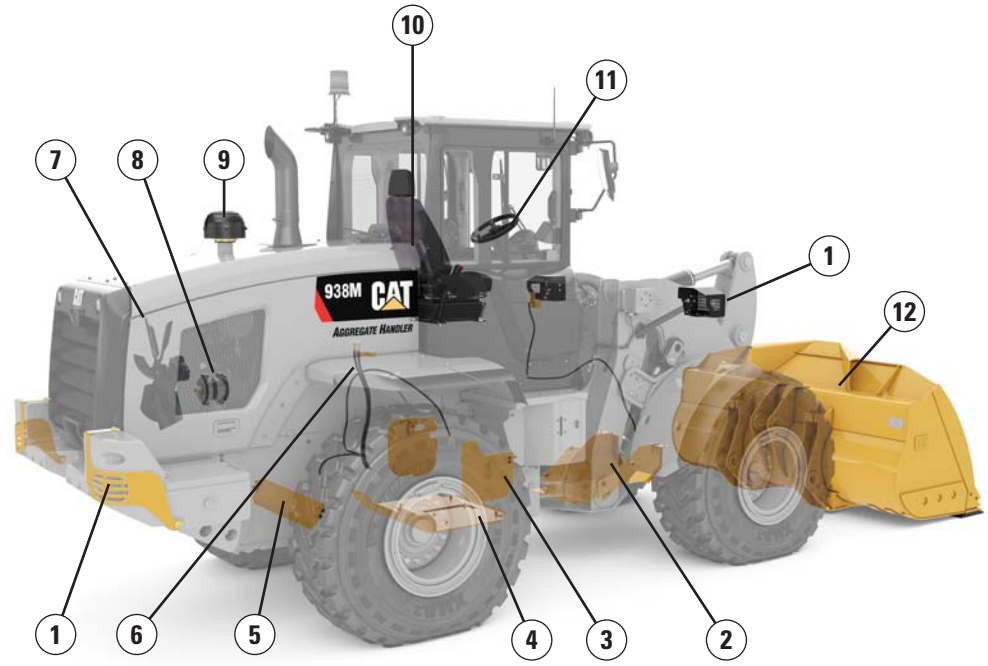
- **A spacious, safe, quiet operator environment** featuring ergonomic controls, seat belt notification and optional Bluetooth radio with integrated microphone plus an auxiliary port.
- **Easy access to vital machine parameters** with the optional secondary display, working in conjunction with the standard soft touch panel to allow real time adjustments to machine features and an integrated help button with over 25 languages.
- **Comfortable soft stops** at cylinder end stroke conditions and programmable kickout points with Caterpillar's exclusive electro-hydraulic cylinder snubbing.
- **An even smoother ride** with optional Ride Control when working unloaded and loaded with excellent material retention.
- **Early starts and late finishes** are made easier with optional LED lighting package that includes engine compartment lighting to illuminate the way for checking oil, and coolant level along with refueling the machine in dark conditions.

# Configured for Success

Ready to work for you.

### The Way You Want It

A complete range of optional equipment and work tools give you the versatility to configure an Aggregate Handler to be successful in your business. Get with your Cat dealer to configure yours.




**Guards:**

1) *Lights*
2) *Drive shaft*
3) *Side power train*
4) *Lower power train*
5) *Crank case*

**Debris Packages:**

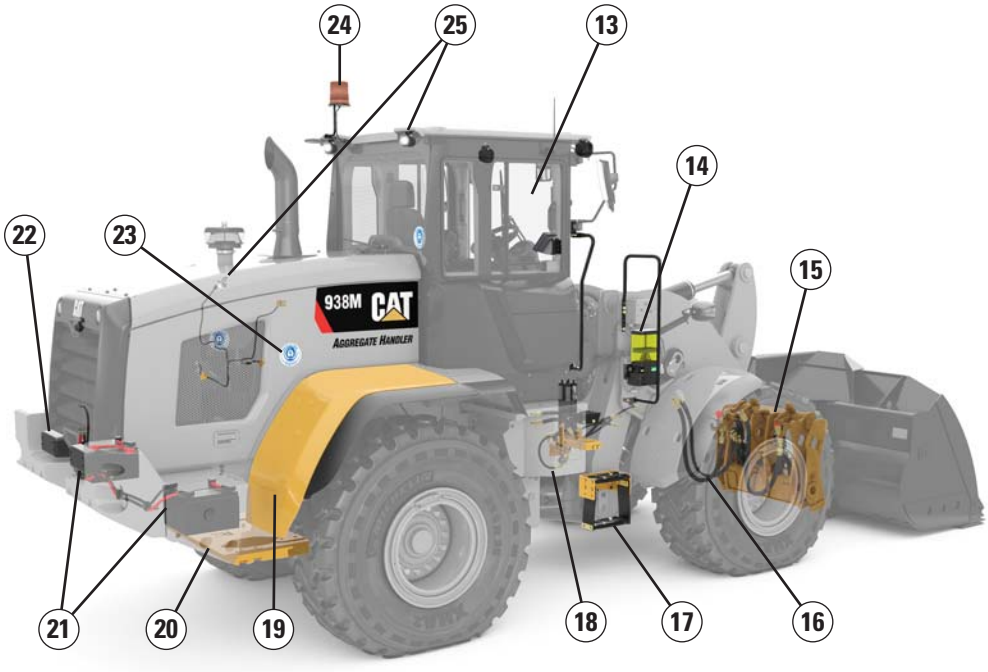
6) *Elevated breathers: axles and gear box*
7) *Reversing fan*
8) *Sealed alternator*
9) *Turbine precleaner*

**Operator Environment:**

10) *Seat, deluxe or premium*
11) *Quick steer*
13) *Deluxe cab (with display)*

**Work Tools**

12) *Full range of tools*




**Other Options:**

14) *Autolube*
15) *Coupler: Fusion™ and ISO*
16) *Auxiliary hydraulics: 3rd and 4th*
17) *Windshield washing platform*
18) *Ride Control*
19) *Fenders: extended and full coverage*
20) *Aggregate weight set*
21) *Cold start package*
22) *Rear object detection*
23) *Blue Angel certification*
24) *Beacon*
25) *LED auxiliary lights*

# Service

## Schedule your downtime to maximize your up time.

Get up and running quickly with ground level, daily service access and optional engine compartment lighting. Three large service doors can be opened and closed in any order to give full access to filters and service points. Extended service intervals on hydraulic and power train filters reduce service time and maximize uptime. Additional service features include:

- **Product Link™ PRO standard** with three year subscription to VisionLink®.
- **Maintenance reminders** through secondary display at scheduled intervals.
- **Fit for Life Diesel Particulate Filter** that is designed to exceed the engine overhaul life.
- **Quick fuel filter service** with Caterpillar's exclusive electric fuel priming pump.
- **Jump start studs** as standard equipment.
- **Extended cleanouts** with single plane cooling system and wide spaced 6 fins per inch coolers as standard.
- **Integrated Autolube** (optional) with adjustable greasing frequency.

# Customer Support

## Unmatched service makes the difference.

### Renowned Cat Dealer Support

**Rely on your Cat dealer** to help you every step of the way with new or used machine sales, rental or rebuild options to meet your business needs.

**Maximize your machine** uptime with unsurpassed worldwide parts availability, trained technicians and customer support agreements.

**Let us earn your business.** Experience an M Series Small Wheel Loader and join the Caterpillar family.

# Small Wheel Loaders Aggregate Handler Specifications

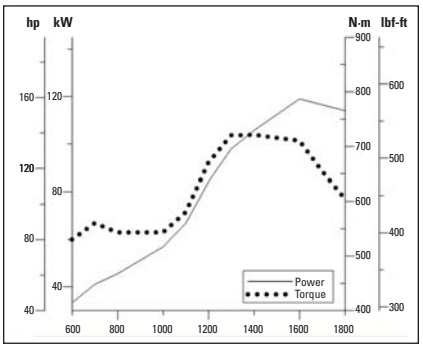
## Engine

| Cat C7.1 ACERT | 926M | | | | 930M | | | | 938M | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Power Mode** | **Performance (HP+) Range 1-4** | | **Standard Range 1-3*** | | **Performance (HP+) Range 1-4** | | **Standard Range 1-3*** | | **Performance (HP+) Range 1-4** | | **Standard Range 1-3*** | |
| Maximum Rated Gross Power | **kW** | **hp** | **kW** | **hp** | **kW** | **hp** | **kW** | **hp** | **kW** | **hp** | **kW** | **hp** |
| Maximum Engine Speed | 1,800 rpm | | 1,600 rpm | | 1,800 rpm | | 1,600 rpm | | 1,800 rpm | | 1,600 rpm | |
| ISO 14396 | 114 | 153 | 109 | 146 | 122 | 164 | 119 | 160 | 140 | 188 | 129 | 173 |
| ISO 14396 (DIN) | 114 | 155 | 109 | 148 | 122 | 166 | 119 | 162 | 140 | 190 | 129 | 175 |
| Rated Net Power | 1,800 rpm | | 1,600 rpm | | 1,800 rpm | | 1,600 rpm | | 1,800 rpm | | 1,600 rpm | |
| SAE J1349 at Minimum Fan Speed | 110 | 148 | 105 | 141 | 117 | 157 | 115 | 154 | 136 | 182 | 125 | 168 |
| ISO 9249 (1977)/EEC 80/1269 at Minimum Fan Speed | 111 | 149 | 106 | 142 | 119 | 160 | 116 | 156 | 137 | 184 | 126 | 169 |
| ISO 9249 (DIN) at Minimum Fan Speed | 111 | 151 | 106 | 144 | 119 | 162 | 116 | 158 | 137 | 186 | 126 | 171 |
| Maximum Gross Torque | **N·m** | **lbf-ft** | **N·m** | **lbf-ft** | **N·m** | **lbf-ft** | **N·m** | **lbf-ft** | **N·m** | **lbf-ft** | **N·m** | **lbf-ft** |
| ISO 14396 | 721 | 531 | 721 | 531 | 804 | 592 | 804 | 592 | 879 | 648 | 879 | 648 |
| Maximum Net Torque | | | | | | | | | | | | |
| SAE J1349 | 694 | 511 | 694 | 511 | 768 | 566 | 768 | 566 | 843 | 621 | 843 | 621 |
| ISO 9249 (1977)/EEC 80/1269 | 702 | 517 | 702 | 517 | 776 | 572 | 776 | 572 | 852 | 628 | 852 | 628 |
| Displacement | 7.01 L | | 427 $in^3$ | | 7.01 L | | 427 $in^3$ | | 7.01 L | | 427 $in^3$ | |
| Bore | 105 mm | | 4 in | | 105 mm | | 4 in | | 105 mm | | 4 in | |
| Stroke | 135 mm | | 5 in | | 135 mm | | 5 in | | 135 mm | | 5 in | |

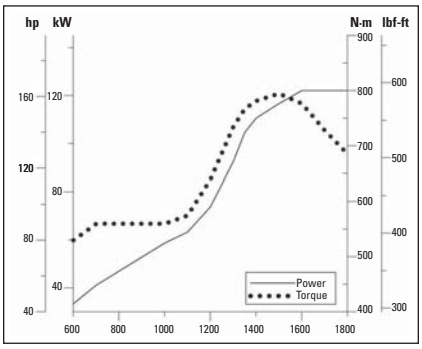
* Range 4 power and torque is equal to Performance Mode with Caterpillar Power by Range technology.
- Net power ratings are tested at the reference conditions for the specified standard and denote power available at the flywheel when the engine is equipped with alternator, air cleaner, emission components and fan at specified speed.
- No derating required up to 3000 m (10,000 ft) altitude. Auto derate protects hydraulic and transmission systems.
- The Cat C7.1 ACERT engine meets Tier 4 Final/Stage IV emission standards.
- Spark arrester performance as standard – Meets the performance requirements of EN 1834-1.2000 (section 6.4.2 Visual Test).

## Engine Torque

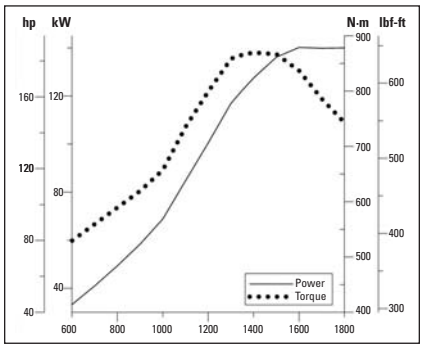
**926M**




**930M**




**938M**




## Cab

- ROPS: ISO 3471: 2008, FOPS: ISO 3449: 2005 LEVEL II
- Declared Sound Levels
  – Operator Sound Pressure Level (ISO 6396:2008): 68 dB(A)*
  – Exterior Sound Power Level (ISO 6395:2008): 101 dB(A)*

* Measurements were conducted at 70% of maximum engine cooling fan speed. Sound level may vary at different engine cooling fan speeds. The cab was properly installed and maintained. The measurements were conducted with the cab doors and the cab windows closed.
– The Blue Angel environmental label is an optional attachment for Europe only.

## Loader Hydraulic System

- Implement system uses a dedicated load sensing variable displacement pump with dual double acting lift cylinders and a single double acting tilt cylinder.
- Flow values listed are for a machine running in Performance Power Mode (1,800 rpm)

* 3rd function flow is fully adjustable from 20% to 100% of maximum flow through the secondary display when equipped.

| | 926M | | 930M | | 938M | |
|---|---|---|---|---|---|---|
| Maximum Flow – Implement Pump | 150 L/min | 40 gal/min | 190 L/min | 50 gal/min | 190 L/min | 50 gal/min |
| 3rd Function Maximum Flow* | 150 L/min | 40 gal/min | 190 L/min | 50 gal/min | 190 L/min | 50 gal/min |
| Maximum Working Pressure – Implement Pump | 26 000 kPa | 3,771 psi | 25 000 kPa | 3,626 psi | 28 000 kPa | 4,061 psi |
| Relief Pressure – Tilt Cylinder | 28 000 kPa | 4,061 psi | 28 000 kPa | 4,061 psi | 30 000 kPa | 4,351 psi |
| 3rd Function Maximum Working Pressure | 26 000 kPa | 3,771 psi | 25 000 kPa | 3,626 psi | 28 000 kPa | 4,061 psi |
| 3rd Function Relief Pressure | 28 000 kPa | 4,061 psi | 28 000 kPa | 4,061 psi | 30 000 kPa | 4,351 psi |
| Lift Cylinder: Double Acting | | | | | | |
| Bore Diameter | 110 mm | 4.3 in | 120 mm | 4.7 in | 120 mm | 4.7 in |
| Rod Diameter | 60 mm | 2.4 in | 65 mm | 2.6 in | 65 mm | 2.6 in |
| Stroke | 728 mm | 28.7 in | 728 mm | 28.7 in | 789 mm | 31.1 in |
| Tilt Cylinder: Double Acting | | | | | | |
| Bore Diameter | 130 mm | 5.1 in | 150 mm | 5.9 in | 150 mm | 5.9 in |
| Rod Diameter | 70 mm | 2.8 in | 90 mm | 3.5 in | 90 mm | 3.5 in |
| Stroke | 555 mm | 21.9 in | 555 mm | 21.9 in | 555 mm | 21.9 in |
| Cycle Times: Performance (HP+) at 1,800 rpm/ Standard Power Mode at 1,600 rpm | | | | | | |
| Raise (Ground Level to Maximum Lift) | 5.5/6.2 seconds | | 5.1/5.7 seconds | | 5.5/6.2 seconds | |
| Dump (at Maximum Lift Height) | 1.5/1.7 seconds | | 1.5/1.7 seconds | | 1.5/1.7 seconds | |
| Float Down (Maximum Lift to Ground Level) | 2.6/2.6 seconds | | 2.7/2.7 seconds | | 2.7/2.7 seconds | |
| Total Cycle Time | 9.6/10.5 seconds | | 9.3/10.1 seconds | | 9.7/10.6 seconds | |

## Steering

- Steering system uses a dedicated load sensing variable displacement pump with dual double acting cylinders.
- Flow values listed are for a machine running in Performance Power Mode (1,800 rpm).

| | 926M | | 930M | | 938M | |
|---|---|---|---|---|---|---|
| Steering Cylinder: Double Acting | | | | | | |
| Bore Diameter | 70 mm | 2.8 in | 70 mm | 2.8 in | 80 mm | 3.1 in |
| Rod Diameter | 40 mm | 1.6 in | 40 mm | 1.6 in | 50 mm | 2 in |
| Stroke | 438 mm | 17.2 in | 438 mm | 17.2 in | 399 mm | 15.7 in |
| Maximum Flow – Steering Pump | 130 L/min | 34 gal/min | 130 L/min | 34 gal/min | 130 L/min | 34 gal/min |
| Maximum Working Pressure – Steering Pump | 24 130 kPa | 3,500 psi | 24 130 kPa | 3,500 psi | 24 130 kPa | 3,500 psi |
| Maximum Steering Torque | | | | | | |
| 0° (Straight Machine) | 50 375 N·m | 37,155 lbf-ft | 50 375 N·m | 37,155 lbf-ft | 57 630 N·m | 42,506 lbf-ft |
| 40° (Full Turn) | 37 620 N·m | 27,747 lbf-ft | 37 620 N·m | 27,747 lbf-ft | 42 570 N·m | 31,398 lbf-ft |
| Steering Cycle Times (Full Left to Full Right) | | | | | | |
| Minimum RPM: Pump Flow Limited | 2.8 seconds | | 2.8 seconds | | 3.1 seconds | |
| Maximum RPM: 90 rpm Steering Wheel Speed | 2.4 seconds | | 2.4 seconds | | 2.3 seconds | |

# Small Wheel Loaders Aggregate Handler Specifications

## Transmission

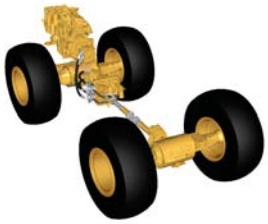
* Creeper control allows maximum speed range adjustability from 1 km/h (0.6 mph) to 13 km/h (8 mph) in Range 1 through the secondary display when equipped. Factory default is 7 km/h (4.4 mph).

| | 926M | | 930M | | 938M | |
|---|---|---|---|---|---|---|
| Forward and Reverse | | | | | | |
| Range 1* | 1-13 km/h | 0.6-8 mph | 1-13 km/h | 0.6-8 mph | 1-13 km/h | 0.6-8 mph |
| Range 2 | 13 km/h | 8 mph | 13 km/h | 8 mph | 13 km/h | 8 mph |
| Range 3 | 27 km/h | 17 mph | 27 km/h | 17 mph | 27 km/h | 17 mph |
| Range 4 | 40 km/h | 25 mph | 40 km/h | 25 mph | 40 km/h | 25 mph |

## Service Refill Capacities

| | 926M | | 930M | | 938M | |
|---|---|---|---|---|---|---|
| Fuel Tank | 195 L | 51.5 gal | 195 L | 51.5 gal | 195 L | 51.5 gal |
| Diesel Exhaust Fluid (DEF) Tank | 19 L | 5.0 gal | 19 L | 5.0 gal | 19 L | 5.0 gal |
| Cooling System | 30 L | 7.9 gal | 30 L | 7.9 gal | 32 L | 8.5 gal |
| Engine Crankcase | 20 L | 5.3 gal | 20 L | 5.3 gal | 20 L | 5.3 gal |
| Transmission (Gear Box) | 8.5 L | 2.2 gal | 8.5 L | 2.2 gal | 11 L | 2.9 gal |
| Axles | | | | | | |
| Front | 21 L | 5.5 gal | 26 L | 6.9 gal | 35 L | 9.2 gal |
| Rear | 21 L | 5.5 gal | 25 L | 6.6 gal | 35 L | 9.2 gal |
| Hydraulic System (Including Tank) | 160 L | 42.3 gal | 165 L | 43.6 gal | 170 L | 44.9 gal |
| Hydraulic Tank | 90 L | 23.8 gal | 90 L | 23.8 gal | 90 L | 23.8 gal |

## Power Train



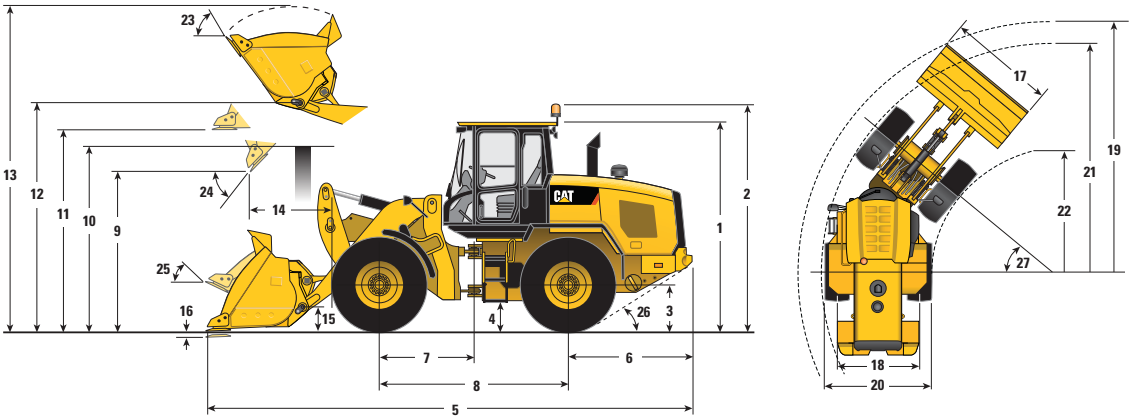
- Power train is governed by the Caterpillar exclusive Intelligent Power Management system to deliver peak performance and efficiency.
- Offset rims available to meet European roading requirements.

**Differential front locking axle can be engaged on the go at full torque to 10 km/h (6.2 mph) on the 926M/930M and up to 20 km/h (12.4 mph) on the 938M.

| | 926M | 930M | 938M |
|---|---|---|---|
| Front Axle | Fixed | Fixed | Fixed |
| Traction Aid** | Locking differential (standard) | Locking differential (standard) | Locking differential (standard) |
| Rear Axle | Oscillating | Oscillating | Oscillating |
| Oscillation Angle by Tire Size | | | |
| 17.5 R25 | ± 13.5 degrees | — | — |
| 20.5 R25, 550/65, 600/65, 650/65 | ± 10.5 degrees | ± 10.5 degrees | ± 10.5 degrees |
| 23.5 R25 | — | — | ± 7 degrees |
| Traction Aid (optional) | Limited slip differential | Limited slip differential | Limited slip differential |
| Brakes | | | |
| Service | Inboard wet disc | Inboard wet disc | Outboard wet disc |
| Park | Spring applied hydraulically released | Spring applied hydraulically released | Spring applied hydraulically released |

## Dimensions with Bucket

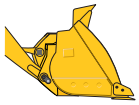
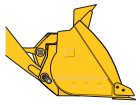
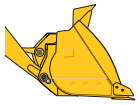
All dimensions are approximate. Dimensions will vary with bucket, and tire choice. Refer to Operating Specifications with Buckets.




| *Vary with bucket. **Vary with tire. | Standard Lift | | | | | |
|---|---|---|---|---|---|---|
| | 926M | | 930M | | 938M | |
| ** 1 Height: Ground to Cab | 3340 mm | 10'11" | 3340 mm | 10'11" | 3340 mm | 10'11" |
| ** 2 Height: Ground to Beacon | 3707 mm | 12'1" | 3707 mm | 12'1" | 3707 mm | 12'1" |
| ** 3 Height: Ground Axle Center | 685 mm | 2'2" | 685 mm | 2'2" | 685 mm | 2'2" |
| ** 4 Height: Ground Clearance | 397 mm | 1'3" | 397 mm | 1'3" | 386 mm | 1'3" |
| * 5 Length: Overall | 7544 mm | 24'9" | 7613 mm | 24'11" | 7715 mm | 25'3" |
| 6 Length: Rear Axle to Bumper | 1986 mm | 6'6" | 1993 mm | 6'6" | 1968 mm | 6'5" |
| 7 Length: Hitch to Front Axle | 1500 mm | 4'11" | 1500 mm | 4'11" | 1525 mm | 5'0" |
| 8 Length: Wheel Base | 3000 mm | 9'10" | 3000 mm | 9'10" | 3050 mm | 10'0" |
| * 9 Clearance: Bucket at 45° | 2807 mm | 9'2" | 2761 mm | 9'0" | 2786 mm | 9'1" |
| ** 10 Clearance: Load Over Height | 3330 mm | 10'11" | 3331 mm | 10'11" | 3354 mm | 11'0" |
| ** 11 Clearance: Level Bucket | 3580 mm | 11'8" | 3580 mm | 11'8" | 3642 mm | 11'11" |
| ** 12 Height: Bucket Pin | 3907 mm | 12'9" | 3907 mm | 12'9" | 3969 mm | 13'0" |
| ** 13 Height: Overall | 5180 mm | 16'11" | 5239 mm | 17'2" | 5411 mm | 17'9" |
| * 14 Reach: Bucket at 45° | 1070 mm | 3'6" | 1109 mm | 3'7" | 1178 mm | 3'10" |
| 15 Carry Height: Bucket Pin | 458 mm | 1'6" | 458 mm | 1'6" | 467 mm | 1'6" |
| ** 16 Dig Depth | 100 mm | 4" | 100 mm | 4" | 100 mm | 4" |
| 17 Width: Bucket | 2750 mm | 9'0" | 2750 mm | 9'0" | 2750 mm | 9'0" |
| 18 Width: Tread Center | 1930 mm | 6'3" | 1930 mm | 6'3" | 2083 mm | 6'10" |
| 19 Turning Radius: Over Bucket | 6042 mm | 19'9" | 6060 mm | 19'10" | 6150 mm | 20'2" |
| 20 Width: Over Tires | 2540 mm | 8'4" | 2540 mm | 8'4" | 2693 mm | 8'10" |
| 21 Turning Radius: Outside of Tires | 5402 mm | 17'8" | 5402 mm | 17'8" | 5546 mm | 18'2" |
| 22 Turning Radius: Inside of Tires | 2851 mm | 9'4" | 2851 mm | 9'4" | 2843 mm | 9'3" |
| 23 Rack Angle at Full Lift | 54° | | 54° | | 54° | |
| 24 Dump Angle at Full Lift | 48° | | 48° | | 48° | |
| 25 Rack Angle at Carry | 45° | | 45° | | 45° | |
| 26 Departure Angle | 33° | | 33° | | 33° | |
| 27 Articulation Angle | 40° | | 40° | | 40° | |
| Operating Weight | 13 128 kg | 28,933 lb | 14 131 kg | 31,144 lb | 16 368 kg | 36,075 lb |

# Bucket Specifications

## Operating Specifications with Buckets

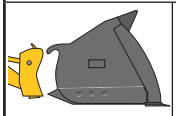
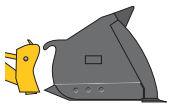
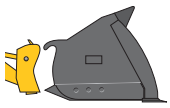
| | Aggregate Handler | | Pin On | | | | |
|---|---|---|---|---|---|---|---|
| | | |  926M |  930M | |  938M | |
| | Capacity – Rated | $m^3$ | 2.5 | 2.5 | 2.7 | 2.9 | 3.2 |
| | | $yd^3$ | 3.3 | 3.3 | 3.5 | 3.8 | 4.2 |
| | Capacity – Rated at 110% Fill Factor | $m^3$ | 2.8 | 2.8 | 3.0 | 3.2 | 3.5 |
| | | $yd^3$ | 3.6 | 3.6 | 3.9 | 4.2 | 4.6 |
| **17** | Width: Bucket | mm | 2750 | 2750 | 2750 | 2750 | 2750 |
| | | ft/in | 9'0" | 9'0" | 9'0" | 9'0" | 9'0" |
| | Nominal Material Density, 110% Fill Factor | $kg/m^3$ | 1450 | 1638 | 1494 | 1670 | 1512 |
| | | $lb/yd^3$ | 2442 | 2757 | 2508 | 2796 | 2551 |
| **9** | Clearance: Full Lift, 45° Dump | mm | 2807 | 2807 | 2761 | 2822 | 2786 |
| | | ft/in | 9'2" | 9'2" | 9'0" | 9'3" | 9'1" |
| **14** | Reach: Full Lift, 45° Dump | mm | 1070 | 1070 | 1109 | 1146 | 1178 |
| | | ft/in | 3'6" | 3'6" | 3'7" | 3'9" | 3'10" |
| | Reach: 2130 mm (7'0") Clearance, 45° Dump | mm | 1573 | 1573 | 1587 | 1652 | 1664 |
| | | ft/in | 5'1" | 5'1" | 5'2" | 5'5" | 5'5" |
| | Reach: Level Arm, Level Bucket | mm | 2413 | 2413 | 2475 | 2514 | 2563 |
| | | ft/in | 7'11" | 7'11" | 8'1" | 8'2" | 8'4" |
| **16** | Dig Depth | mm | 100 | 100 | 100 | 100 | 100 |
| | | in | 4" | 4" | 4" | 4" | 4" |
| **5** | Length: Overall | mm | 7544 | 7551 | 7613 | 7666 | 7715 |
| | | ft/in | 24'9" | 24'9" | 24'11" | 25'1" | 25'3" |
| **13** | Height: Overall | mm | 5180 | 5180 | 5239 | 5301 | 5411 |
| | | ft/in | 16'11" | 16'11" | 17'2" | 17'4" | 17'9" |
| **19** | Turning Radius Bucket at Carry | mm | 6042 | 6042 | 6060 | 6136 | 6150 |
| | | ft/in | 19'9" | 19'9" | 19'10" | 20'1" | 20'2" |
| | Tipping Load – Straight, ISO 14397-1* | kg | 9318 | 10 567 | 10 427 | 12 536 | 12 527 |
| | | lb | 20,537 | 23,290 | 22,981 | 27,630 | 27,610 |
| | Tipping Load – Straight, Rigid Tire** | kg | 9706 | 11 008 | 10 861 | 13 059 | 13 049 |
| | | lb | 21,392 | 24,261 | 23,938 | 28,781 | 28,760 |
| | Tipping Load – Full Turn, ISO 14397-1* | kg | 7976 | 9008 | 8876 | 10 658 | 10 647 |
| | | lb | 17,580 | 19,853 | 19,563 | 23,489 | 23,466 |
| | Tipping Load – Full Turn, Rigid Tire** | kg | 8486 | 9583 | 9443 | 11 338 | 11 327 |
| | | lb | 18,702 | 21,121 | 20,811 | 24,988 | 24,964 |
| | Breakout Force | kg | 9331 | 12 101 | 11 430 | 13 028 | 12 521 |
| | | lb | 20,565 | 26,669 | 25,192 | 28,712 | 27,595 |
| | Operating Weight | kg | 13 128 | 14 040 | 14 131 | 16 339 | 16 368 |
| | | lb | 28,933 | 30,944 | 31,144 | 36,010 | 36,075 |

*Full compliance to ISO 14397-1 (2007) Section 1 thru 6, which requires 2% verification between calculation and testing.

**Compliance to ISO 14397-1 (2007) Section 1 thru 5.

Note: Dimensions listed are for machines configured with sand and gravel buckets, bolt-on cutting edges, maximum counterweight, 80 kg (176 lb) operator, and Michelin 20.5 R25 (L-3) XHA2 tires at a pressure of 4.14 bar (60 psi) in the front tires and 2.76 bar (40 psi) in the rear tires.

## 926M Operating Specifications with Buckets

| | Aggregate Handler | | Fusion | | | | |
|---|---|---|---|---|---|---|---|
| | | |  926M |  930M | |  938M | |
| | Capacity – Rated | $m^3$ | 2.5 | 2.5 | 2.7 | 2.9 | 3.2 |
| | | $yd^3$ | 3.3 | 3.3 | 3.5 | 3.8 | 4.2 |
| | Capacity – Rated at 110% Fill Factor | $m^3$ | 2.8 | 2.8 | 3.0 | 3.2 | 3.5 |
| | | $yd^3$ | 3.6 | 3.6 | 3.9 | 4.2 | 4.6 |
| **17** | Width: Bucket | mm | 2747 | 2747 | 2747 | 2747 | 2747 |
| | | ft/in | 9'0" | 9'0" | 9'0" | 9'0" | 9'0" |
| | Nominal Material Density, 110% Fill Factor | $kg/m^3$ | 1343 | 1527 | 1405 | 1567 | 1418 |
| | | $lb/yd^3$ | 2261 | 2572 | 2358 | 2623 | 2392 |
| **9** | Clearance: Full Lift, 45° Dump | mm | 2779 | 2779 | 2733 | 2751 | 2752 |
| | | ft/in | 9'1" | 9'1" | 8'11" | 9'0" | 9'0" |
| **14** | Reach: Full Lift, 45° Dump | mm | 1102 | 1102 | 1140 | 1216 | 1215 |
| | | ft/in | 3'7" | 3'7" | 3'8" | 3'11" | 3'11" |
| | Reach: 2130 mm (7'0") Clearance, 45° Dump | mm | 1590 | 1590 | 1603 | 1684 | 1684 |
| | | ft/in | 5'2" | 5'2" | 5'3" | 5'6" | 5'6" |
| | Reach: Level Arm, Level Bucket | mm | 2455 | 2455 | 2517 | 2614 | 2614 |
| | | ft/in | 8'0" | 8'0" | 8'3" | 8'6" | 8'6" |
| **16** | Dig Depth | mm | 100 | 100 | 100 | 101 | 100 |
| | | in | 4" | 4" | 4" | 4" | 4" |
| **5** | Length: Overall | mm | 7586 | 7593 | 7655 | 7767 | 7766 |
| | | ft/in | 24'10" | 24'10" | 25'1" | 25'5" | 25'5" |
| **13** | Height: Overall | mm | 5205 | 5205 | 5264 | 5379 | 5441 |
| | | ft/in | 17'0" | 17'0" | 17'3" | 17'7" | 17'10" |
| **19** | Turning Radius, Bucket at Carry | mm | 6054 | 6054 | 6072 | 6166 | 6166 |
| | | ft/in | 19'10" | 19'10" | 19'11" | 20'2" | 20'2" |
| | Tipping Load – Straight, ISO 14397-1* | kg | 8696 | 9924 | 9866 | 11 835 | 11 824 |
| | | lb | 19,165 | 21,873 | 21,745 | 26,084 | 26,059 |
| | Tipping Load – Straight, Rigid Tire** | kg | 9058 | 10 338 | 10 277 | 12 328 | 12 316 |
| | | lb | 19,964 | 22,784 | 22,651 | 27,171 | 27,145 |
| | Tipping Load – Full Turn, ISO 14397-1* | kg | 7387 | 8401 | 8344 | 9996 | 9984 |
| | | lb | 16,279 | 18,515 | 18,390 | 22,031 | 22,004 |
| | Tipping Load – Full Turn, Rigid Tire** | kg | 7858 | 8937 | 8877 | 10 634 | 10 621 |
| | | lb | 17,319 | 19,697 | 19,564 | 23,438 | 23,408 |
| | Breakout Force | kg | 8821 | 11 496 | 10 890 | 11 863 | 11 849 |
| | | lb | 19,440 | 25,336 | 24,000 | 26,145 | 26,116 |
| | Operating Weight | kg | 13 642 | 14 554 | 14 602 | 16 902 | 16 932 |
| | | lb | 30,066 | 32,077 | 32,183 | 37,252 | 37,319 |

*Full compliance to ISO 14397-1 (2007) Section 1 thru 6, which requires 2% verification between calculation and testing.

**Compliance to ISO 14397-1 (2007) Section 1 thru 5.

Note: Dimensions listed are for machines configured with sand and gravel buckets, bolt-on cutting edges, maximum counterweight, 80 kg (176 lb) operator, and Michelin 20.5 R25 (L-3) XHA2 tires at a pressure of 4.14 bar (60 psi) in the front tires and 2.76 bar (40 psi) in the rear tires.

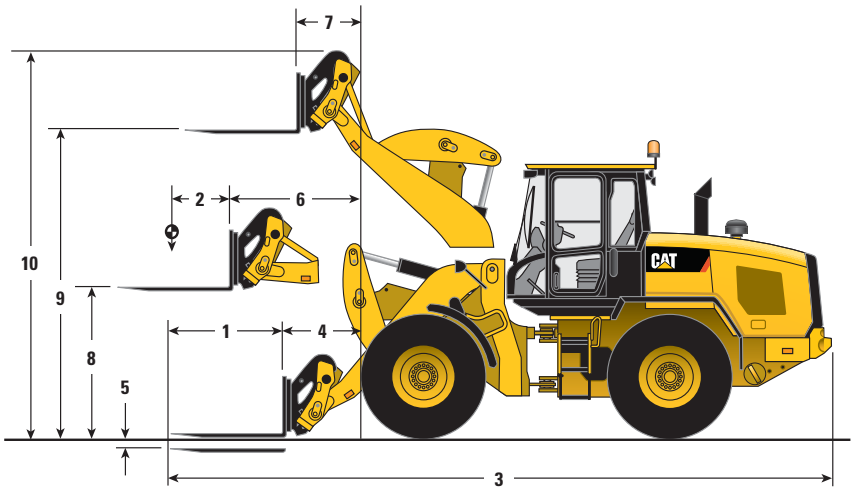
## Sand and Gravel Bucket Selection – Standard Lift

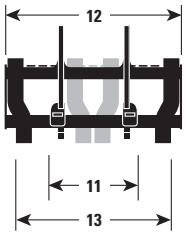
| Material Type | | | | | Sand, Dry and Loose | Mason Sand | Concrete Sand / Pea Gravel / Bunker Sand | Sand and Clay, Loose / 1" Crushed Concrete | #57 Stone / 3/4" Stone / Sand and Gravel, Dry | Sand, Damp | Sand, Wet | Gravel, Pitrun / Sand, Water Filled | | Sand and Gravel, Wet | Tip Load Full Turn* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fill Factor %** | | | | | 105% | 105% | 110% / 105% / 115% | 105% / 105% | 105% / 105% / 110% | 110% | 110% | 110% / 110% | | 110% | | |
| | | m³ / yd³ | Counter-weight | kg/m³ / lb/yd³ | 1300 (2,191) | 1375 (2,317) | 1450 (2,443) | 1525 (2,570) | 1600 (2,696) | 1675 (2,822) | 1750 (2,949) | 1825 (3,075) | 1900 (3,202) | 1975 (3,328) | 2050 (3,454) | kg / lb |
| **926M** | Pin On | 2.5 (3.3) | Aggregate | | | 115% | 110% | 105% | 100% | | | | | | | 7976 (17,585) |
| | Fusion | 2.5 (3.3) | Aggregate | 115% | 100% | 105% | 100% | | | | | | | | | 7387 (16,285) |
| **930M** | Pin On | 2.5 (3.3) | Aggregate | | | | | 115% | 110% | 105% | 100% | | | | | 9008 (19,859) |
| | | 2.7 (3.5) | Aggregate | | | 115% | 110% | 105% | 100% | | | | | | | 8876 (19,568) |
| | Fusion | 2.5 (3.3) | Aggregate | | | 115% | 110% | 105% | 100% | | | | | | | 8401 (18,521) |
| | | 2.7 (3.5) | Aggregate | | 115% | 110% | 105% | 100% | | | | | | | | 8344 (18,395) |
| **938M** | Pin On | 2.9 (3.8) | Aggregate | | | | | 115% | 110% | 105% | 100% | | | | | 10 658 (23,495) |
| | | 3.2 (4.2) | Aggregate | | | 115% | 110% | 105% | 100% | | | | | | | 10 647 (23,473) |
| | Fusion | 2.9 (3.8) | Aggregate | | | | 115% | 110% | 105% | 100% | | | | | | 9996 (22,038) |
| | | 3.2 (4.2) | Aggregate | | 115% | 110% | 105% | 100% | | | | | | | | 9984 (22,010) |

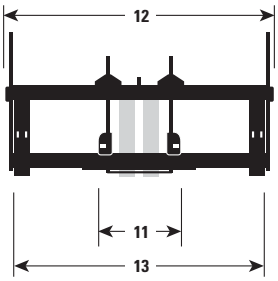
Material density, fill factor, and counterweight options are key variables when choosing the appropriate bucket size. The long floor and open throat design of the Performance Series Buckets along with the aggressive rack angles of the optimized linkage will demonstrate fill factors greater than 100% ISO rated. Refer to the expected fill factor % per material type at the top of the table and find a matching counterweight and fill factor along the side for proper bucket sizing.

*Full compliance to ISO 14397-1 (2007) Section 1 thru 6, which requires 2% verification between calculation and testing.

## Operating Specifications with Forks




| | Pallet Fork – Fusion | | | | | | Construction Fork – Fusion | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 926M | | 930M | | 938M | | 926M | | 930M | | 938M | |
| | mm | ft/in | mm | ft/in | mm | ft/in | mm | ft/in | mm | ft/in | mm | ft/in |
| **1** Fork Tine Length | 1220 | 4'0" | 1220 | 4'0" | 1220 | 4'0" | 1524 | 5'0" | 1524 | 5'0" | 1524 | 5'0" |
| **2** Load Center | 610 | 2'0" | 610 | 2'0" | 610 | 2'0" | 762 | 2'6" | 762 | 2'6" | 762 | 2'6" |
| **3** Length: Overall | 7875 | 25'10" | 7882 | 25'10" | 7942 | 26'0" | 8298 | 27'2" | 8305 | 27'2" | 8366 | 27'5" |
| **4** Reach: Ground | 926 | 3'0" | 926 | 3'0" | 961 | 3'1" | 1045 | 3'5" | 1045 | 3'5" | 1081 | 3'6" |
| **5** Dig Depth | 47 | 1.9" | 47 | 1.9" | 44 | 1.7" | 120 | 4.7" | 120 | 4.7" | 119 | 4.7" |
| **6** Reach: Level Arm | 1569 | 5'1" | 1569 | 5'1" | 1617 | 5'3" | 1627 | 5'4" | 1627 | 5'4" | 1675 | 5'5" |
| **7** Reach: Full Lift | 767 | 2'6" | 767 | 2'6" | 814 | 2'8" | 825 | 2'8" | 825 | 2'8" | 872 | 2'10" |
| **8** Clearance: Level Arm | 1792 | 5'10" | 1792 | 5'10" | 1830 | 6'0" | 1729 | 5'8" | 1729 | 5'8" | 1766 | 5'9" |
| **9** Clearance: Full Lift | 3693 | 12'1" | 3693 | 12'1" | 3758 | 12'3" | 3630 | 11'10" | 3630 | 11'10" | 3693 | 12'1" |
| **10** Height: Overall | 4676 | 15'4" | 4676 | 15'4" | 4740 | 15'6" | 4935 | 16'2" | 4935 | 16'2" | 0 | 0'0" |
| **11** Minimum Fork Spacing | 300 | 0'11" | 300 | 0'11" | 300 | 0'11" | 300 | 0'11" | 300 | 0'11" | 300 | 0'11" |
| **12** Carriage Width | 1566 | 5'1" | 1566 | 5'1" | 1566 | 5'1" | 2498 | 8'2" | 2498 | 8'2" | 2498 | 8'2" |
| **13** Maximum Fork Spacing | 1550 | 5'1" | 1550 | 5'1" | 1550 | 5'1" | 2375 | 7'9" | 2375 | 7'9" | 2375 | 7'9" |
| | kg | lb | kg | lb | kg | lb | kg | lb | kg | lb | kg | lb |
| Tipping Load – Straight, ISO 14397-1* | 7074 | 15,590 | 8006 | 17,645 | 9578 | 21,109 | 6345 | 13,984 | 7215 | 15,902 | 8688 | 19,149 |
| Tipping Load – Full Turn, ISO 14397-1* | 6069 | 13,376 | 6839 | 15,073 | 8162 | 17,989 | 5413 | 11,930 | 6132 | 13,514 | 7372 | 16,246 |
| Operating Weight | 12 991 | 28,632 | 13 903 | 30,643 | 16 165 | 35,628 | 13 326 | 29,369 | 14 238 | 31,380 | 16 500 | 36,365 |
| Rated Load (% of Full Turn Tip): | | | | | | | | | | | | |
| 50% of Tip: SAE J1197** | 3035 | 6,688 | 3420 | 7,536 | 4081 | 8,994 | 2707 | 5,965 | 3066 | 6,757 | 3686 | 8,123 |
| 60% of Tip: Rough Terrain EN474-3** | 3641 | 8,025 | 4104 | 9,044 | 4897 | 10,793 | 3248 | 7,158 | 3679 | 8,108 | 4423 | 9,748 |
| 80% of Tip: Firm and Level EN474-3** | 4855 | 10,700 | 5471 | 12,059 | 6530 | 14,391 | 4331 | 9,544 | 4905 | 10,811 | 5897 | 12,997 |

*Full compliance to ISO 14397-1 (2007) Section 1 thru 6, which requires 2% verification between calculation and testing.

**Full compliance to EN474-3 and SAE J1197.

Note: Dimensions listed are for a machine configured with Fusion work tools, maximum counterweight, 80 kg (176 lb) operator, and Michelin 20.5 R25 (L-3) XHA2 tires.

# Supplemental Specifications

## Optional Equipment

| | 926M | | | | 930M | | | | 938M | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Operating Weight | | Tipping Load – Full Turn with 2.5 m³ (3.3 yd³) Pin On Bucket | | Operating Weight | | Tipping Load – Full Turn with 2.7 m³ (3.5 yd³) Pin On Bucket | | Operating Weight | | Tipping Load – Full Turn with 2.9 m³ (3.8 yd³) Pin On Bucket | |
| **Change with Options Removed:** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** |
| Heavy Counterweight | N/A | N/A | N/A | N/A | –320 | –705 | –504 | –1,110 | –320 | –705 | –499 | –1,098 |
| Aggregate Counterweight | –298 | –657 | –421 | –928 | –298 | –657 | –419 | –924 | –298* | –657* | –410* | –904* |
| Guard, Power Train Lower | –77 | –169 | –70 | –154 | –77 | –169 | –70 | –153 | –68 | –150 | –61 | –134 |
| Guard, Driveshaft | –44 | –96 | –12 | –26 | –44 | –96 | –12 | –26 | –45 | –100 | –12 | –26 |
| Guard, Crankcase | –11 | –24 | –14 | –31 | –11 | –24 | –14 | –31 | –11 | –24 | –14 | –31 |
| Ride Control | –49 | –107 | –26 | –59 | –49 | –107 | –26 | –58 | –49 | –107 | –27 | –59 |
| Guard, Power Train Side | –11 | –24 | –9 | –20 | –11 | –24 | –9 | –20 | –11 | –24 | –9 | –20 |
| **Change with Options Added:** | | | | | | | | | | | | |
| Secondary Steer | +69 | +152 | +74 | +163 | +69 | +152 | +73 | +160 | +69 | +152 | +73 | +160 |
| Roading Fenders | +18 | +39 | +24 | +52 | +18 | +39 | +24 | +52 | +18 | +39 | +24 | +52 |
| Cold Start Package | +54 | +119 | +75 | N/A | +54 | +119 | +75 | +165 | +54 | +119 | +74 | +163 |

*Counterweight removed – not compatible with 23.5 tires on 938M.

## Tire Options

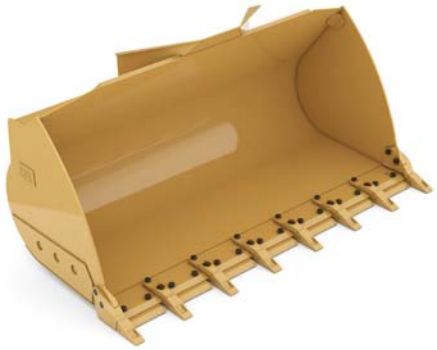
| | 926M | | | | 930M | | | | 938M* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Change with Tire Option as Compared to 20.5R25 L3 Tire** | 550/65 R25 | | 17.5 R25 (L-3) | | 600/65 R25 | | 20.5R25 (L-5) | | 23.5R25** | | 650/65 R25 | |
| | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** | **mm** | **in** |
| Vertical Heights | –70 | –2.8" | –65 | –2.6" | –15 | –0.6" | +35 | +1.4" | +65 | +2.6" | –35 | –1.4" |
| Reach: Bucket At 45° | +43 | +1.7" | +73 | +2.9" | +29 | +1.1" | –21 | –0.8" | –63 | –2.5" | –5 | –0.2" |
| Width: Over Tires | +10 | +0.4" | –69 | –2.7" | +98 | +3.9" | 0 | 0" | +38 | +1.5" | +121 | 4.8" |
| Turning Radius: Outside of Tires | +0 | +0" | –45 | –1.8" | +42 | +1.7" | +1 | 0" | +14 | +0.6" | +53 | 2.1" |
| Turning Radius: Inside of Tires | –5 | –0.2" | 35 | +1.4" | –49 | –1.9" | 0 | 0" | –19 | –0.7" | –61 | 2.4" |
| | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** | **kg** | **lb** |
| Tipping Load – Straight | –83 | –182 | –212 | –466 | +9 | +19 | +444 | +978 | +486 | +1,071 | +332 | +731 |
| Tipping Load – Full Turn | –72 | –157 | –183 | –403 | +8 | +17 | +384 | +846 | +421 | +927 | +287 | +632 |
| Operating Weight | –126 | –277 | –322 | –709 | +14 | +30 | +678 | +1,494 | +748 | +1,648 | +506 | +1,115 |

*Offset rims available to meet European roading requirements.

**Not compatible with Aggregate counterweight.

## Ground Engagement Options

Bolt-on Cutting Edge



Long Teeth and Segments

Short Teeth and Segments

| Change with Ground Engagement Option Compared to Bolt-on Cutting Edge | 926M | | | | 930M | | | | 938M | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Long Teeth and Segments | | Short Teeth and Segments | | Long Teeth and Segments | | Short Teeth and Segments | | Long Teeth and Segments | | Short Teeth and Segments | |
| | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in |
| Dig Depth | +12 | +0.5" | +5 | +0.2" | +11 | +0.4" | +5 | +0.2" | +11 | +0.4" | +5 | +0.2" |
| Length: Overall | +146 | +5.7" | +121 | +4.8" | +146 | +5.7" | +121 | +4.8" | +146 | +5.7" | +121 | +4.8" |
| Dump Clearance | –103 | –4.1" | –82 | –3.2" | –104 | –4.1" | –83 | –3.3" | –105 | –4.1" | –84 | –3.3" |
| Reach | +104 | +4.1" | +89 | +3.5" | +103 | +4.1" | +88 | +3.5" | +102 | +4" | +87 | +3.4" |
| | kg | lb | kg | lb | kg | lb | kg | lb | kg | lb | kg | lb |
| Tipping Load – Straight | –148 | –325 | –142 | –311 | –150 | –329 | –143 | –315 | –138 | –305 | –132 | –291 |
| Tipping Load – Full Turn | –145 | –318 | –139 | –305 | –146 | –322 | –140 | –309 | –136 | –298 | –130 | –285 |
| Breakout Force | –121 | –266 | –115 | –254 | –121 | –266 | –115 | –254 | –112 | –245 | –106 | –234 |
| Operating Weight | +120 | +264 | +116 | +255 | +120 | +264 | +116 | +255 | +111 | +244 | +106 | +233 |

# Small Wheel Loaders Aggregate Handler Standard Equipment

## Standard Equipment

Standard equipment may vary. Consult your Cat dealer for details.

### POWER TRAIN

- Axle seal guards
- Auto idle shut down feature
- Cat C7.1 ACERT engine
  - Power Modes (Standard and Performance)
  - Power by Range (High Power in Range 4)
  - Turbocharged and aftercooled
  - Filtered crankcase breather
  - Diesel particulate filter (Fit for Life)
- Coolant protection to –34° C (–29° F)
- Differential lock in front axle
- Dry type air cleaner
- Enclosed wet disc full hydraulic brakes
- Fuel priming pump, automatic
- Fuel water separator
- Hydraulically driven demand cooling fan
- Intelligent hydrostatic transmission
  - Power train modes
  - Directional Shift Aggressiveness
  - Rimpull control, adjust wheel torque
  - Creeper control, adjust ground speed
- Lubed for life driveshafts
- Parking brake, electric
- Wide spaced 6 fins per inch cooling package
- S·O·S℠ sampling ports
- Throttle lock and maximum speed limiter

### HYDRAULICS

- Automatic lift, lower and tilt kickouts
- Bucket and Fork Modes, adjustable in-cab
- Cylinder damping at kickout and end stops
- Fine Mode control in Fork Mode
- Hydraulic Response setting
- Load sensing hydraulics and steering
- Seat-mounted hydraulic joystick controls

### ELECTRICAL

- Alternator, 115-amp, heavy duty
- 12V power supply in cab (2)
- Batteries, 1,000 CCA (2) 24 volt system
- Back-up alarm
- Emergency shutdown switch
- Heavy duty gear reduction starter
- Product Link PRO with subscription
- Remote jump start post
- Resettable main and critical function breakers

### OPERATOR ENVIRONMENT

- 75 mm (3 in) retractable seat belt, with audible alarm and indicator
- Automatic temperature control
- Cab, enclosed and pressurized
- Cup holders
- External heated mirrors with lower parabolic
- Ground level cab door release
- Gauges
  - Digital hour meter, odometer, tachometer, ground speed and direction indicator
  - Engine coolant temperature gauge
  - Fuel and Diesel Exhaust Fluid level
  - Hydraulic oil temperature gauge
- Hydraulic control lockout
- Interior cab lighting, door and dome
- Interior rearview mirrors (2)
- Lunch box storage
- Operator warning system indicators
- Radio ready speakers
- Rear window defrost, electric
- Seat-mounted controls, adjustable
- Sliding glass on the side windows
- Column mounted multi function control – lights, wipers, turn signal
- Suspension seat, fabric
- Tilt and telescopic steering wheel
- Wet arm wiper/washer, front and rear

### OTHER STANDARD EQUIPMENT

- Large-access enclosure doors
- Parallel lift loader linkage
- Recovery hitch with pin
- Remote mounted lubrication points
- Lockable compartments and enclosures

## Optional Equipment

Optional equipment may vary. Consult your Cat dealer for details.

- Antifreeze/coolant, extended-life
- Auto lube, integrated in secondary display
- Auxiliary flow, third function
- Axles, differential, limited slip, rear
- Axles, elevated breathers
- Beacon light, strobe
- Cab, deluxe (standard in Europe):
  - Automatic blower control
  - Electrically adjustable heated mirrors (2)
  - LED interior lighting
  - Secondary display to adjust settings
- Ride control adjustable speed activation
- Preventative maintenance reminders
- Integrated help function (22 languages available)
- Sunscreen, front and rear
- Camera, rearview (standard in Europe)
- Cold start package:
  - Ether starting aid, block heater and additional batteries 1,000 CCA (4 in total)
- Coupler, (Fusion and ISO 23727)
- Debris packages (low, medium, high)
- Fenders (extended cover and full coverage)
- Guards
  - Power train, (lower, side, driveshaft and crankcase)
  - Windshield and lights
  - Cylinders, tilt and steering
- Lights, auxiliary, halogen or LED with engine compartment lights
- Rear Object Detection
- Radio packages:
  - Radio ready with Bluetooth
  - Radio, AM/FM with Bluetooth and clock
  - Radio, AM/FM with CD player deluxe, weatherband, Bluetooth and clock
- Seats:
  - Deluxe seat – fully adjustable fabric air suspension seat with high seat backrest
  - Premium seat – fully adjustable leather and fabric air suspension with high backrest and air lumbar support. Heated and cooled bottom cushion and backrest.
- Steering:
  - Dual mode and Secondary
- Tires:
  - Bias ply, 17.5, 20.5-25
  - Radial, 17.5, 20.5, 23.5, 550/65, 600/65, 650/65 R25
- Work tools

# Notes

# Notes

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AEHQ7796 (04-2016)

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# PERFORMANCE DATA[DM9069]

May 27, 2013

**Performance Number: DM9069** **Change Level: 01**

| | | | |
|---|---|---|---|
| **SALES MODEL:** | C27 | **COMBUSTION:** | DI |
| **ENGINE POWER (BKW):** | 824.0 | **ENGINE SPEED (RPM):** | 1,800 |
| **GEN POWER WITH FAN (EKW):** | 725.0 | **HERTZ:** | 60 |
| **COMPRESSION RATIO:** | 16.5 | **FAN POWER (KW):** | 28.0 |
| **APPLICATION:** | PACKAGED GENSET | **ADDITIONAL PARASITICS (KW):** | 38.4 |
| **RATING LEVEL:** | PRIME | **ASPIRATION:** | TA |
| **SUB APPLICATION:** | STANDARD | **AFTERCOOLER TYPE:** | ATAAC |
| **PUMP QUANTITY:** | 1 | **AFTERCOOLER CIRCUIT TYPE:** | JW+OC, ATAAC |
| **FUEL TYPE:** | DIESEL | **INLET MANIFOLD AIR TEMP (C):** | 46 |
| **MANIFOLD TYPE:** | DRY | **JACKET WATER TEMP (C):** | 99 |
| **GOVERNOR TYPE:** | ADEM4 | **TURBO CONFIGURATION:** | PARALLEL |
| **ELECTRONICS TYPE:** | ADEM4 | **TURBO QUANTITY:** | 2 |
| **IGNITION TYPE:** | CI | **TURBOCHARGER MODEL:** | GTA5008BS-56T-1.60 |
| **INJECTOR TYPE:** | EUI | **CERTIFICATION YEAR:** | 2006 |
| **REF EXH STACK DIAMETER (MM):** | 254 | **PISTON SPD @ RATED ENG SPD (M/SEC):** | 9.1 |
| **MAX OPERATING ALTITUDE (M):** | 2,438 | | |

## General Performance Data

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | BRAKE MEAN EFF PRES (BMEP) | BRAKE SPEC FUEL CONSUMPTN (BSFC) | VOL FUEL CONSUMPTN (VFC) | INLET MFLD PRES | INLET MFLD TEMP | EXH MFLD TEMP | EXH MFLD PRES | ENGINE OUTLET TEMP |
|---|---|---|---|---|---|---|---|---|---|---|
| EKW | % | BKW | KPA | G/BKW-HR | L/HR | KPA | DEG C | DEG C | KPA | DEG C |
| 725.0 | 100 | 824 | 2,033 | 203.3 | 199.6 | 181.9 | 46.3 | 647.0 | 127.1 | 500.6 |
| 652.5 | 90 | 748 | 1,845 | 205.6 | 183.2 | 165.8 | 45.3 | 633.3 | 114.5 | 494.0 |
| 580.0 | 80 | 672 | 1,658 | 207.9 | 166.6 | 147.7 | 44.7 | 619.4 | 100.9 | 487.7 |
| 543.8 | 75 | 635 | 1,566 | 208.6 | 157.8 | 137.0 | 43.7 | 610.1 | 93.5 | 483.1 |
| 507.5 | 70 | 597 | 1,473 | 209.1 | 148.8 | 125.8 | 42.6 | 599.3 | 86.0 | 477.4 |
| 435.0 | 60 | 522 | 1,288 | 210.0 | 130.7 | 102.7 | 40.3 | 573.5 | 71.0 | 462.8 |
| 362.5 | 50 | 448 | 1,104 | 210.9 | 112.5 | 80.1 | 37.9 | 541.7 | 56.9 | 443.6 |
| 290.0 | 40 | 374 | 923 | 213.2 | 95.1 | 60.7 | 36.1 | 500.7 | 45.3 | 415.8 |
| 217.5 | 30 | 300 | 740 | 217.3 | 77.7 | 43.2 | 34.5 | 451.1 | 35.3 | 379.9 |
| 181.2 | 25 | 263 | 648 | 220.5 | 69.0 | 35.2 | 33.9 | 422.9 | 30.9 | 358.7 |
| 145.0 | 20 | 225 | 554 | 225.2 | 60.3 | 27.6 | 33.3 | 392.1 | 26.9 | 335.0 |
| 72.5 | 10 | 147 | 362 | 248.8 | 43.5 | 16.2 | 33.5 | 321.3 | 20.8 | 277.3 |

| GENSET POWER WITH FAN | PERCENT LOAD | ENGINE POWER | COMPRESSOR OUTLET PRES | COMPRESSOR OUTLET TEMP | WET INLET AIR VOL FLOW RATE | ENGINE OUTLET WET EXH GAS VOL FLOW RATE | WET INLET AIR MASS FLOW RATE | WET EXH GAS MASS FLOW RATE | ENGINE OUTLET WET EXH VOL FLOW RATE (0 DEG C AND 101 KPA) | ENGINE OUTLET DRY EXH VOL FLOW RATE (0 DEG C AND 101 KPA) |
|---|---|---|---|---|---|---|---|---|---|---|
| EKW | % | BKW | KPA | DEG C | M3/MIN | M3/MIN | KG/HR | KG/HR | M3/MIN | M3/MIN |
| 725.0 | 100 | 824 | 192 | 172.5 | 60.3 | 160.7 | 4,148.7 | 4,316.2 | 56.7 | 51.5 |
| 652.5 | 90 | 748 | 175 | 162.0 | 57.2 | 150.5 | 3,923.7 | 4,077.5 | 53.6 | 48.8 |
| 580.0 | 80 | 672 | 155 | 150.3 | 53.5 | 139.1 | 3,660.0 | 3,799.8 | 49.9 | 45.5 |
| 543.8 | 75 | 635 | 144 | 142.4 | 51.3 | 132.5 | 3,510.8 | 3,643.2 | 47.9 | 43.7 |
| 507.5 | 70 | 597 | 132 | 134.5 | 49.1 | 125.6 | 3,354.7 | 3,479.6 | 45.7 | 41.8 |
| 435.0 | 60 | 522 | 108 | 118.9 | 44.5 | 111.4 | 3,033.5 | 3,143.1 | 41.3 | 37.9 |
| 362.5 | 50 | 448 | 85 | 103.5 | 40.0 | 96.9 | 2,714.9 | 2,809.4 | 36.9 | 33.9 |
| 290.0 | 40 | 374 | 65 | 88.6 | 35.9 | 83.6 | 2,431.5 | 2,511.2 | 33.1 | 30.5 |
| 217.5 | 30 | 300 | 47 | 73.7 | 32.0 | 70.6 | 2,169.4 | 2,234.5 | 29.5 | 27.4 |
| 181.2 | 25 | 263 | 39 | 66.2 | 30.2 | 64.2 | 2,045.6 | 2,103.5 | 27.7 | 25.8 |
| 145.0 | 20 | 225 | 31 | 58.8 | 28.5 | 57.9 | 1,927.4 | 1,977.9 | 26.0 | 24.3 |
| 72.5 | 10 | 147 | 20 | 48.4 | 26.0 | 47.4 | 1,756.3 | 1,792.8 | 23.5 | 22.2 |

# Generator set data sheet

| | |
|---|---|
| **Model:** | **DQCC** |
| **Frequency:** | **60 Hz** |
| **Fuel type:** | **Diesel** |
| **kW rating:** | **800 Standby**<br>**725 Prime** |
| **Emissions level:** | **EPA NSPS Stationary Emergency Tier 2** |

| | |
|---|---|
| **Exhaust emission data sheet:** | **EDS-1088** |
| **Exhaust emission compliance sheet:** | **EPA-1122** |
| **Sound data sheet:** | **MSP-1160** |
| **Sound data sheet – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD):** | **MSP-1014** |
| **Cooling system data in various ambient conditions:** | **MCP-249** |
| **Cooling system data in various ambient conditions – with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD):** | **MCP-175** |
| **Prototype test summary data sheet:** | **PTS-160** |

| **Fuel consumption** | **Standby** | | | | **Prime** | | | | **Continuous** |
|---|---|---|---|---|---|---|---|---|---|
| | **kW (kVA)** | | | | **kW (kVA)** | | | | **kW (kVA)** |
| **Ratings** | 800 (1000) | | | | 725 (906) | | | | |
| **Load** | **1/4** | **1/2** | **3/4** | **Full** | **1/4** | **1/2** | **3/4** | **Full** | **Full** |
| **US gph** | 17.0 | 29.0 | 41.0 | 53.0 | 15.5 | 27.5 | 38.0 | 48.0 | |
| **L/hr** | 64.4 | 109.8 | 155.2 | 200.6 | 58.7 | 104.1 | 143.8 | 181.7 | |

| **Engine** | **Standby rating** | **Prime rating** | **Continuous rating** |
|---|---|---|---|
| Engine manufacturer | Cummins Inc. | | |
| Engine model | QSK23-G7 NR2 | | |
| Configuration | Cast iron, in line 6 cylinder | | |
| Aspiration | Turbocharged and air-to-air after-cooled | | |
| Gross engine power output, kWm (bhp) | 910 (1220) | 809 (1085) | |
| BMEP at set rated load, kPa (psi) | 2510 (364) | 2282 (331) | |
| Bore, mm (in.) | 170 (6.69) | | |
| Stroke, mm (in.) | 170 (6.69) | | |
| Rated speed, rpm | 1800 | | |
| Piston speed, m/s (ft/min) | 10.21 (2010) | | |
| Compression ratio | 16:1 | | |
| Lube oil capacity, L (qt) | 102 (108) | | |
| Overspeed limit, rpm | 2100 | | |
| Regenerative power, kW | 93 | | |

## Fuel flow

| | | |
|---|---|---|
| Maximum fuel flow, L/hr (US gph) | 685 (181) | |
| Maximum fuel inlet restriction, kPa (in Hg) | 13.44 (4) | |
| Maximum fuel inlet temperature, °C (°F) | 71 (160) | |


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| Air | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Combustion air, $m^3$/min (scfm) | 64 (2265) | 62 (2201) | |
| Maximum air cleaner restriction, kPa (in $H_2O$) | 6.2 (25) | | |
| Alternator cooling air, $m^3$/min (cfm) | 117 (4156) | | |

## Exhaust

| | | | |
|---|---|---|---|
| Exhaust flow at set rated load, $m^3$/min (cfm) | 155 (5455) | 147 (5191) | |
| Exhaust temperature, °C (°F) | 483 (902) | 461 (862) | |
| Maximum back pressure, kPa (in $H_2O$) | 10.1 (40.8) | | |

## Standard set-mounted radiator cooling (non-seismic)

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 50 (122) | | |
| Fan load, $kW_m$ (HP) | 24 (32) | | |
| Coolant capacity (with radiator), L (US gal) | 109.5 (29) | | |
| Cooling system air flow, $m^3$/min (scfm) | 998 (35233) | | |
| Total heat rejection, MJ/min (Btu/min) | 33.52 (31793) | 30.22 (28672) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |
| Maximum fuel return line restriction kPa (in Hg) | 30.47 (9) | | |

## Optional set-mounted radiator cooling (with seismic feature codes L228-2 (IBC) and/or L225-2 (OSHPD))

| | | | |
|---|---|---|---|
| Ambient design, °C (°F) | 45 (113) | | |
| Fan load, $kW_m$ (HP) | 27 (36) | | |
| Coolant capacity (with radiator), L (US gal) | 89 (23.5) | | |
| Cooling system air flow, $m^3$/min (scfm) | 1252 (44183) | | |
| Total heat rejection, MJ/min (Btu/min) | 33.52 (31793) | 30.22 (28672) | |
| Maximum cooling air flow static restriction, kPa (in $H_2O$) | 0.12 (0.5) | | |
| Maximum fuel return line restriction kPa (in Hg) | 30.47 (9) | | |

## Optional heat exchanger cooling

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum raw water pressure, jacket water circuit, kPa (psi) | | | |
| Maximum raw water pressure, aftercooler circuit, kPa (psi) | | | |
| Maximum raw water pressure, fuel circuit, kPa (psi) | | | |
| Maximum raw water flow, jacket water circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, aftercooler circuit, L/min (US gal/min) | | | |
| Maximum raw water flow, fuel circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min) | | | |
| Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min) | | | |
| Raw water delta P at min flow, jacket water circuit, kPa (psi) | | | |


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| | Standby rating | Prime rating | Continuous rating |
|---|---|---|---|
| Raw water delta P at min flow, aftercooler circuit, kPa (psi) | | | |
| Raw water delta P at min flow, fuel circuit, kPa (psi) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Optional remote radiator cooling[1]

| | | | |
|---|---|---|---|
| Set coolant capacity, L (US gal) | | | |
| Max flow rate at max friction head, jacket water circuit, L/min (US gal/min) | | | |
| Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min) | | | |
| Heat rejected, jacket water circuit, MJ/min (Btu/min) | | | |
| Heat rejected, aftercooler circuit, MJ/min (Btu/min) | | | |
| Heat rejected, fuel circuit, MJ/min (Btu/min) | | | |
| Total heat radiated to room, MJ/min (Btu/min) | | | |
| Maximum friction head, jacket water circuit, kPa (psi) | | | |
| Maximum friction head, aftercooler circuit, kPa (psi) | | | |
| Maximum static head, jacket water circuit, m (ft) | | | |
| Maximum static head, aftercooler circuit, m (ft) | | | |
| Maximum jacket water outlet temp, °C (°F) | | | |
| Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F) | | | |
| Maximum aftercooler inlet temp, °C (°F) | | | |
| Maximum fuel flow, L/hr (US gph) | | | |
| Maximum fuel return line restriction, kPa (in Hg) | | | |

## Weights[2]

| | |
|---|---|
| Unit dry weight kgs (lbs) | 6075 (13395) |
| Unit wet weight kgs (lbs) | 6337 (13973) |

**Notes**:

[1] For non-standard remote installations contact your local Cummins representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

## Derating factors

| | |
|---|---|
| **Standby** | Engine power available up to 1137 m (3730 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.4% per 305 m (1000 ft). Above 40 °C (104 °F), derate 10% per 10 °C (18 °F). |
| **Prime** | Engine power available up to 754 m (2475 ft) at ambient temperatures up to 40 °C (104 °F). Above these elevations, derate at 4.5% per 305 m (1000 ft). Above 40 °C (104 °F), derate 20.9% per 10 °C (18 °F). |
| **Continuous** | |


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## Ratings definitions

| Emergency Standby Power (ESP): | Limited-Time Running Power (LTP): | Prime Power (PRP): | Base Load (Continuous) Power (COP): |
|---|---|---|---|
| Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528. | Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514. | Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. |

## Alternator data

| Voltage | Connection[1] | Temp rise degrees C | Duty[2] | Single phase factor[3] | Max surge kVA[4] | Winding No. | Alternator data sheet | Feature code |
|---|---|---|---|---|---|---|---|---|
| 277/480 | Wye | 125/105 | S/P | | 2944 | 312 | ADS-309 | B276-2 |
| 277/480 | Wye | 105 | S | | 3313 | 312 | ADS-310 | B280-2 |
| 347/600 | Wye | 125/105 | S/P | | 2944 | 7 | ADS-309 | B550-2 |
| 220/380 | Wye | 105/80 | S/P | | 4234 | 312 | ADS-312 | B599-2 |
| 277/480 | Wye | 80 | S | | 3866 | 312 | ADS-311 | B601-2 |
| 347/600 | Wye | 105/80 | S/P | | 3866 | 7 | ADS-311 | B603-2 |
| 347/600 | Wye | 80 | S | | 3866 | 7 | ADS-311 | B604-2 |
| 220/380 | Wye | 80 | P | | 3866 | 312 | ADS-311 | B687-2 |
| 277/480 | Wye | 80 | P | | 3866 | 312 | ADS-311 | B694-2 |
| 208/416 | Wye | 125/105 | S/P | | 3313 | 311 | ADS-310 | B732-2 |
| 208/416 | Wye | 105/80 | S/P | | 3866 | 311 | ADS-311 | B733-2 |
| 208/416 | Wye | 80 | S | | 4234 | 311 | ADS-312 | B734-2 |
| 220/380 | Wye | 125 | P | | 3313 | 312 | ADS-310 | B736-2 |
| 220/380 | Wye | 125/105 | S/P | | 3866 | 312 | ADS-311 | B737-2 |
| 255/440 | Wye | 125/105 | S/P | | 3313 | 312 | ADS-310 | B741-2 |

**Notes**:

[1] Limited single phase capability is available from some three phase rated configurations. To obtain single phase rating, multiply the three phase kW rating by the Single Phase Factor[3]. All single phase ratings are at unity power factor.

[2] Standby (S), Prime (P) and Continuous ratings (C).

[3] Factor for the *Single phase output from Three phase alternator* formula listed below.

[4] Maximum rated starting kVA that results in a minimum of 90% of rated sustained voltage during starting.

## Formulas for calculating full load currents:

**Three phase output**

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

**Single phase output**

$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$

**Warning**: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

**For more information contact your local Cummins distributor or visit power.cummins.com**

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D-3354 (09/17)

# Sound data
## 800DQCC 60 Hz

## Sound pressure level @ 7 meters, dB(A)

See notes 1-8 listed below

| Configuration | | Measurement location number | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Standard - unhoused | Infinite exhaust | 93.5 | 97.6 | 96.7 | 96.4 | 95.3 | 94.7 | 94.3 | 94.2 | 95.6 |
| F200 - weather | Mounted muffler | 87.4 | 92.3 | 81.2 | 82.8 | 90.5 | 81.5 | 78.5 | 87.9 | 87.6 |
| F201 - quiet site II first stage | Mounted muffler | 74.4 | 75.1 | 76.7 | 82.6 | 90.5 | 80.8 | 72.1 | 72.2 | 82.9 |
| F202 - quiet site II second stage | Mounted muffler | 72.1 | 77.4 | 78.2 | 74.4 | 78.2 | 71.7 | 73.2 | 72.5 | 74.8 |

## Sound power level, dB(A)

See notes 2-6, 9, 10 listed below

| Configuration | | Octave band center frequency (Hz) | | | | | | | | Overall sound power level |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| Standard - unhoused | Infinite exhaust | 85.6 | 107.7 | 110.5 | 114.5 | 116.8 | 110.5 | 119.2 | 120.4 | 125.2 |
| F200 - weather | Mounted muffler | 93.4 | 105.4 | 107.7 | 107.6 | 108.1 | 105.1 | 108.0 | 109.1 | 116.0 |
| F201 - quiet site II first stage | Mounted muffler | 92.4 | 104.1 | 102.2 | 101.0 | 101.3 | 100.3 | 103.8 | 105.6 | 111.5 |
| F202 - quiet site II second stage | Mounted muffler | 86.3 | 100.0 | 97.8 | 92.6 | 99.8 | 98.5 | 102.9 | 101.5 | 108.4 |

## Exhaust sound power level, dB(A)

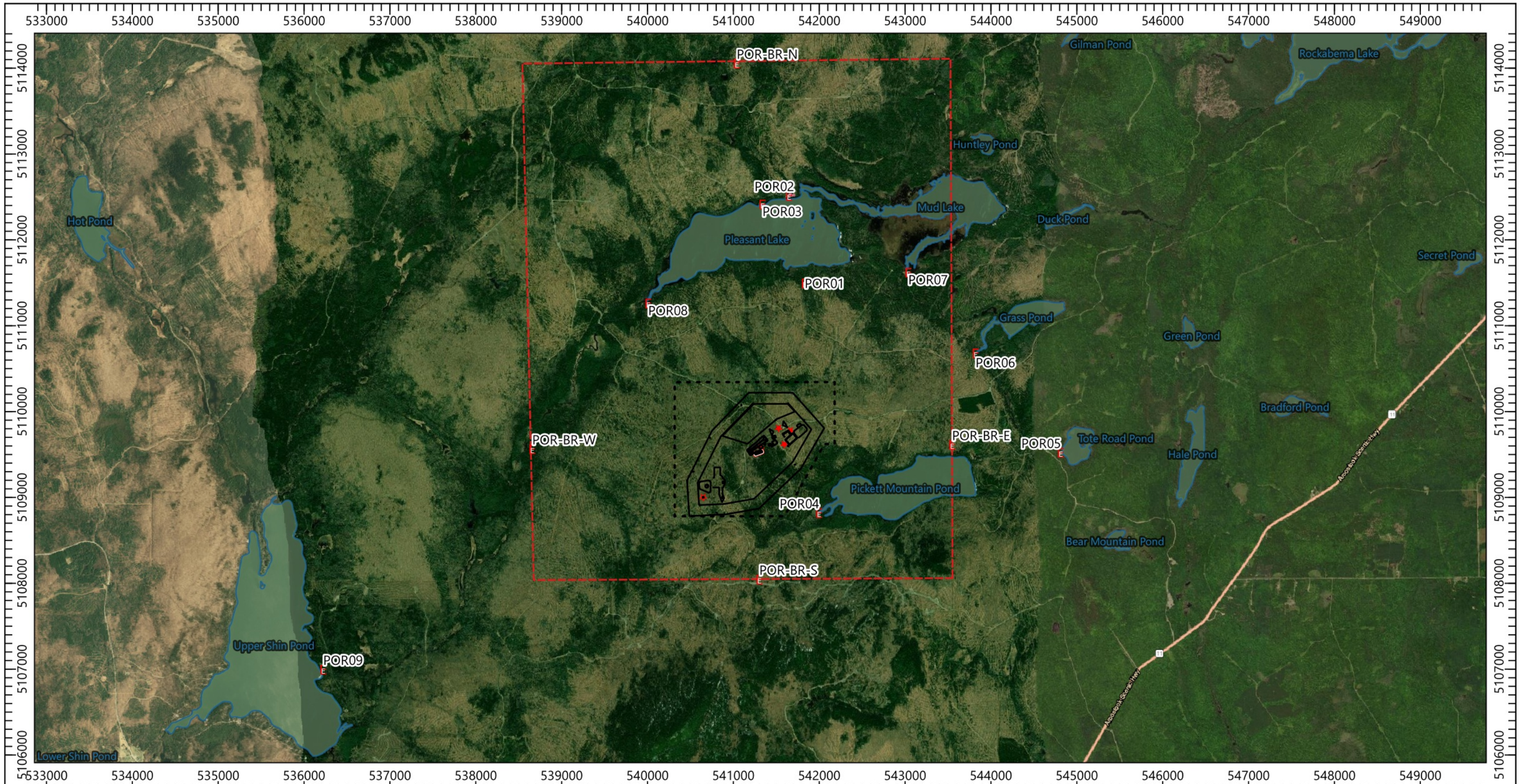
| Open exhaust (no muffler rated load) | Octave band center frequency (Hz) | | | | | | | | Sound power level |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | |
| | 104.1 | 114.0 | 123.5 | 122.2 | 124.6 | 125.0 | 123.4 | 121.5 | 131.8 |

Note:

1. Position 1 faces the engine front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7 m (23 ft) from the surface of the generator set and 1.2 m (48”) from floor level.
2. Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
3. Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
4. Sound levels for aluminum enclosures are approximately 2 dB(A)s higher than listed sound levels for steel enclosures.
5. Sound data for generator set with infinite exhaust do not include exhaust noise.
6. Data is based on full rated load with standard radiator-cooling fan package.
7. Sound pressure levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
8. Reference sound pressure is 20 µPa.
9. Sound power levels per ISO 3744 and ISO 8528-10, as applicable.
10. Reference power = 1 pw ($10^{-12}$ W).
11. Exhaust sound pressure levels are per ISO 6798, as applicable.
12. Sound pressure level at different microphone locations and average sound pressure level at 7 m for F202, F201 and F200 enclosures are based on Insertion loss calculations.
13. Average sound pressure level at 7 m for F202 - quiet site II second stage enclosure is calculated using overall frequency spectrum data of the insertion loss.

# Appendix C

# Figures




## LEGEND

- Property Boundary
- Residential Property
- Site Area
- E Point of Reception
- Point Source
- Line Source
- Site layout

Noise Contours (dBA)

40, 45, 50, 55, 60, 65, 70, 75, 80

0 2,500 5,000 7,500 10,000 Metres

ORIGINAL DRAWING PROVIDED BY WOLFDEN
IMAGERY EXTRACTED FROM ESRI

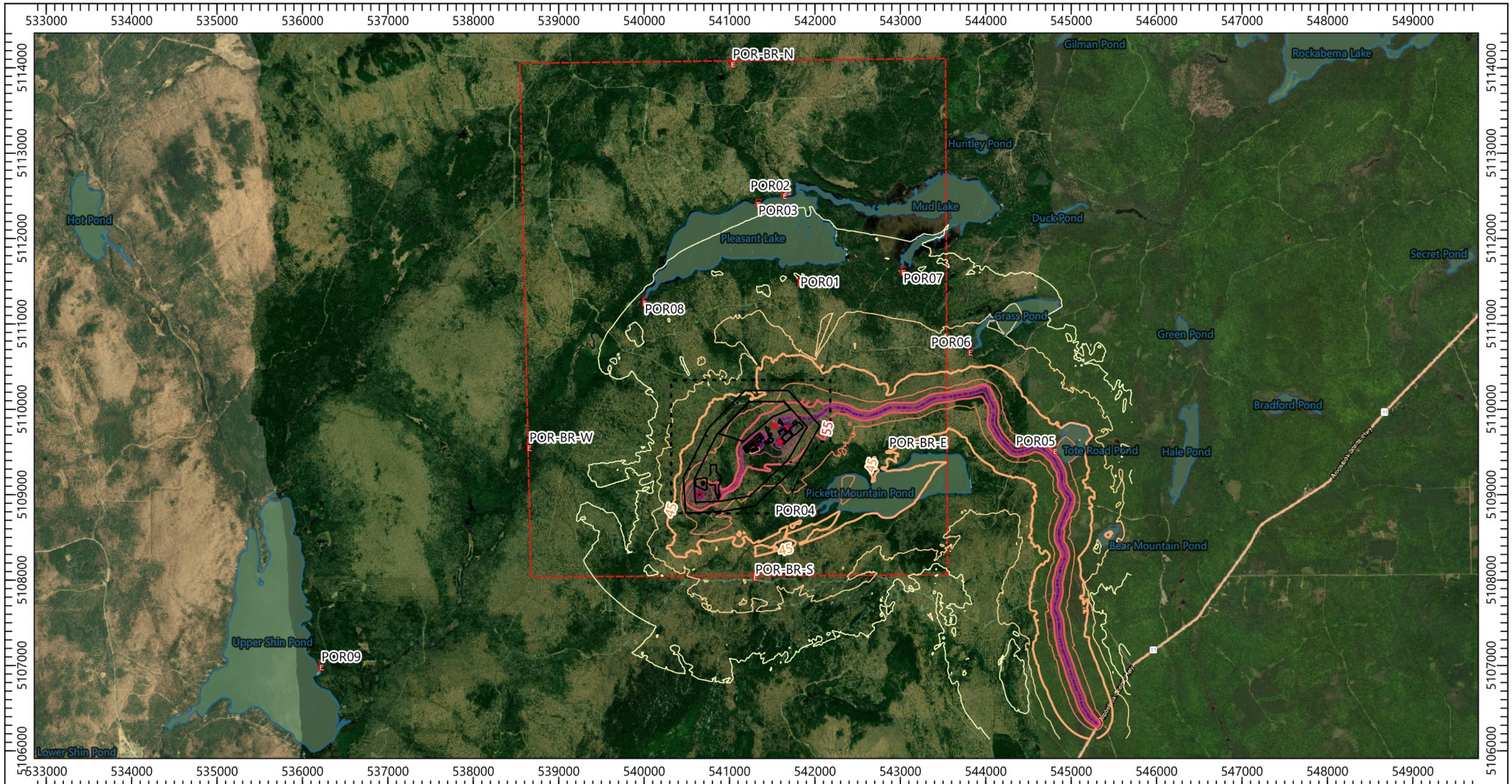
Source: ESRI
Datum & Projection:
NAD83 / UTM zone 19N

wood.

**Wolfden Resources Corporation**
**Picket Mountain Project - Noise Study**

**Noise Contours (Daytime/Nighttime)**

| | |
|---|---|
| PROJECT NO: 3617197478 | FIGURE: 1 |
| SCALE: 1:43000 | DATE: August 2022 |




## LEGEND

- Property Boundary
- Residential Property
- Site Area
- E Point of Reception
- Point Source
- Line Source
- Site layout

Noise Contours (dBA)

- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80

0 2,500 5,000 7,500 10,000 Metres

ORGINIAL DRAWING PROVIDED BY WOLFDEN
IMAGERY EXTRACTED FROM ESRI

Source: ESRI
Datum & Projection:
NAD83 / UTM zone 19N

wood.

**Wolfden Resources Corporation**
**Picket Mountain Project - Noise Study**

**Noise Contours (Daytime/Nighttime)**

| | |
|---|---|
| PROJECT NO: 3617197478 | FIGURE: 2 |
| SCALE: 1:43000 | DATE: August 2022 |

# EXHIBIT 17.0 FIRE, POLICE, AND AMBULANCE

## 17.1 FIRE

The Island Falls Fire Department is located approximately 12.5 miles southeast of the Project Area. The Island Falls Town Manager stated in a July 20, 2022, letter that the Island Falls Fire Department has capacity to provide emergency fire services for the Project, which are expected to be minimal in nature (**Attachment 17-A**).

## 17.2 LAW ENFORCEMENT

The Penobscot County Sherriff's Office, located in Bangor Maine, and approximately 95 miles south of the Project Area, is responsible for law enforcement services for residents and visitors to cities, towns, plantations, and unorganized territories of Penobscot County. The applicant has met with the Penobscot County Sherriff's Office, who requested additional information before determining availability and capacity to provide law enforcement services for the project. The mine permit application package will be sent to the Penobscot County Sherriff's Office and follow-up consultation to request a letter is planned.

## 17.3 AMBULANCE

The Town of Island Falls Ambulance Department is located approximately 12.5 miles southeast of the Project Area. The Island Falls Town Manager stated in a July 20, 2022, letter that the Island Falls Ambulance Department has capacity to provide ambulance service to the Project, which is expected to be minimal in nature (**Attachment 17-A**).

## 17.4 UTILITIES

Wolfden proposes to construct a solar facility within the Project Area to provide power for the mining location. The Project will require a new transmission line to supply the additional electrical power required for mine operations beyond what is generated from solar operations to ensure operations continue to take place without interruption as well as to supply power for peak loading. The transmission line will be paid for entirely by Wolfden and will be constructed and owned by Versant Power (Versant).

All electrical components at and from the termination of the Versant transmission line will be paid for entirely and constructed, owned, and operated by Wolfden. Versant has confirmed that supply of this power requirement is feasible. Project utilities are further described in **Exhibit 20 Electricity and Communications**, including a letter from Versant Power. The Project will also include emergency back-up power in the form of diesel generators, to be used only when needed.

# 17.5 IN-HOUSE EMERGENCY SERVICES

## 17.5.1 Onsite Security

Wolfden will provide its own onsite security, minimizing any need for law enforcement services. An onsite security guard will be present 24 hour per day, 7 days per week through an outside vendor. The site will be operated 24 hours per day, 7 days per week by workers further reducing the opportunity for unauthorized access. Access to the interior of the Project Area will be managed by a series of fixed barricades at each road access to the property as well as a stationed security facility and traffic gate at the Project entrance. “Danger” and “No Unauthorized Entry” signs will be posted around the perimeter of the property boundary within visual distance of any point of the boundary. Security cameras may be used as required. Further information on security measures is presented in **Exhibit 2 Project Description**.

## 17.5.2 Onsite Emergency Services

Several layers of emergency service prevention and response are included in the design, build standards, and safety programs of the Project. Buildings and structures will incorporate fire protection standards, minimizing the risk of fires. Wolfden will provide for fire response underground with its own employees as this requires specialized training and equipment that will be provided in-house.

Comprehensive emergency response training programs are established within the mining industry and include areas of focus such as first responder, firefighting, and fire rescue. The Project will be operated under a strict and well-defined safety program and in conformance with OSHA General Industry standards, which include requirements for medical, first aid and fire protection. Emergency Response/Mine Rescue Teams will be trained in the response of incidents that could potentially occur onsite. Required support from the surrounding communities would be in addition to the onsite response services described above and are anticipated to be minimal in nature. Wolfden will communicate and coordinate with first responders from the local community where their specialized training and skill sets complement and support onsite emergency services.

# EXHIBIT 17 FIGURES

Not Applicable

# EXHIBIT 17 ATTACHMENTS

Attachment 17-A: Island Falls Fire and Ambulance Support Letter

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 17-A: Island Falls Fire and Ambulance Support Letter

# TOWN OF ISLAND FALLS

68 Houlton Road, P.O. Box 100
Island Falls, Maine 04747

**Board of Selectmen**
Frank Porter
Anthony Bowers
James Lord
Royden Hunt
Anthony Binotto

**Town Manager**
Jutta Beyer

**Town Clerk**
Kelly Ripley

**Phone**
207.463.2246

**Fax**
207.463.2550

**Website**
www.islandfallsme.us

Jeremy Oullette
VP Project Development
Wolfden Resources Corporation

07/20/2022

To Mr. Oullette,

This letter is in response to Wolfden Resources request to rezone 415 acres of land - located near Pickett Mountain approximately 13 miles northeast of Island Falls in T6R6, Penobscot County, WELS - from its present General Management (M-GN) designation to Planned Development (D-PD) for a commercial mining operation. On-site operations will include an underground mine to extract commercial grades of minerals from a known metallic mineral deposit that will be transported to an offsite processing facility; and may also include a solar farm, of to be determined size, if deemed environmentally and economically viable. At full capacity, the Pickett Mountain Project (Project) will employ around 120 onsite employees, who will work in shifts, with approximately 45 – 60 onsite workers at any given time. The Project duration is anticipated to be 10 – 15 years including construction, operation, and decommissioning.

Consistent with OSHA requirements and mining industry established best practices, the Project will include several layers of on-site emergency service prevention and response including fire protection build standards and emergency response training programs that include fire and medical/first aid. Support from the surrounding communities would be in addition to the existing services and will be minimal in nature.

Island Falls' Ambulance and Fire Response services are sufficient and able to support Wolfden Resources ambulance and fire response needs, which are anticipated to be minimal.

Regards,

Board of Selectmen of Island Falls

Frank Porter

Anthony Binotto

Royden Hunt

Anthony Bowers

James Lord

# EXHIBIT 18.0 EDUCATIONAL SERVICES

This exhibit is not applicable to this application per communications with LUPC staff on July 11, 2022.

# EXHIBIT 19.0 SOLID WASTE DISPOSAL

## 19.1 CONSTRUCTION AND SITE PREPARATION

Grubbed organic material will be managed on-site when possible. Most of the timber and stumps are small, and to the extent timber removed has limited or no economic value, it will be chipped on-site for use as erosion control mix. At an estimated 360 cy of mulch generated per acre of stumps (average forest property) the total estimated biomass generation is approximately 46,500 cy. Any excess chipped or ground material will be made available to contractors for use as erosion control or biomass material. A letter from Sargent Corporation is provided in **Attachment 19-A** as confirmation of demand for excess material. Unused materials during construction such as excess concrete are sent back to the supplier or transported to an approved landfill facility.

## 19.2 OPERATIONS

During operations at Pickett Mountain, solid waste material will generally be made up of cardboard and packaging from plastics along with paper refuse; paper refuse from offices and facilities will be recycled where possible. Chemicals and explosives are typically packaged in plastic bags or plastic packaging, depending on the type and quantity. Liquid chemicals for water treatment and concentration are stored in reusable plastic and aluminum totes that can be washed and reused in the majority of applications. Construction waste materials such as lumber and metal fasteners will be generated onsite but in limited fashion. Steel from damaged underground screen mesh and worn-out steel pipe make up majority of steel refuse. These materials are generally recovered and recycled and that practice will be the goal of the operation. Broken down equipment such as motors and pumps will be repaired or recycled when possible. Typically, an operation this size will make use of two to three 6-cubic yard rear load dumpsters that will be serviced by a licensed solid waste hauler on a weekly basis.

Solid waste management in the area is serviced by Casella Waste Management, including the Pine Tree Waste transfer station in Houlton and the Northern Katahdin Valley Waste Disposal District in Dyer Brook. This district serves the communities of Amity, Crystal, Dyer Brook, Hammond, Hersey, Island Falls, Merrill, Moro Plantation, Mount Chase, Patton and New Limerick. The facilities offer commercial and municipal waste disposal transfer. There would be no burden on these services as they are paid for services. Confirmation of waste management capacity is identified in **Attachment 19-B.**

## 19.3 CLOSURE/RECLAMATION

During closure and reclamation activities, most major components are disassembled and sold through the services of a demolition contractor. Recyclable materials such as copper, steel, and plastics are sorted and sold through the same contractor. During demolition and removal of infrastructure components, demolition debris that is not considered for recycling, sale, or approved for onsite disposal, will go to a licensed solid waste disposal facility.

# EXHIBIT 19 FIGURES

Not Applicable

# EXHIBIT 19 ATTACHMENTS

Attachment 19-A: Sargent Corporation Consumption of Excess Chipped Material Letter

Attachment 19-B: Casella Waste Systems Capacity to Handle Solid Waste Materials

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 19-A: Sargent Corporation Consumption of Excess Chipped Material Letter

August 19, 2021

Attn: Jeremy Ouellette
Project Pickett Mtn. Project
RE: Stump Grinding for stormwater management.

Jeremy,

Sargent Corporation uses stump grindings as an erosion control device replacing silt fence on many projects and would be interested in using surplus grindings for other local projects that require erosion control devices for stormwater management.

DEP has approved the material as an acceptable product for replacing silt fence on many projects in Maine per Chapter 500 of their STORMWATER MANAGEMENT document (see attached)

We hope you find this helpful, please call if you have any questions. 207-944-0368

Respectfully,
SARGENT CORPORATION

Stephen Perry

**Corporate Headquarters**
Telephone: 207-827-4435
Fax: 207-827-6150
378 Bennoch Road
P.O. Box 435
Stillwater, ME 04489

**New Hampshire Operations**
Telephone: 603-734-2132
Fax: 603-734-2197
361 Calef Highway
Epping, NH 03042

**Mid-Atlantic Operations**
Telephone: 804-368-7118
Fax: 804-368-7387
11139 Air Park Road
Suite 1
Ashland, VA 23005

sargent-corp.com

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 19-B: Casella Waste Systems Capacity to Handle Solid Waste Materials

**JUNIPER RIDGE LANDFILL**

**Operated By NEWSME Landfill Operations, LLC**

October 20, 2022

Alexander Pries
Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

**RE: Juniper Ridge Landfill Disposal Capacity**

Dear Mr. Pries,

Juniper Ridge Landfill (JRL) is a State of Maine owned non-hazardous solid waste disposal facility that has the ability and capacity to accept the anticipated volumes of in-state construction and demolition debris and special waste generated by the proposed Wolfen Mount Chase LLC, Pickett Mountain Metallic Mine Project.

It is important to note that the special waste (filter cake material) to be generated, will require proper waste characterization/testing prior to disposal approval. This necessary step is to ensure the material is non-hazardous and is acceptable under JRL's current licenses.

As of June 21, 2022, JRL has roughly 1,930,700 cy of capacity remaining in its currently constructed Cells 1-14. Also permitted but not yet constructed (Cells 15-17), is another roughly 5,042,300 cy, which brings the total remaining permitted site capacity to roughly 6,973,000 cy, under Maine Solid Waste licenses #S-20700-WD-7A-A-N (Amended #S-020700-WD-N-A) and #S-020700-WD-BI-N.

Sincerely,

NEWSME Landfill Operations, LLC

Jeffrey Pelletier
*Environmental Manager*

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# EXHIBIT 20.0 ELECTRICITY AND COMMUNICATIONS

## 20.1 ELECTRICAL SUPPLY

Electricity is required for the Project to operate electrical equipment, including dewatering pumps, ventilation motors, water treatment, cranes and lighting in the Project Area. The estimated average power consumption for standard continued operations of Pickett Mountain is 2.34 MW (56 megawatt-hours [MWh] per day). An approximate 47-acre area located in the north has been sited to support a potential solar facility if subsequent evaluations, planning, and agency consultations indicate this is viable. The primary purpose for the solar facility would be to provide the majority of energy required for mine operations. The goal of including solar energy in the Project is to reduce the overall carbon footprint during operations while also reducing operating costs.

The Project will require a new transmission line to supply the electrical power from an electrical substation in Patten, ME, to the project site. This will require construction of approximately 11 miles of overhead transmission line running from a substation in Patten along Route 11 and the existing private gravel access road to the on-site Project substation. The transmission line construction and maintenance will be funded by Wolfden and owned and operated by Versant Power. All electrical components at and from the Versant Power point of interconnection at the site will be funded, owned, and operated by Wolfden. Versant Power has confirmed that supply of this power requirement is feasible. A letter to this effect is included in **Attachment 20-A.** The Versant Power letter refers to both the electrical supply to the mine and an additional 4.71 MW anticipated for the off-site processing facility.

The Project will also include emergency generator back-up power, but these would be used only when needed. Generator derived power will be focused to necessary functions such as fire water pumps, sump pumps, large power motors to shut them down safely, and plumbing heat trace for winter operations.

### 20.1.1 Solar Facility

If feasible, Wolfden proposes to construct a solar facility within the rezone area to provide a portion of the power required for the Project. Depending on final design and approval of a solar facility, the solar facility is anticipated to generate 61% of the total power needs of the Project. The solar facility will include erection of solar panels, inverters and transformers within the array, and a medium voltage electrical collector line (Collector) running underground and connecting to a substation at a point of interconnection with Versant within the rezone area. The area under and between the panels will be vegetated, and not mowed more than twice per year to allow for a vegetated stormwater treatment buffer within the array.

The solar facility will be decommissioned and removed at the end of its useful life or at the end of the Project life depending on intent by the electrical utility, allowing that portion of the site to also return to its natural character. The solar facility would have an independent decommissioning bond as approved by MDEP, as required by Maine law (35-A MRSA §§3491 et seq.).

## 20.2 COMMUNICATIONS

Communications for the Project will be supplied by Clear Connect, which will supply services from either Viasat or HughesNet. Voice communications will be via voice over IP (VOIP) or through a boosted cellular service. A letter from the communications supplier confirming feasibility is presented in **Attachment 20-B.**

# EXHIBIT 20 FIGURES

Not Applicable

# EXHIBIT 20 ATTACHMENTS

Attachment 20-A: Versant Power Letter

Attachment 20-B: Clear Connect Communications Correspondence

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 20-A: Versant Power Letter

July 29, 2022

Mr. Jeremy Ouellette
Wolfden Resources
101 Gardner Street
Patten, ME 04765

Dear Mr. Ouellette:

Thank you for reaching out to us with regard to Wolfden Resources' plan for a mining site on Pickett Mountain, located in the Patten area.

Our engineering department has run preliminary load flows for the future mining load fed from our Patten tap by extending it eleven miles north to your site.

Initially, the model indicated that there would be voltage drop issues with 336.4 ACSR at 44 kV. This is the size conductor we would recommend for a starting point. Once VAR support was added, the site maintained good voltage under steady state conditions. The VAR requirement is large for Versant Power-Maine Public District with up to nine MVAR required with a peak ten MW, three MVAR load assumption: a conservative analysis given your current 7 MW peak load estimation. Note that this arrangement also worked with the L1176 contingency.

What this means for the Wolfden Resources project is that the plan, as conceptually outlined above, should be able to supply the mining site with necessary power. However, please understand that a full study would need to be completed first.

If you should have any further questions, please don't hesitate to reach out to me at 207-760-2401 or at chris.lyng@versantpower.com .

We look forward to hearing from you.

Sincerely,

Christopher Lyng
Supervisor, Customer Contact Center
cc: Internal Distribution

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 20-B: Clear Connect Communications Correspondence

## Pries, Alex

**From:** Dustine Polizia <dustine@clearconnectco.com>
**Sent:** Wednesday, August 3, 2022 1:26 PM
**To:** Jeremy Ouellette; Pries, Alex
**Subject:** RE: Internet Service Options - Request for Information

Here is the updated pricing

*Business 35 - $69.99/ mo*

- 35 Gigabits of data per month
- 25mbps down * 3mbps up speed
- Save $10/ mo for first 6 months

*Business 50 - $99.99/ mo*

- 50 Gigabits of data per month
- 25mbps down * 3mbps up speed
- Save $10/ mo for first 6 months

*Business 75 - $149.99/ mo*

- 75 Gigabits of data per month
- 25mbps down * 3mbps up speed
- Save $20/ mo for first 6 months

**Equipment**

*Lease*

- $19.99/mo ( If there are ever any issues or malfunctions equipment is owned by hughesnet and will be repaired or replaced)

*Buy with 24 month Commitment*

- $599.99 (Customer owns equipment cost cover

*Buy with no Commitment*

- $999.99 (Customer owns equipment cost cover

**Install / Upfront Cost**

- Install $99.99 – Currently Waived
- Lease setup and equipment shipping $99.99 – Currently $50 off so $49.99
- i.e. Upfront cost for 50G plan with equipment rental $159.97

Viasat  Highspeed internet

- 35x4M highspeed internet unlimited data $175.00
- 60x4M Highspeed internet unlimited data $300.00
- Install is $100
- 2yr term but ETF is $15 for months remaining

No payment upfront, pay after install

****I specialize in Multi Site Locations, I have direct partnerships with ALL major carriers and can help you find and set up services based on the needs of your business. I will be your one stop shop..Please feel**

**Dustine Polizia**

Supplier Management,

Sr. Solutions Advisor

ClearConnect

303-974-7566

dustine@clearconnectco.com

# EXHIBIT 21.0 PUBLIC ROADS

## 21.1 NEAREST PUBLIC ROAD

Access to the Project Area is through well developed and well-maintained private gravel roads, currently used for logging. The nearest public road to the Project Area is Route 11, located approximately 4.4 miles southeast of the Project Area and along private gravel logging roads.

## 21.2 TRAFFIC ROUTES

Traffic routes along private and public roads will be needed to support the mine operations, which includes transportation of ore to the Tailings Management Facility (TMF) for processing and subsequent hauling of the concentrate to market. **Figure 21-1** details the conceptual transportation route to a TMF located in either Hersey or Patten, while **Figure 21-2** details the conceptual route to a TMF located in Stacyville. WSP prepared a technical memorandum with additional details on the conceptual routes and roads likely to be used (**Attachment 21-A).** These conceptual routes are further discussed in **Section 21.4.** WSP's analysis concluded that the additional traffic levels from mine operations do not represent a major impact to the existing road infrastructure.

## 21.3 PRIVATE ROADS

Access between the Project Area and Route 11 is along 4.4 miles of well-developed and well-maintained private gravel roads (consisting of Pleasant Lake Road, Bear Mountain Road, and Hale Pond Road) that were established and are maintained for commercial logging trucks. These roads are also used for recreational purposes including all-terrain vehicles and snowmobiles. These routes will be used by employees, contractors, delivery vehicles, and ore rock transportation trucks. A right of way easement for use of these roads for the duration of the project is included in **Exhibit 3 – Deed, Lease, Sales Contract, or Easement.**

## 21.4 PUBLIC ROADS

### 21.4.1 Public Roads – Routine Traffic

Public roads will be used by mine employees, contractors, and delivery vehicles. It is expected that the majority of onsite employees and contractors will be from the local work force traveling to the site along Route 11 from surrounding roads, many of whom already use portions of this route for their current employment. Delivery vehicles will also use Route 11 and surrounding roads to access the site at the Bear Mountain intersection. Many of these public roads are outside of LUPC jurisdiction but are discussed here for completeness and per request of the LUPC. Based on the estimated additional level of Project traffic, there may be incremental effects to noise, dust, and emissions levels. The minimal increase, relative to current traffic, is not expected to negatively impact health and safety to local residents and businesses in the area. See **Attachment 21-A** for additional information on these routes and volumes.

### 21.4.2 Public Roads – Potential Ore and Concentrates Transport Routes

As previously noted, public roads will also be used for the transport of ore concentrate from the Project Area to the TMF. After processing, the processed concentrate will then be transported to market. Wolfden has not finalized the location of the TMF, so this exhibit presents conceptual traffic routes for three potential locations under consideration. Note that the actual transportation route may vary depending on the final location of the TMF. See **Attachment 21-A** for additional information on these routes.

#### 21.4.2.1 Hersey TMF

From the Project Area, ore rock trucks would travel on private gravel roads to an ore processing and concentrator facility. The location of the ore processing facility in Hersey is still to be determined. Trucks carrying concentrate from the process facility will continue to travel south on Route 11 to Maine State Route 159 (SR-159) in Patten. Trucks carrying mineral concentrate will travel east on SR-159 to an access ramp to I-95 in Island Falls traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick (see **Figure 21-1**).

#### 21.4.2.2 Patten TMF

From the Project Area, ore rock trucks would travel on private gravel roads to Route 11, hence south-southwest to Patten to an ore processing and concentrator facility. The location of the ore processing facility in Patten is still to be determined. Trucks carrying concentrate will travel east on SR-159 to an access ramp to I-95 in Island Falls traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick (see **Figure 21-1)**.

#### 21.4.2.3 Stacyville TMF

From the Project Area, ore rock trucks would travel on private gravel roads to Route 11, hence south to Stacyville to an ore processing and concentrator facility. The location of the ore processing facility in Stacyville is still to be determined. Trucks carrying concentrate will travel southeast along Route 11 to Maine State Route 158 (SR-158) or Main Street in Sherman to an access ramp to I-95 traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick (see **Figure 21-2)**.

## 21.5 TRAFFIC VOLUMES

Anticipated traffic volumes from the Project are presented in WSP's technical memorandum provided as **Attachment 21-A.** WSP's analysis concluded that the additional traffic levels from mine operations do not represent a major impact to the existing road infrastructure.

### 21.5.1 Routine Traffic

Onsite traffic will be from employees and contractors commuting to and from the site, visitors, and delivery vehicles. **Attachment 21-A** provides further details on the estimates of approximate visitors to the Project on a daily basis.

### 21.5.2 Ore and Concentrate Transport Traffic

Ore trucks will be 32,000-pound (empty truck weight) semi-tractor trailer dump trucks, with a loaded weight of 80,000 pounds (48,000-pound payload). The mine will generate approximately 55 round trips per day between the mine and the concentrator/TMF. Shipping of ore via trucks will only occur during daytime hours with a preference to utilize private roads. Concentrate transport trucks going to market will have similar empty and loaded weights to the ore haul trucks. The TMF will generate approximately 11 round trips per day by trucks travelling to and from market on public roads.

## 21.6 SUFFICIENCY OF EXISTING ROADS

### 21.6.1 Private Roads

Existing private gravel roads are currently in good condition and have been well maintained for logging operations conducted on and around the Project Area. Appendix B of **Attachment 21-A** details the results of the field assessment completed by Wood engineers to assess the adequacy of the existing private roads for mine-related vehicles. Engineers determined that with a few routine improvements the roads will function adequately for the Project.

### 21.6.2 Public Roads

Route 11 and SR-158 are the two primary public roads that ore trucks may travel on between the mine and concentrator/TMF, and for concentrate transport. Route 11 is characterized by rolling hills ranging in elevation from approximately 485 to 955 feet MSL. Posted speed limits on Route 11 ranges from 50 MPH to 35 MPH. SR-158 has gradual slope from approximately 542 to 490 from west to east with a posted speed limit of 35 MPH. Each road typically has an approximate 11 feet wide travel lane with 3-foot shoulder in both directions. Some portions of both Route 11 and SR-158 have three lanes. Roads are in good to fair condition and include several bridge crossings; and intersections along state routes have good turning radiuses.

Average Annual Daily Traffic (AADT) presented on the MDOT website ranged from 620-2848 along Route 11 and 3090 AADT for SR-158 in 2021. Eight crashes were reported from 2018-2021 along Route 11 and the short section of SR-158 to access ramps at I-95, according to MDOT Crash Portal. The Level of Service is A (light & free flowing) on all state roads within the route. State roads allow for up to 88,000 lbs for 5 axel configurations of unconsolidated rock material. The increase in ore truck, commuter vehicles, delivery vehicle and concentrate truck trips per day as noted in **Attachment 21-A** is minor compared to current volumes and well within existing capacity of public roads to be utilized for the mine operations.

## 21.7 IMPROVEMENTS TO PRIVATE AND PUBLIC ROADS

### 21.7.1 Private Roads

To support safe travel of additional traffic, road widths will be expanded to meet MDOT Standards along with some additional clearing of up to 10’ on each side of the roadway in areas where visibility is constricted.

In addition, a total of 18 feet (inclusive of the 10' visibility clearing) of clearing will be completed along the access road to accommodate a new overhead power line leading to the mine.

Improvements on existing gravel roads will be conducted to improve year-round use, safe passage of vehicles on a single lane road and public safety as follows.

- Maintenance of spring thaw impacts along the gravel roads will be undertaken by Wolfden. Wolfden will evaluate the scope of maintenance and improvements during the design analysis for the mine under the mining application (mine design and permitting phase).
- During the mine design analysis widening of the gravel roads will be evaluated for safe passage of logging trucks, ore rock trucks, and workers. A maximum width between 22 and 25 feet to the road shoulder should be sufficient for safe passage of large vehicles and recreational traffic (ATVs and snowmobiles in winter).
- During that analysis, consideration will also be given to providing a separate lane for safe passage of recreational vehicular traffic (ATVs and snowmobiles).
- Maintenance of bridge decking at Pickett Pond outlet crossing may include improvement or replacement of the wood decking as dictated by normal wear and tear of truck traffic. The bridge currently handles traffic from logging trucks and consists of a single 16-foot lane. Traffic over the bridge will be managed with traffic controls consisting of traffic lights as well as signage ("Single Lane Bridge Ahead" and "Traffic Signal Ahead") on both approaches to the bridge to allow only single-direction traffic over the bridge at a time. The exit from the bridge on each end of the bridge will transition to a full two-lane width to allow traffic from the bridge to pass safely by vehicles stopped in the opposite lane.
- A cooperative road maintenance agreement will be established between Wolfden and commercial loggers who access their own private property as well the Wolfden property.
- Appropriate signage and if required for traffic management, traffic lighting systems will be utilized throughout the length of the traffic gravel roads.

### 21.7.2 Public Roads

Potential Improvements to state highways may be implemented to improve traffic safety. Wolfden will hire a MDOT approved transportation engineer familiar with the area to consider, evaluate and design improvements, as identified by MDOT, during the mine design and permitting phase. These improvements may include:

- Signage will be added to the approaches to the intersection of Hale Pond Road and Route 11 indicating truck entering and leaving Hale Pond Road (i.e., "Trucks Turning and Entering").
- Overhead lighting will be added at the intersection of Hale Pond Road and Route 11 to provide illumination at the intersection.
- Paving of the entrance to Hale Pond Road for the full width of the entrance and minimum of 50 feet from the intersection.
- Addition of 12-foot deceleration and acceleration lanes at the intersection of Hale Pond Road and Route 11 for trucks to avoid obstruction of traffic during acceleration and deceleration periods. The deceleration and acceleration lanes will be designed in accordance with MDOT standards based on the road grades and speed limits.

- Providing portable Changeable Message Signs for Route 11 and Route 158 to provide traffic information to mine employees, haul trucks, and the public as needed.

## 21.8 CONSULTATION WITH MAINE DEPARTMENT OF TRANSPORTATION

On November 18, 2022, a letter was sent to MDOT, with jurisdiction over public roads likely affected by Project operations, to explain potential increases in traffic resulting from the construction and operation of the Project. In a response letter dated December 14, 2022, MDOT commented that a MDOT Permit would be required for the existing access road due to the additional vehicle trips, roadway improvements would be necessary at the intersection of Hale Pond Road and Route 11 due to the increased traffic volumes, and that the proposed traffic volumes do not suggest significant roadway impacts beyond the Hale Pond Road and Route 11 intersection. **Attachment 21-B** provides the MDOT response letter.

# EXHIBIT 21 FIGURES

Figure 21-1: Transportation Route (Hersey and Patten)

Figure 21-2: Transportation Route (Stacyville)

# EXHIBIT 21ATTACHMENTS

Attachment 21-A: WSP Traffic and Transportation Routes Memorandum

Attachment 21-B: MDOT Correspondence

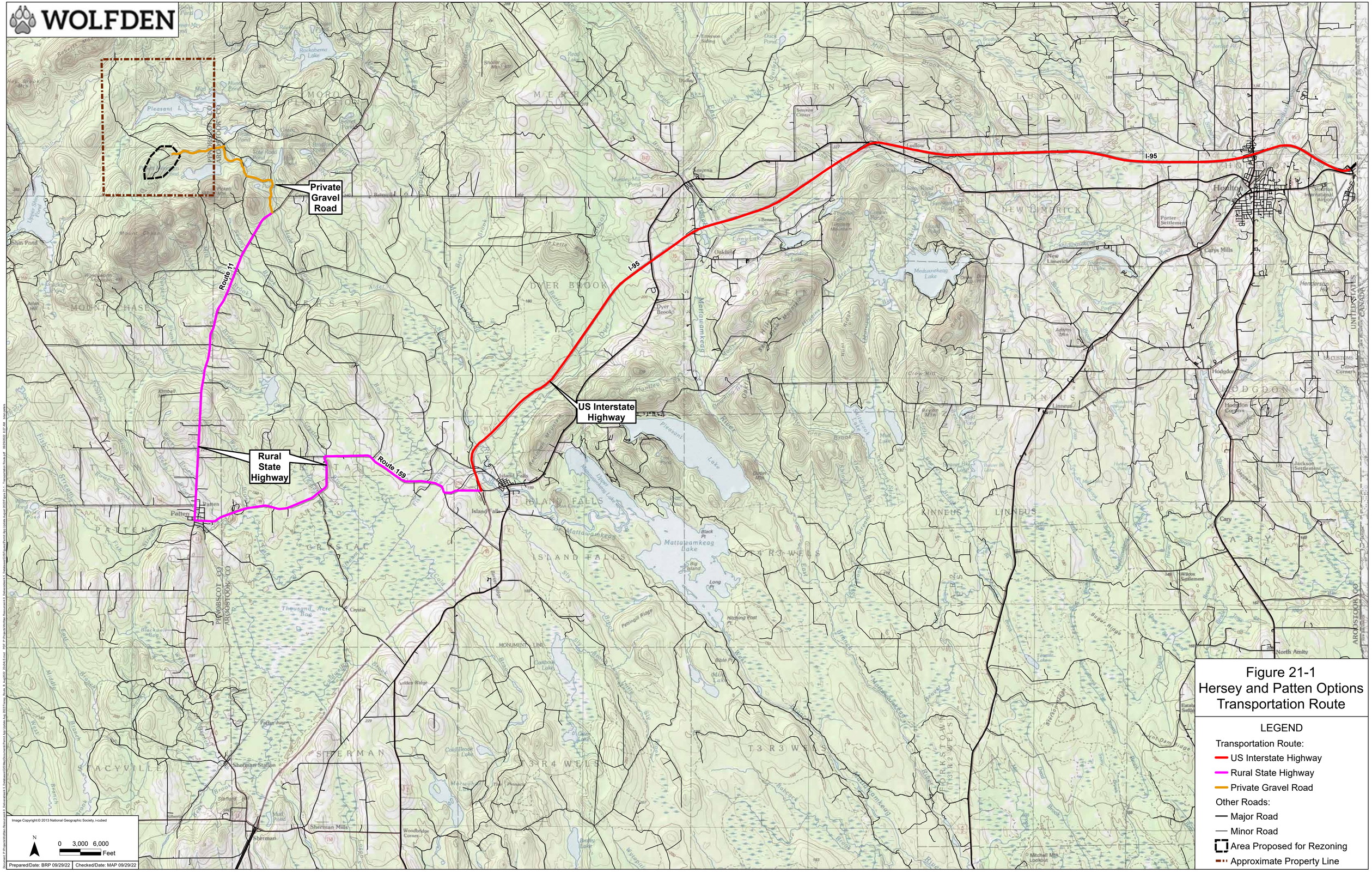


Figure 21-1
Hersey and Patten Options
Transportation Route

LEGEND

Transportation Route:
- US Interstate Highway
- Rural State Highway
- Private Gravel Road

Other Roads:
- Major Road
- Minor Road
- Area Proposed for Rezoning
- Approximate Property Line

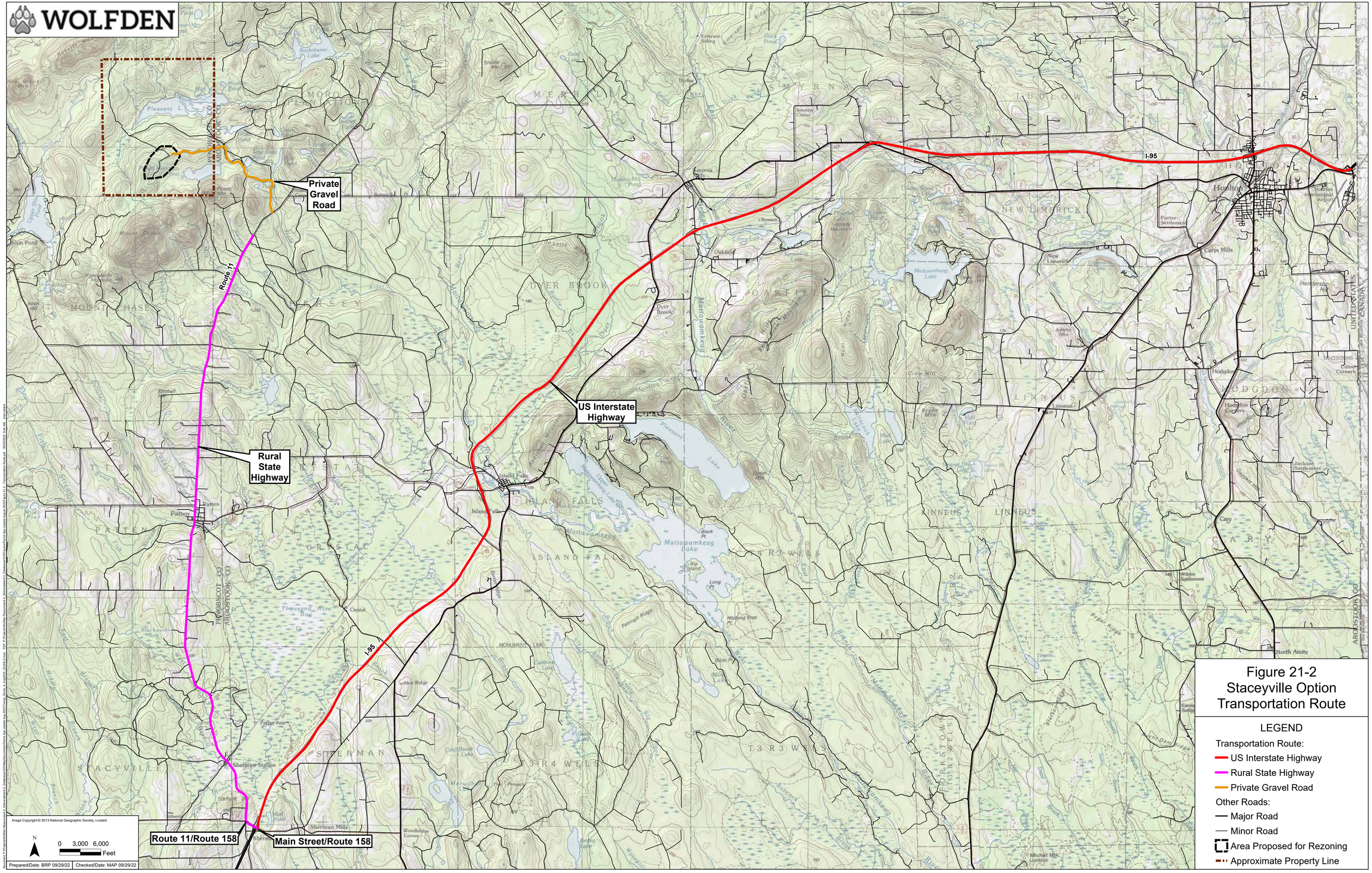


Figure 21-2
Staceyville Option
Transportation Route

LEGEND

Transportation Route:
- US Interstate Highway
- Rural State Highway
- Private Gravel Road

Other Roads:
- Major Road
- Minor Road
- Area Proposed for Rezoning
- Approximate Property Line

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 21-A: WSP Traffic and Transportation Routes Memorandum

**TECHNICAL MEMORANDUM**

**DATE:** October 14, 2022

**TO:** Alex Pries (Stantec)

**FROM:**

Mark Peters, P.E.
Associate Civil Engineer
Maine License No. 6631

**REVIEWED BY:**

Peter Baker
Principal Project Manager

**SUBJECT:** Pickett Mountain Mine Site – Traffic and Transportation Routes

**PROJECT NO.:** 3617227547

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## 1.0 INTRODUCTION

This memorandum has been prepared by WSP USA Earth & Environment (formerly Wood Environment and Infrastructure Solutions) to provide maps and descriptions of existing transportation infrastructure routes, and an analysis of potential impacts and improvements from mine related traffic. Access to the site is through well developed and well-maintained private gravel roads, currently used for logging. These private roads connect to a series of local and State highway routes and eventually the interstate system. These routes will be used for travel of employees to work and for transportation of ore rock for processing and mineral concentrates to market for smelting. The additional traffic volume and capacity of this road system does not burden existing infrastructure and Wolfden will evaluate with local towns and MDOT and implement measures to ensure the continued safe use of all public roads.

## 2.0 DESCRIPTION OF PROPOSED TRANSPORTATION INFRASTRUCTURE ROUTES, IMPACTS AND IMPROVEMENTS

The following transportation evaluation describes the potential proposed routes to be used by trucks carrying ore rock from the proposed Pickett Mountain site to an offsite processing and concentrating

facility and then trucks carrying the mineral concentrate to the US – Canadian border, the level of additional traffic, potential impacts and potential improvements to promote safety. The proposed route is dependent on the final locations where the ore processing will occur as well as where the mineral concentrate will be shipped for further processing (smelting) in Canada. These processing locations have not been finalized and therefore the proposed routes could be subject to change.

## 2.1 TRANSPORTATION NEED

The proposed mining activity has an anticipated mill feed rate of 1,200 tonnes/day (2,645,547 lbs.) that will require shipment for processing and concentrating at an offsite facility. Typical tractor trailer tare weights (empty weight including driver and fuel) vary and range from 26,000 to 37,000 lbs. Using an average of 32,000 lbs. tare weight allows 48,000 lbs. for cargo; requiring approximately 55 ore shipments per day. With anticipated metal recoveries, total concentrate yields will be approximately 192 tonnes/day (423,288 lbs.) of concentrate for shipment for smelting. Using an average of 32,000 lbs. tare weight allows 48,000 lbs. for cargo; requiring approximately 11 concentrate shipments per day.

Roads within the area will also be used for employee travel to and from the mine site as well as all supply vehicles and contractors.

## 2.2 POTENTIAL TRANSPORTATION ROUTE OPTION DESCRIPTIONS

Three potential proposed ore processing locations are being considered, including a location in Hersey (Hersey Option), a location in Patten (Patten Option), and a location in Stacyville (Stacyville Option). The ore processing facility location will be selected at a later date, however the transportation routes for the ore rock and mineral concentrate haul trucks for the three potential locations are discussed below. The proposed truck route consists of gravel roads on private property from the Pickett Mountain site to public roads that include rural town and rural state highways, and a US Interstate Highway (See **Figures 21-1 and 21-2 in Attachment A** for traffic routes for each option).

**Hersey Option:**

From the Mine Site, ore rock trucks will travel on private gravel roads to Maine (ME) State Route 11 (ME SR-11), hence south-southwest to Hersey to an ore processing and concentrator facility. The location of the ore processing facility in Hersey is still to be determined. Trucks carrying mineral concentrate from the process facility will continue to travel south on ME SR-11 to ME SR-159 in Patten. Trucks carrying mineral concentrate will travel east on ME SR-159 to an access ramp to I-95 in Island Falls traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick (see **Attachment A Figure 21-1** for this traffic route). These roads are more specifically described below:

- Approximately 4.4 miles of gravel roads (consisting of an unnamed road, Pleasant Lake Road, Bear Mountain Road, and Hale Pond Road). Elevations from the Pickett Mountain site to Maine (ME) state route (SR)-11 drop from approximately 1205 to 852 feet mean sea level (MSL) from west to east.
    - Existing gravel roads are currently in good condition, and well maintained for logging operations conducted on and around the property. An agreement is in place with land owning neighbors to allow right of way using this set of gravel roads outside of the Wolfden property boundary. Confirmation of the right of way is in the form of a letter within this

report. Confirmation of right to upgrade and maintain is established in the original agreement between both companies registered on April 2, 2020, in book 6000 on page 29.
    - The gravel roads are single lane varying in width from 15 to 25 feet with drainage ditches where elevated. One bridge crossing is present as well as 13 culverts and one bridge culvert.
    - The permanent bridge crossing at Pickett Pond outlet, consists of concrete abutments with two layers of wood decking and steel beams for support. The bridge deck is approximately 16 feet wide with a 22 feet span. The bridge appears to be in good structural condition.
    - Intersection of the gravel road with ME SR-11 has a good turning radius. The gravel road width at the shoulder of ME SR-11 is approximately 55 feet.
    - There is no available traffic data for the gravel roads mostly used for logging traffic in addition to access to a seasonal camp on the south side of Pleasant Pond.
    - The gravel roads are also used for recreational purposes by the public including all-terrain vehicles (ATVs) and snowmobiles.
    - **Attachment B Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary** provides a description of field reconnaissance activities performed for roadway and bridge inspection, along existing unpaved roads connecting the proposed Mine Site to State Route 11 on June 28, 2022.
- Approximately 3.3 miles south-southwest on ME SR-11 to Hersey for ore rock haul trucks to an ore processing facility. Trucks carrying mineral concentrate from the Hersey processing facility would continue to travel south on ME SR-11 approximately 4.8 miles to the intersection with ME SR-159.
    - ME SR-11 is characterized by rolling hills ranging in elevation from approximately 595 to 958 feet MSL. Posted speed limits on these portions of ME SR-11 ranges from 50 MPH to 35 MPH.
    - ME SR-11 typically has an approximate 11 feet wide travel lane with 3-foot shoulder in both directions. Some portions of ME SR-11 have 3 lanes
    - The road is in good to fair condition.
    - AADT presented on Maine DOT website ranged from 620 to 2480 along this portion of ME SR-11 in 2021.
    - The hourly traffic capacity for ME SR-11 is reported by the Maine DOT as 1800 vehicles.
    - Four crashes were reported from 2018-2021 along this portion ME SR-11 according to Maine DOT Crash Portal.
    - The Level of Service is A (light & free flowing) on this road within the transportation route.
- Approximately 9.5 miles east on ME SR-159 to I-95 for haul trucks carrying mineral concentrate from the Patten processing facility.
    - ME SR-159 is characterized by rolling hills ranging in elevation from approximately 464 to 594. The posted speed limit on this portion of ME SR-159 ranges from 25 MPH to 45 MPH.
    - ME SR-159 typically has an approximate 11 feet wide travel lane with 3-foot shoulders in both directions.
    - The road is in good to fair condition.
    - AADT presented on Maine DOT website was 1187 in 2021.
    - The hourly traffic capacity for ME SR-159 is reported by the Maine DOT as 1800 vehicles.
    - Eighteen crashes were reported from 2018-2021 along this section of ME SR-159 according to Maine DOT Crash Portal.
    - The Level of Service is A (light & free flowing) on this road within the transportation route.

- Approximately 29.1 miles of I-95 from ME SR-159 to US-Canada border, with a posted speed of 75 MPH, 10-foot right shoulder both directions.
    - Road is in good condition.
    - AADT data from Maine DOT website ranged from 1580-2470 in 2015 and 2021, and 69 crashes along I-95 (both north and south lanes) for the section from Island Falls to the Canadian border from 2018-2021 according to Maine DOT Crash Portal with most assumed as animal collisions, with a Level of Service of C (stable).
    - On-ramps to be used along proposed route have good turning radiuses.

**Patten Option:**

From the Mine Site, ore rock trucks will travel on private gravel roads to Maine ME SR-11, hence south-southwest to Patten to an ore processing and concentrator facility. The location of the ore processing facility in Patten is still to be determined. Trucks carrying mineral concentrate will travel east on ME SR-159 to an access ramp to I-95 in Island Falls traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick. This route for Patten is essentially the same as the Hersey Option except the ore rock trucks would travel past Hersey to an ore processing facility in Patten (see **Figure 21-1** for this traffic route). These roads are more specifically described below:

- Approximately 4.4 miles of gravel roads – see Hersey Option for details.
- Approximately 8.1 miles south-southwest on ME SR-11 to Patten for ore rock haul trucks to an ore processing facility. See Hersey Option for details.
- Approximately 9.5 miles east on ME SR-159 to I-95 for haul trucks carrying mineral concentrate from the Patten processing facility. See Hersey Option for details.
- Approximately 29.1 miles of I-95 from ME SR-159 to US-Canada border, with a posted speed of 75 MPH, 10-foot right shoulder both directions. See Hersey Option for details.

**Stacyille Option:**

From mine the site, ore rock trucks will travel on private gravel roads to ME SR-11, hence south to Stacyville to an ore processing and concentrator facility. The location of the ore processing facility in Stacyville is still to be determined. Trucks carrying mineral concentrate will travel southeast along ME SR-11 to ME SR-158 or Main Street in Sherman to an access ramp to I-95 traveling northeast to Houlton and the Canadian-US border and proceed to the Canadian National Highway in Woodstock New Brunswick (see **Figures 21-2** for this traffic route). These roads are more specifically described below:

- Approximately 4.4 miles of gravel roads. See Hersey Option for details.
- 17.4 miles of primarily 2-lane (several portions have 3-lanes) rural state highway from the intersection of Hale Pond Road with ME SR-11 to the intersection of ME SR-11 and ME SR-158 and then access to I-95 (including 17 miles along ME SR-11 and 0.37 miles along ME SR-158).
    - ME SR-11 is characterized by rolling hills ranging in elevation from approximately 485 to 955 feet MSL. Posted speed limits on ME SR-11 ranges from 50 MPH to 35 MPH.
    - ME SR-158 has gradual slope from approximately 542 to 490 from west to east with a posted speed limit of 35 MPH.
    - Both roads have an hourly traffic capacity reported by the Maine DOT as 1800 vehicles.
    - Each road typically has an approximate 11 feet wide travel lane with 3-foot shoulder in both directions. Some portions of both ME SR-11 and ME SR-158 have 3 lanes.

- Roads are in good to fair condition and include several bridge crossings.
- AADT presented on Maine DOT website ranged from 620-2848 along ME SR-11 and 3090 AADT for ME SR-158 in 2021. Eight crashes were reported from 2018-2021 along ME SR-11 and the short section of ME SR-158 to access ramps at I-95, according to Maine DOT Crash Portal. The Level of Service is A (light & free flowing) on all state roads within the route.
- Intersections along state routes have good turning radiuses.

- 40.5 miles of I-95 from SR-158 to US-Canada border, with a posted speed of 75 MPH, 10-foot right shoulder both directions.
  - Road is in good condition.
  - AADT data from Maine DOT website ranged from 1580-2470 in 2015 and 2021, and 103 crashes along I-95 (both north and south lanes) for the section from Sherman to the Canadian border from 2018-2021 according to Maine DOT Crash Portal with most assumed as animal collisions, with a Level of Service of C (stable).
  - On-ramps to be used along proposed route have good turning radiuses.

## 2.3 TRAFFIC INCREASES

- Proposed traffic to the Pickett Mountain site includes a peak of 61 onsite employees during the day-shift (46 mine employees plus 15 administrative staff and support personnel) plus visits by up to 9 contractors during the day shift. This results in a maximum of 70 peak trips/hour during shift changes on ME SR-11 for mine workers. It is expected that the majority of workers employed at the mine will be from local work force, many of whom may currently use portions of this route for current employment.
- Assuming a 10-hour day shipment time frame, the average hourly haul truck traffic would be approximately 11 trucks per hour (55 leaving and 55 returning ore rock haul trucks for a total of 110 truck per 10-hour day).
- The total approximate worker and haul truck traffic is 81 peak trips/hour.
- Maine DOT requires a traffic permit to be obtained if traffic to be added to a route is greater than or equal to 100/hour. Proposed traffic increase may require a traffic permit.
- The daily traffic to and from the site (assuming a peak of 61 onsite employees during the day shift, 45 onsite employees during the night shift, 18 daily contractors [9 each during day and night shifts, 3 daily visitors, and 55 shipments of ore rock per day) results in 364 additional trips/day on ME SR-11 (an average of 15 vehicles/hour). The rural state highways have an hourly capacity of 1,800 vehicles, and its use is currently well under that capacity.
- Shipping of ore rock and mineral concentrate via haul trucks will only occur during daytime hours.

Table 1 provides a summary of the site traffic due to the mine operations.

**Table 1 – Summary of Site Traffic**

| Category | Position | Vehicle Type | Total Vehicles | Total trips/24-hour period | Trips/ Peak Hr |
|---|---|---|---|---|---|
| On site employees | Admin/support (day) | Light | 15 | 30 | 15 |
| Contractors | Contractors (day) | Light | 9 | 18 | 9 |
| Contractors | Contractors (night) | Light | 9 | 18 | 0 * |
| On site employees | Day shift mine | Light | 46 | 92 | 46 |
| On site employees | Night shift mine | Light | 45 | 90 | 0* |
| Visitors | Visitors (day) | Light | 3 | 6 | 3 |
| | | **Total Onsite** | **127** | **254** | **73** |
| Ore Rock | Ore Rock Haul (day) | 80,000 lbs max | 55 | 110 | 11 |
| | | **Grand Total** | **182** | **364** | **84** |

*Note: The day shift and the night shift are offset by 1 hour and not part of the same hourly trips

## 2.4 IMPACTS

The potential proposed route for hauling ore rock and concentrate consists of private gravel roads and rural state and federal highways. The weight limit will be restricted by the Federal Interstate which allows a maximum of 80,000 pounds (lbs.) for both five and six axel tractor trailer configurations. State roads allow up to 88,000 lbs. for 5 axle configurations for certain commodities including unconsolidated rock material. Planned weight load will be 80,000 lbs. The private gravel roads are constructed for logging trucks with the similar weight constraints.

As identified previously, on average 55 truck shipments of ore rock will occur daily. This small level of increased traffic will not burden or impact proposed traffic routes.

The additional volume of traffic may require a traffic permit but will not represent a burden or impact on the existing traffic capacity of the proposed route.

An easement has been agreed to between Wolfden and Herbert C. Haynes and Lakeville Shores, Inc., which is confirmed by letter in **Attachment C Road Access and Easement to Route 11 in Hersey, Maine.**

# 3.0 ANTICIPATED ROAD IMPROVEMENTS

During the detailed mine design and permitting phase, improvements to gravel roads and rural state highways will be conducted for traffic safety. Wolfden will hire an MEDOT approved transportation engineer familiar with the area to consider, evaluate and design improvements, as needed. These potential improvements are described in the following sections.

## 3.1 UNIMPROVED GRAVEL ROADS

The gravel road width currently ranges between 15-25 feet. Based on Maine DOT "Lane Width and Shoulder Width – C1" dated November 10/2010, a minimum road with of a highway corridor priority (HCP) 6 roadway, with a speed limit of less than 40 mph, is 10 – 12 feet with a 1-3 feet shoulder per lane or a total minimum

of 22-26 feet with a 1-foot shoulder. To support safe travel of additional traffic, road widths will be expanded to meet MDOT Standards along with some additional clearing of up to 10' on each side of the roadway in areas where visibility is constricted. A total of 18 feet (inclusive of the 10' visibility clearing) of clearing will be completed along the one side of the access road to accommodate the overhead power line.

Improvements on existing gravel roads will be conducted to improve year-round use, safe passage of vehicles on a single lane road and public safety. **Attachment B Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary** provides a description of field reconnaissance activities as well as recommended roadway and bridge improvements or repairs. In addition, the following activities will be evaluated during the mine design analysis:

- Maintenance of spring thaw impacts along the gravel roads will be undertaken by Wolfden. Wolfden will evaluate the scope of maintenance and improvements during the design analysis for the mine under the mining application (mine design and permitting phase).
- During the mine design analysis widening of the gravel roads will be evaluated for safe passage of logging trucks, ore rock trucks, and workers. A maximum width between 22 and 26 feet to the road shoulder should be sufficient for safe passage of large vehicles and recreational traffic (ATVs and snowmobiles in winter).
- During that analysis, consideration will also be given to providing a separate lane for safe passage of recreational vehicular traffic (ATVs and snowmobiles).
- Repair or replace road culverts.
- Maintenance of bridge as recommended in **Attachment B Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary** The bridge currently handles traffic from logging trucks and consists of a single 16-foot lane. Traffic over the bridge will be managed with traffic controls consisting of traffic lights as well as signage ("Single Lane Bridge Ahead" and "Traffic Signal Ahead") on both approaches to the bridge to allow only single-direction traffic over the bridge at a time. The exit from the bridge on each end of the bridge will transition to a full two-lane width to allow traffic from the bridge to pass safely by vehicles stopped in the opposite lane.
- A cooperative road maintenance agreement, in general, will be established between Wolfden and commercial loggers who access their own private property as well the Wolfden property.
- Appropriate signage and if required for traffic management, traffic lighting systems will be utilized throughout the length of the traffic gravel roads.

## 3.2 RURAL STATE HIGHWAYS

Potential Improvements to rural state highways will be for traffic safety and will be based on the MEDOT approved transportation engineer recommendations developed in conjunction with the towns and MEDOT permitting approvals during detailed design for the mine. These improvements may include:

- Signage will be added to the approaches to the intersection of Hale Pond Road and ME SR-11 indicating truck entering and leaving Hale Pond Road (i.e., "Trucks Turning and Entering").
- Overhead lighting will be added at the intersection of Hale Pond Road and ME SR-11 to provide illumination at the intersection.
- Paving of the entrance to Hale Pond Road for the full width of the entrance and minimum of 50 feet from the intersection.

- Addition of 12-foot deceleration and acceleration lanes at the intersection of Hale Pond Road and ME SR-11 for trucks to avoid obstruction of traffic during acceleration and deceleration periods. The deceleration and acceleration lanes will be designed in accordance with MEDOT standards based on the road grades and speed limits.
- Providing portable Changeable Message Signs for ME SR 11 or other roads depending on the selected ore processing facility location to provide traffic information to mine employees, haul trucks, and the public as needed.

## 3.0 SUMMARY

The proposed traffic routes shown on **Figures 21-1 and Figure 21-2** in **Attachment A**, with the additional traffic levels from the mine operation do not constitute a major impact on the existing road infrastructure. Wolfden will work with stakeholders (LUPC, the public, commercial loggers, towns, and MEDOT) to accommodate modifications to ensure public safety and recreational access along the proposed private and state highway routes.

# ATTACHMENT A

## Figures

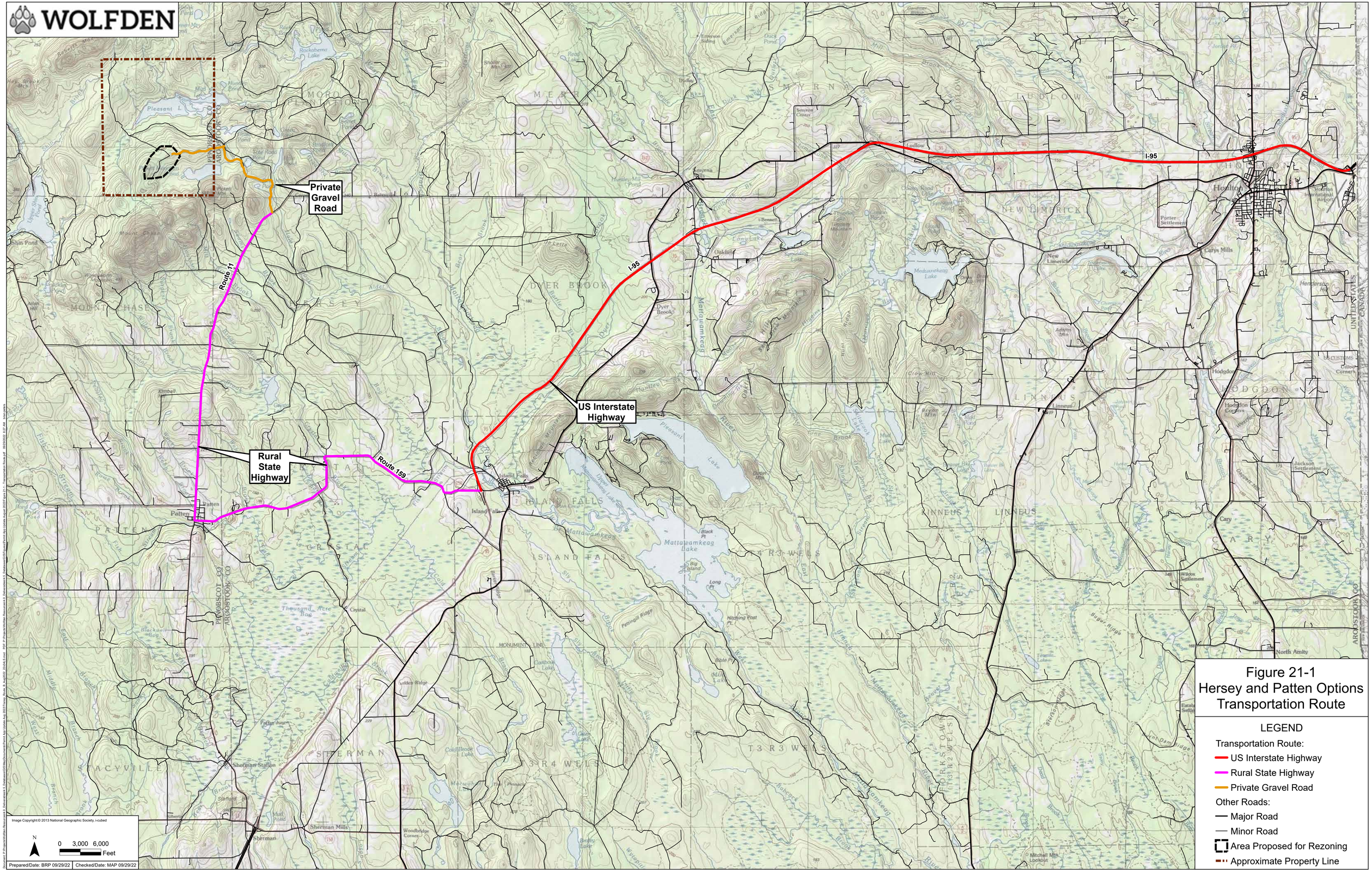


Figure 21-1
Hersey and Patten Options
Transportation Route

LEGEND

Transportation Route:
- US Interstate Highway
- Rural State Highway
- Private Gravel Road

Other Roads:
- Major Road
- Minor Road
- Area Proposed for Rezoning
- Approximate Property Line

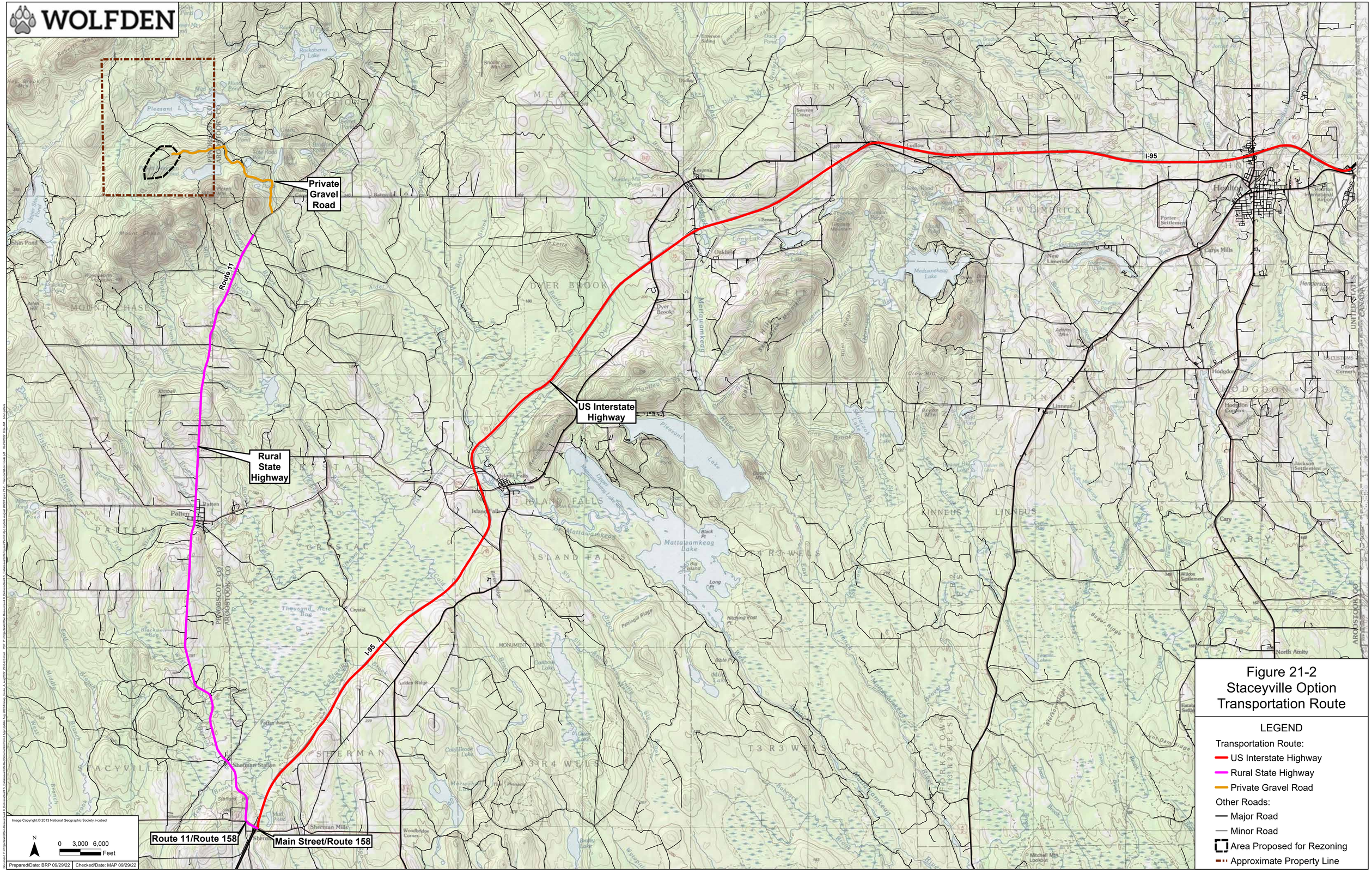


Figure 21-2
Staceyville Option
Transportation Route

LEGEND

Transportation Route:
- US Interstate Highway
- Rural State Highway
- Private Gravel Road

Other Roads:
- Major Road
- Minor Road
- Area Proposed for Rezoning
- Approximate Property Line

# ATTACHMENT B

## Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary

# TECHNICAL MEMORANDUM

**DATE:** September 14, 2022

**TO:** Alex Pries (Stantec)

**FROM:**

Nicholas Langlais, P.E. 9/14/22
Senior Geotechnical Engineer
Maine License No. 13759

Jeffrey Walker, P.E. 9/14/22
Senior Associate Structural Engineer
Maine License No. 11028

**REVIEWED BY:**

Mark Peters, P.E. 9/14/22
Associate Civil Engineer
Maine License No. 6631

**SUBJECT:** Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary

**PROJECT NO.:** 3617227547

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## 1.0 INTRODUCTION

Wood Environment and Infrastructure Solutions, Inc. (Wood) has prepared this memorandum for Stantec Inc. (Stantec) and Wolfden Mt. Chase LLC (Wolfden) to summarize field reconnaissance activities and provide preliminary recommendations to support the rezoning petition at the proposed Wolfden Pickett Mountain Mine Site (Mine Site) in Penobscot County, Maine (**Figure 1**).

Wood engineers performed field reconnaissance activities, including roadway and bridge inspection, along existing unpaved roads connecting the proposed Mine Site to State Route 11 on June 28, 2022. It is our understanding that the existing unpaved roads (consisting of Bear Mountain Pond Road, Hale Pond Road, Pleasant Lake Road, and potentially other unnamed roads) will be used year-round to access the Mine Site and are currently on private property and used for logging.

The following traffic estimates were provided by the Pickett socioeconomics report, "Economic Assessment of the Proposed Pickett Mine Project" (Stepwise Data Research. July 2022).

- Concentrate or Ore Trucks:

- 48,000-pound payload and 32,000-pound truck weight = 80,000 pounds total (at 80,000 pounds this would be a semi-tractor trailer dump truck for legal highway travel without a permit).
- Special loads transporting large equipment will be on a special request basis so timing and logistics can be managed.

- Truck Traffic:
  - 55 truckloads per day at 80,000 pounds per truck (truck plus payload)
  - 55 return trucks per day at 32,000 pounds per truck (empty truck)
  - Total of 110 trucks per day (daytime only)
- Employee traffic:
  - Light vehicles
  - Mine only operations will have 106 employees per day which includes 91 mine employees (46 day-shift and 45 night-shift) plus 15 day-shift administrative staff and mining support personnel
  - 236 trips per day (daily round trips by 106 mine employees plus 9 contractors and 3 visitors per day)
- Deliveries:
  - Materials and consumables
  - Variable number, and components can be engineered to meet road capacity
  - Maximum ten deliveries per day; typically two to five deliveries per day
  - During construction, deliveries for construction materials will be required. It is expected the construction traffic would be no more than the traffic during mine operations but more variable based on schedule and phase of construction.

A preliminary structural analysis of the bridge located at mile 2.05 has been conducted (see Section 3.0 and **Attachment 3**). To complete the bridge analysis and rating, including the bridge foundation, the following additional information will be required:

1. Actual truck axle spacing
2. Actual truck wheel spacing, width, and tire pressure
3. Detailed foundation information including geotechnical data

The following sections provide a summary of the conditions encountered during the field reconnaissance and preliminary recommendations regarding potential improvements to the roadway and bridge.

## 2.0 ROADWAY

Wood inspected approximately 4.4 miles of the existing unpaved roads between the proposed Mine Site and State Route 11 during the field reconnaissance activities. An aerial showing the extent of the roadway inspected is provided in **Attachment 1**. Wood began the inspection at the end of the proposed access road (Mine Site), designated as Mile 0.0; State Route 11 was designated as Mile 4.4. Wood stopped at approximately 0.1-mile intervals along the existing unpaved roads to take photos, measure roadway width, and document observed features, including steep banks, bedrock outcrops, turnouts, intersections, clearings, wet areas and/or

drainage ditches/gullies, flowing water, culverts, etc. In addition, Wood stopped between the 0.1-mile intervals as necessary to document these features if present. Photos and descriptions/observations at each location are provided in the photo log in **Attachment 1**.

The following general observations were made based on the results of the inspection:

- The existing unpaved roadway is generally in good condition with very little rutting, consisting of sandy gravel or gravelly sand with cobbles. Several bedrock outcrops were also observed within the limits of the roadway.
- The roadway buildup appears to vary but is estimated to be on the order of approximately 6 to 12 inches minimum, based on one hand-auger exploration and visual observations. Hand-augering proved to be difficult due to the density of the buildup and frequent cobble-sized particles within the buildup.
- The roadway width generally varies between approximately 15 and 25 feet, with increases in width at intersections.
- Wood identified one bridge, 13 culverts, and one culvert bridge (locations and descriptions provided in **Attachment 1**):
    - 12 corrugated steel culverts, 12 to 30-inch diameter. Generally minimal cover (approximately 0 to 3 inches) over the pipes. Ends of the culverts were frequently damaged/crushed.
    - 1 corrugated plastic culvert at the Route 11 intersection, 26 inches in diameter with damaged/broken ends.
    - 2 of the culverts were associated with small stream flows. The remaining 10 culverts were dry and appeared associated with stormwater flow only, however 3 to 4 culverts may have wetlands located at the ends of the pipes.
    - 1 corrugated steel bridge culvert (mile 3.85 in **Attachment 1**), approximately 6 feet high and 17 feet wide spanning a stream. Bowing is noticeable at the top of the culvert, indicating the culvert may have experienced some spreading at the base causing some separation and disconnection from the headwall.
    - Replacing culverts with wetlands or a stream channel will require state and federal permitting.

Observations of the road indicate that no seasonal limitations are anticipated. With the recommended improvements implemented (listed below) and periodic fine grading maintenance of the road conducted, the road will function adequately for the project.

The following preliminary recommendations for roadway improvements are provided considering potential future use as an access road to the Mine Site:

- Widen portions of the road as necessary to meet Maine Department of Transportation (MDOT) requirements and to allow for safe passage of vehicles. Based on MDOT "Lane Width and Shoulder Width – C1" dated November 10, 2010, a minimum road width for a highway corridor priority (HCP) 6 roadway (local road/lowest priority), with a speed limit of less than 40 mph, is 10 – 12 feet with a 1-3 feet shoulder per lane or a total minimum width of 22-26 feet with a 1-foot shoulder. As stated previously, the existing roadway width generally varies between approximately 15 and 25 feet.

- Add turnouts as necessary to allow for safe passage of vehicles.
- Evaluate each culvert in more detail for damage and flow capacity issues. Eventually replace culverts identified with function issues and install with appropriate cover considering anticipated traffic loading. Culverts would be replaced with appropriate engineering designs and in accordance with Maine Department of Environmental Protection (MDEP) regulations.
- Monitor culverts during mine operations and provide maintenance and/or replacement as needed.
- The culvert bridge appears stable, but a more detailed evaluation of bridge culvert should be performed to determine if repair is possible or if complete replacement is required.
- Clearing vegetation adjacent to the road to improve sight lines where visibility is limited.

## 3.0 BRIDGE

There is one relatively short bridge located at mile 2.05. The bridge is 16-feet wide by 22-feet long. The abutments are at a slight skew (+/- 6.5-deg) to the longitudinal axis of the bridge. The construction is typical for logging roads. consisting of 4-inch by 8-inch wood plank wearing boards supported by 4-inch by 8-inch timber stringers at approximately 14 inches on center, with six W12x65 steel beams. Edge protection consists of 10-inch by 10-inch timber curbs bolted through the stringers to the edge steel beams. The foundation and wing walls consist of 2-foot by 2-foot by 6-foot dry stacked precast concrete blocks. At the abutments, only one layer of precast blocks was visible. Total depth of the abutments could not be determined. There were no obvious signs of scour at either abutment. Photos of the bridge are provided in **Attachment 2**.

Overall, the bridge appears in good condition with limited components in fair to poor condition. There are no outward signs of structural damage or concern for the concrete abutments and wing walls. While the steel beams are not painted, there is only surface rust with no obvious pitting or other corrosion issues and are otherwise in good condition. There were no observed checks or other damage to the timber stringers. The timber boards of the wearing surface are showing signs of wear but are not worse than what should be anticipated for surfaces in contact with vehicles.

With the recommended improvements implemented (listed below) the bridge should function adequately for the project but additional investigation and detailed analysis will be required.

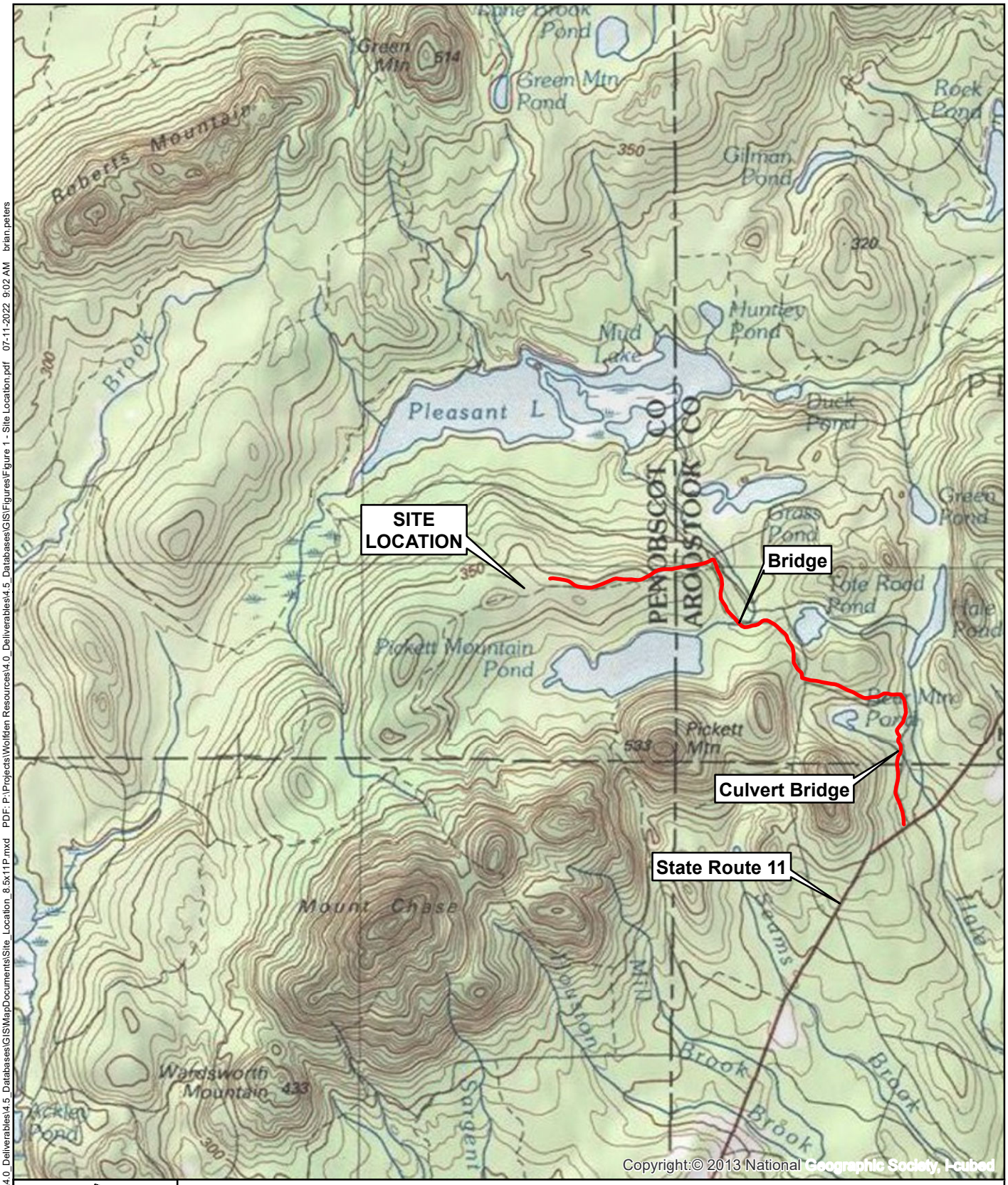
The following list summarizes the items of potential concern based on the visual inspections:

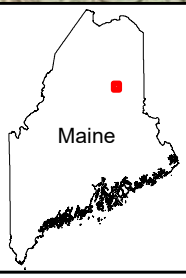
1. There are obvious signs of decay and fungal growth on the timber curbs. The curbing should be replaced in kind, along with the steel connection hardware by a qualified contractor.
2. There are obvious signs of decay and fungal growth on the wood bearing plate between the steel beams and the concrete abutments, and on the wood bulkhead behind the ends of the steel beam which retains the road material and the ends of the bridge. These items should be replaced with material other than wood, which is susceptible to decay when in contact with the earth.
3. There is no positive mechanical connection between the timber stringers and the steel beams, and between the steel beams and the abutments. While the low travel speeds on this road likely do not create larger lateral or longitudinal loads, in the current configuration friction is the only method of resistance. Bolts between the members should be added to resist these loads.

Sufficient data was collected to complete a preliminary structural analysis and load rating of the bridge frame superstructure but not the bridge foundation. A preliminary structural analysis for the bridge structural framing using an 80,000-pound semi-tractor trailer dump truck was conducted to evaluate if the bridge has any potential load limitations. The results of the preliminary structural analysis indicate the bridge superstructure should be capable of supporting the semi-tractor trailer dump truck. The preliminary calculations are provided in **Attachment 3**. To provide a complete analysis of the foundation, further foundation and geotechnical

investigation will be necessary to determine the subsurface soil conditions and the size and extent of the foundation/footings.

# FIGURES




wood.

N

0 2,500 5,000 Feet

Prepared/Date: BRP 07-08-22 | Checked/Date: NDL 07-08-22

Figure 1
Site Location

Wolfden Mt. Chase LLC
Pickett Mountain Mine Site

Document: P:\Projects\Wolfden Resources\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\Site_Location_8.5x11P.mxd PDF: P:\Projects\Wolfden Resources\4.0_Deliverables\4.5_Databases\GIS\Figures\Figure 1 - Site Location.pdf 07-11-2022 9:02 AM brian.peters

# ATTACHMENT 1

## Roadway Photo Log

## Photographic Log

| | |
|---|---|
| **Project:** | Wolfden Mt. Chase LLC |
| **Project No.:** | 3617227547 |
| **Address:** | Pickett Mountain |
| **Date:** | 6/28/2022 |
| **Field Technician:** | Nick Langlais, P.E. |

wood.

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 32 feet
Mile 0.0

Photo 2: Looking Backward
Mile 0.0

Photo 3: Looking Left
Mile 0.0

Photo 4: Looking Left; Bedrock outcrop
Mile 0.0

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 20 feet
Mile 0.1

Photo 2: Looking Backward
Mile 0.1

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 21 feet
Mile 0.2

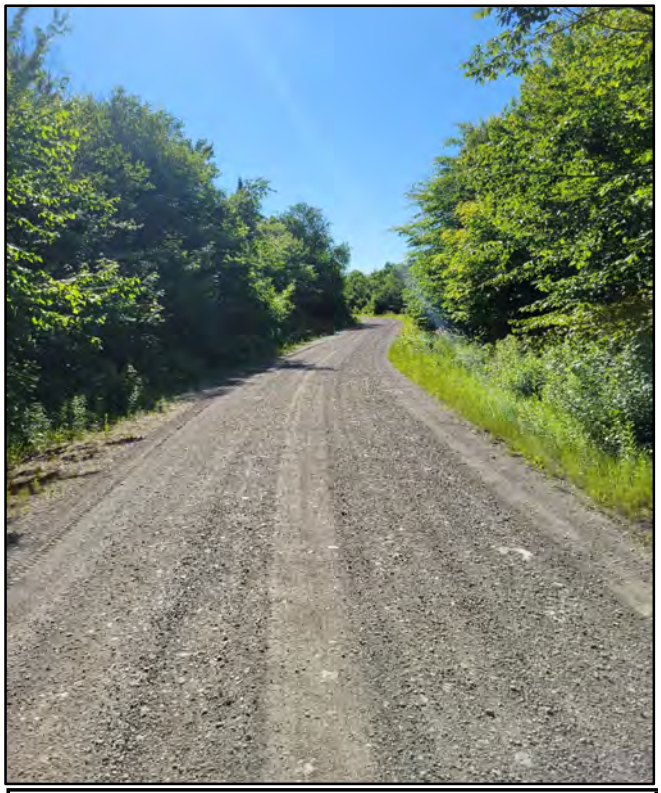


Photo 2: Looking Backward
Mile 0.2

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 27 feet
Mile 0.3

Photo 2: Looking Backward
Mile 0.3

Photo 3: Looking Right; Turnout width approximately 60 feet
Mile 0.3

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

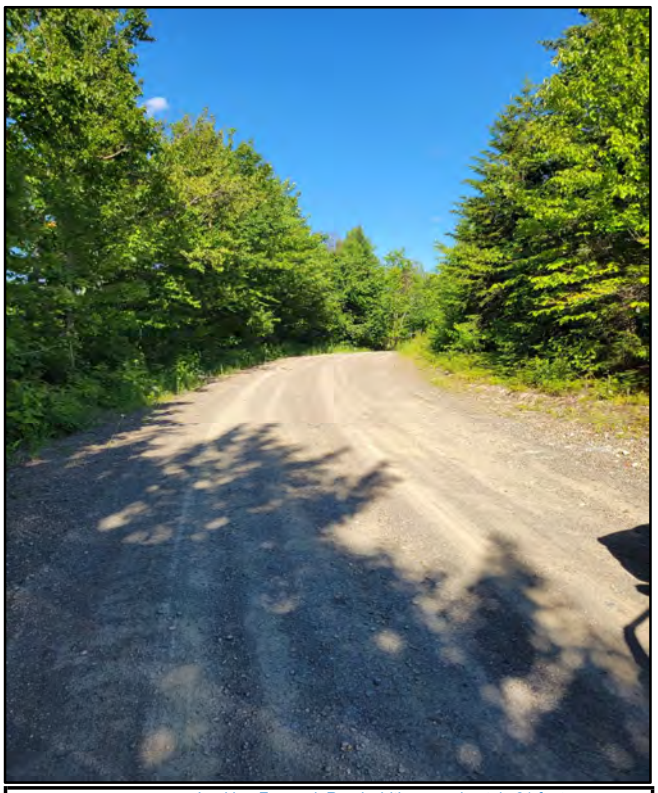


Photo 1: Looking Forward; Road width approximately 21 feet
Mile 0.4

Photo 2: Looking Backward
Mile 0.4

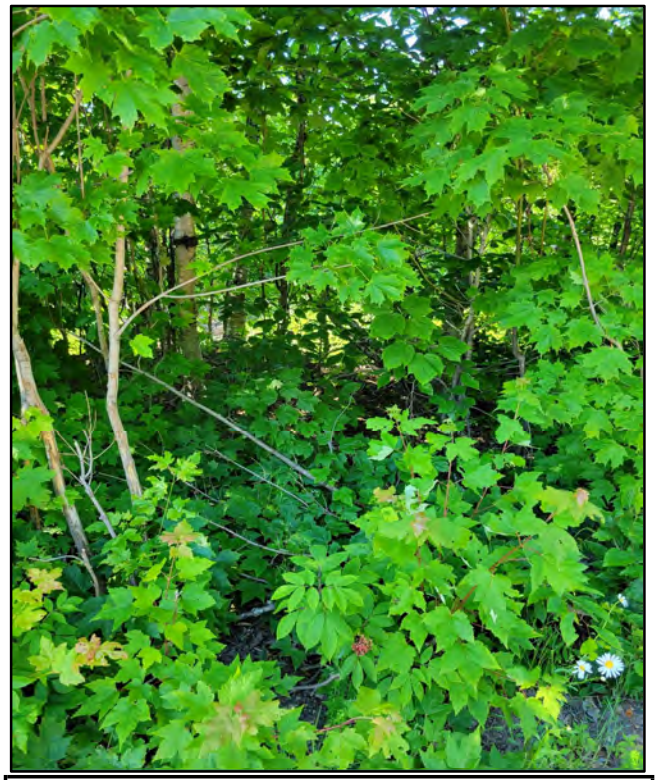


Photo 3: Looking Left; Steep bank slope downward
Mile 0.4

Photo 4: Looking Right; Bedrock outcrop
Mile 0.4

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 23 feet
Mile 0.5

Photo 2: Looking Backward
Mile 0.5

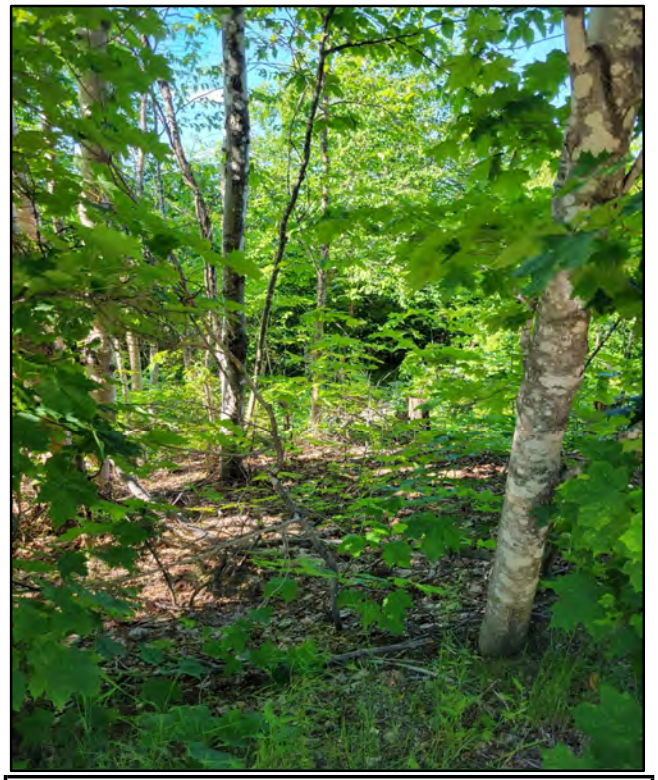


Photo 3: Looking Left; Steep bank slope downward
Mile 0.5

Photo 4: Looking Right; Bedrock outcrop
Mile 0.5

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 24 feet
Mile 0.6

Photo 2: Looking Backward
Mile 0.6

Photo 3: Looking Right; Steep slope off edge of roadway
Mile 0.6

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Left; Clearing
Mile 0.7

Photo 2: Looking Right; Clearing
Mile 0.7

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 20 feet
Mile 0.8

Photo 2: Looking Backward
Mile 0.8

Photo 3: Looking Left; Clearing
Mile 0.8

Photo 4: Looking Right; Clearing
Mile 0.8

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 24 feet
Mile 0.9

Photo 2: Looking Backward
Mile 0.9

Photo 3: Looking Left; Clearing
Mile 0.9

Photo 4: Looking Right; Turnout approximately 50 feet wide
Mile 0.9

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

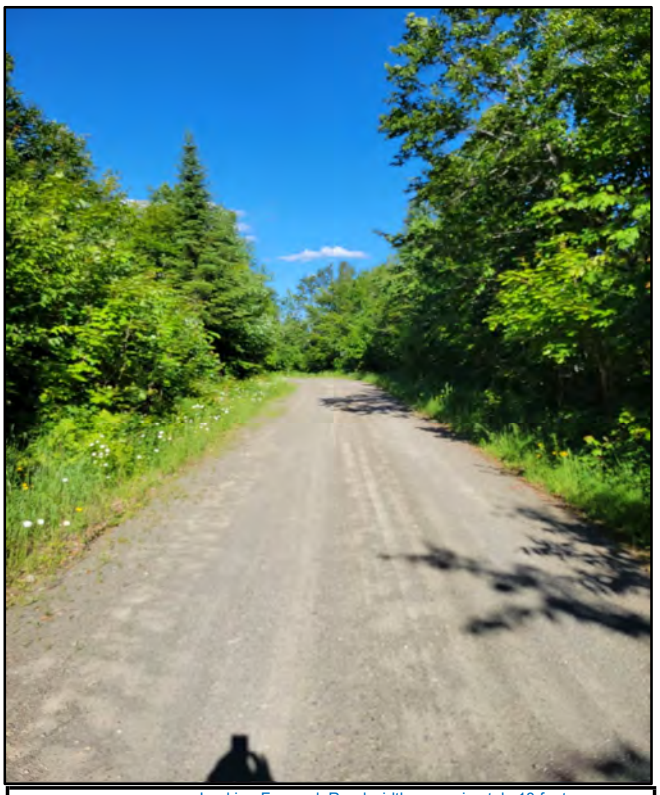


Photo 1: Looking Forward; Road width approximately 18 feet
Mile 1.0

Photo 2: Looking Backward
Mile 1.0

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 15 feet
Mile 1.1

Photo 2: Looking Backward
Mile 1.1

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 17 feet
Mile 1.2

Photo 2: Looking Backward
Mile 1.2

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 27 feet
Mile 1.3

Photo 2: Looking Backward
Mile 1.3

Photo 3: Looking Right; Clearing
Mile 1.3

Photo 4: Looking Right; Clearing
Mile 1.3

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 26 feet
Mile 1.4

Photo 2: Looking Backward
Mile 1.4

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 23 feet
Mile 1.5

Photo 2: Looking Backward
Mile 1.5

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

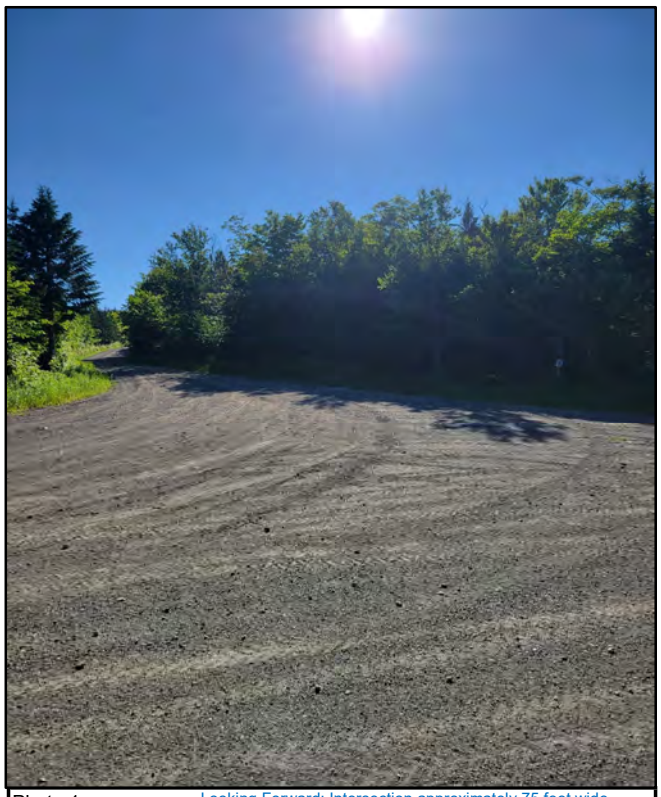


Photo 1: Looking Forward; Intersection approximately 75 feet wide
Mile 1.55

Photo 2: Looking Backward; Intersection
Mile 1.55

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 21 feet
Mile 1.6

Photo 2: Looking Backward
Mile 1.6

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 19 feet
Mile 1.7

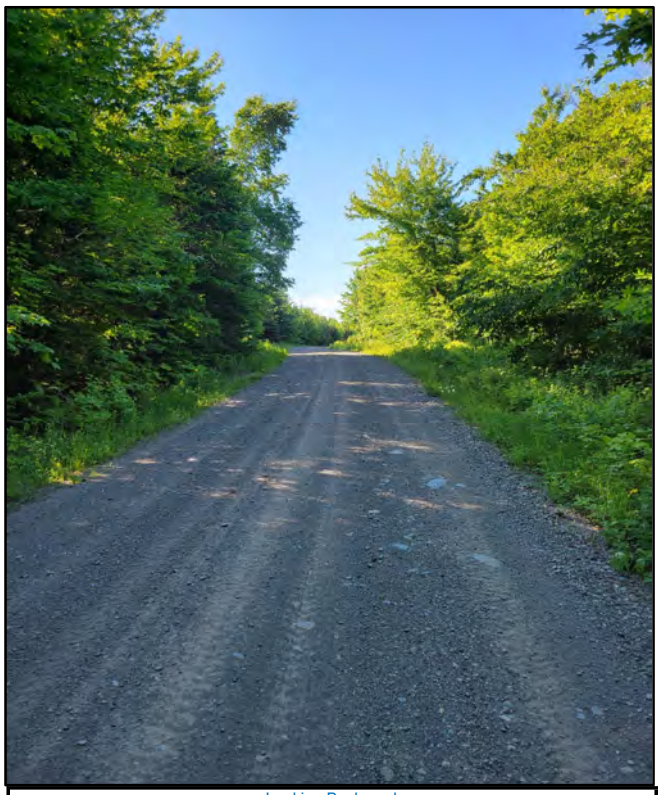


Photo 2: Looking Backward
Mile 1.7

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 19 feet
Mile 1.8

Photo 2: Looking Backward
Mile 1.8

Photo 3: Looking Right; Clearing
Mile 1.8

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 19 feet
Mile 1.9

Photo 2: Looking Backward
Mile 1.9

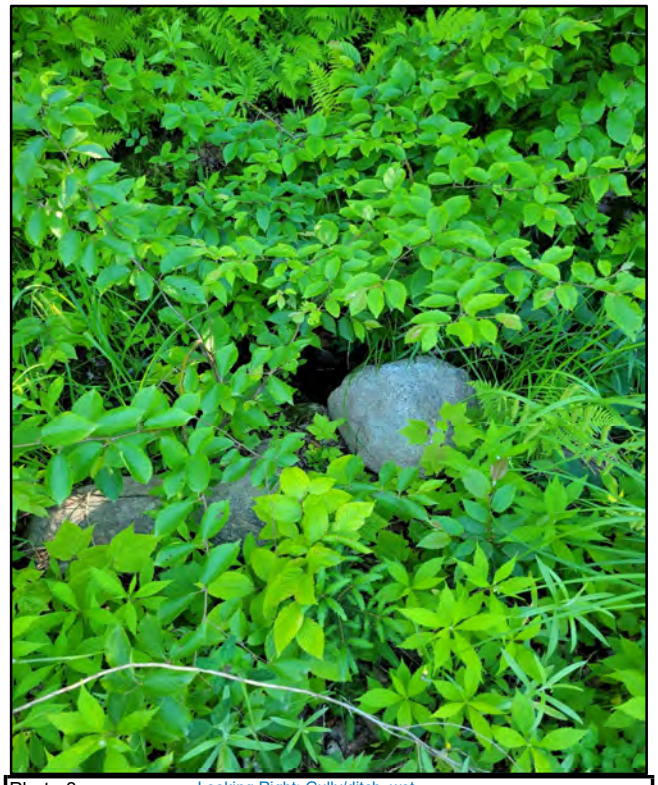


Photo 3: Looking Right; Gully/ditch, wet
Mile 1.9

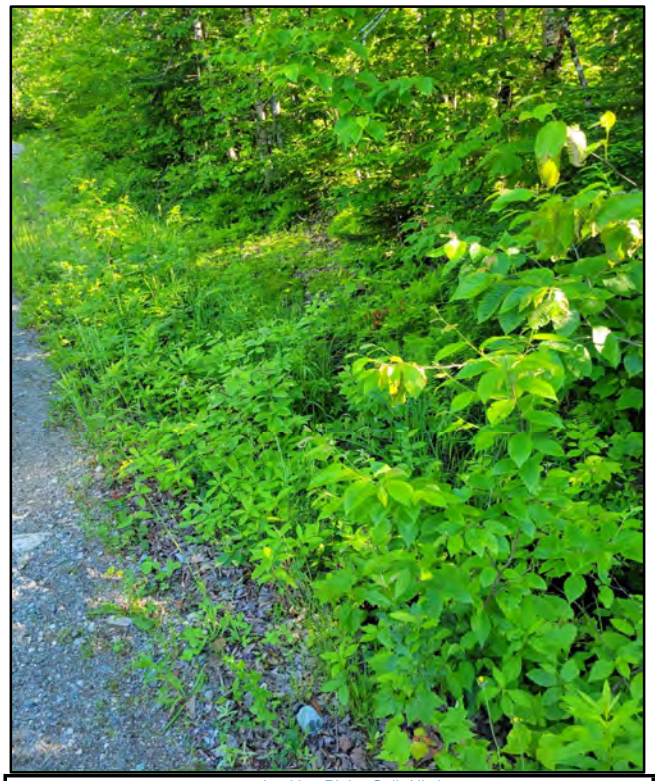


Photo 4: Looking Right; Gully/ditch, wet
Mile 1.9

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

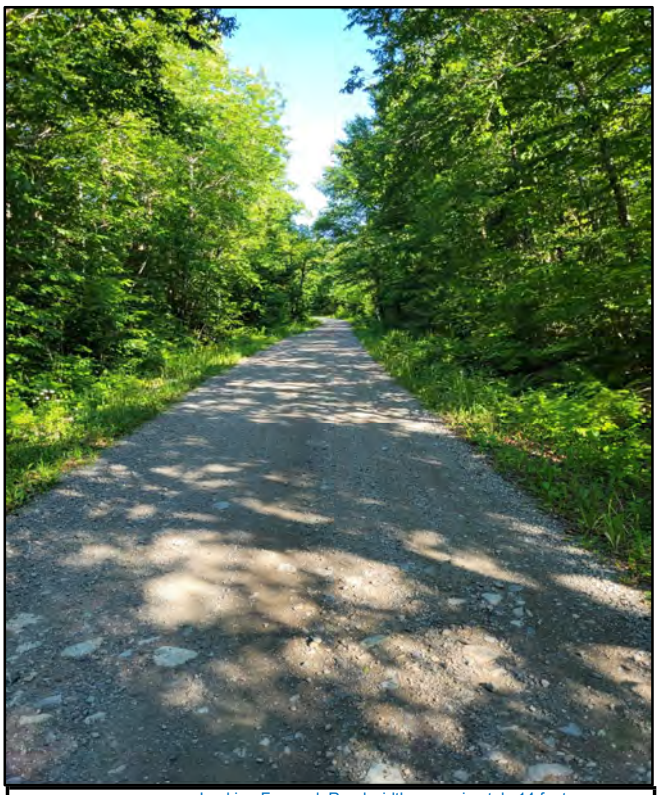


Photo 1: Looking Forward; Road width approximately 14 feet
Mile 2.0

Photo 2: Looking Backward
Mile 2.0

Photo 3: Looking Right; Gully/ditch, wet
Mile 2.0

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Bridge
Mile 2.05

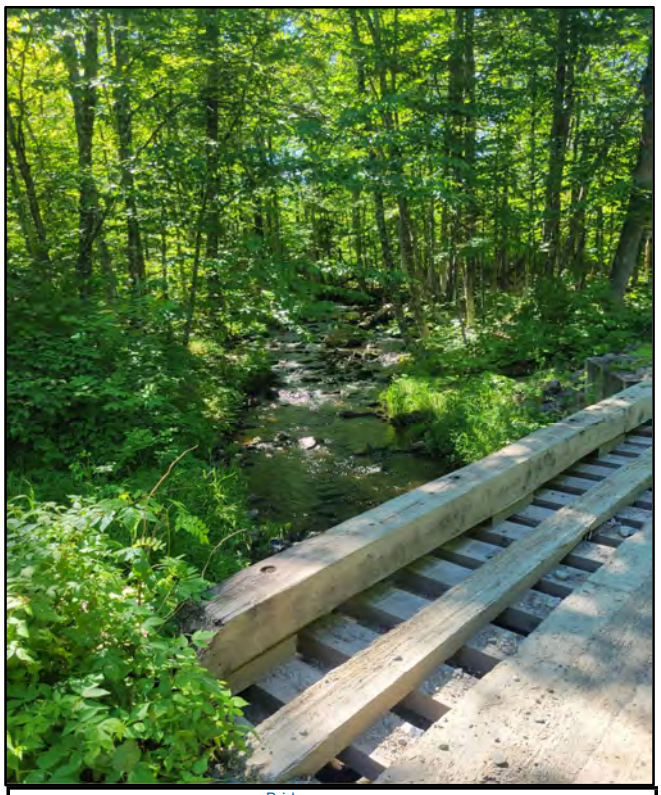


Photo 2: Bridge
Mile 2.05

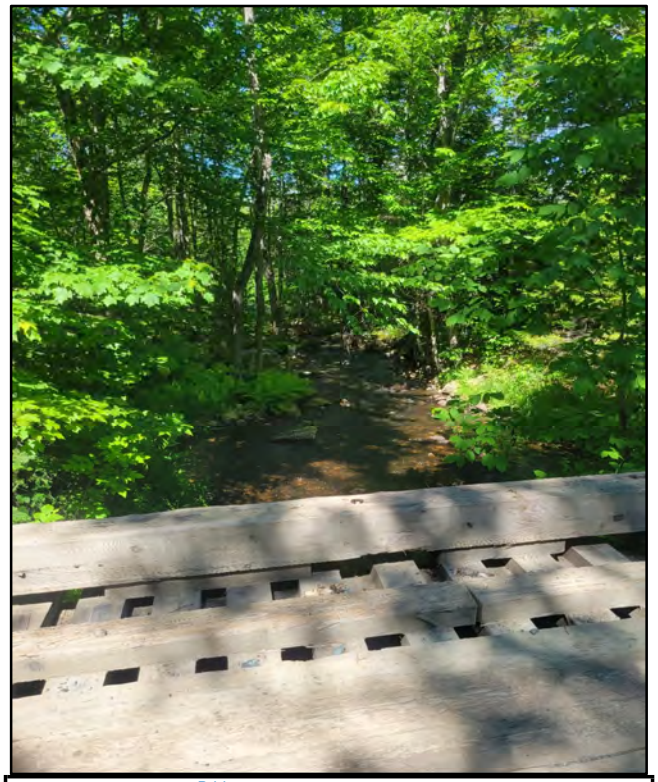


Photo 3: Bridge
Mile 2.05

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

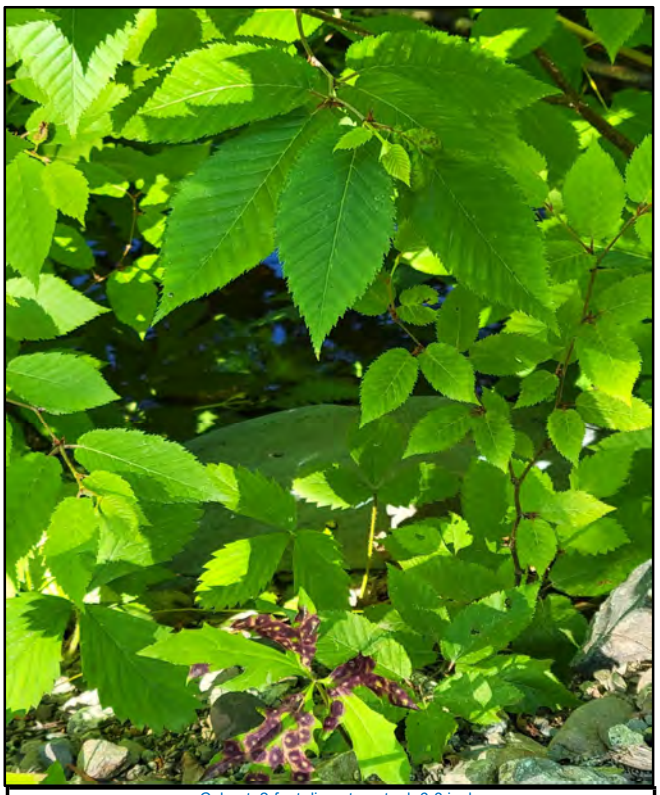


Photo 1: Culvert; 2-foot diameter, steel; 6-8 inches cover
Mile 2.08

Photo 2: Culvert; 2-foot diameter, steel; 6-8 inches cover
Mile 2.08

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 18 feet
Mile 2.1

Photo 2: Looking Backward
Mile 2.1

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 16 inch diameter, steel, crushed
Mile 2.15

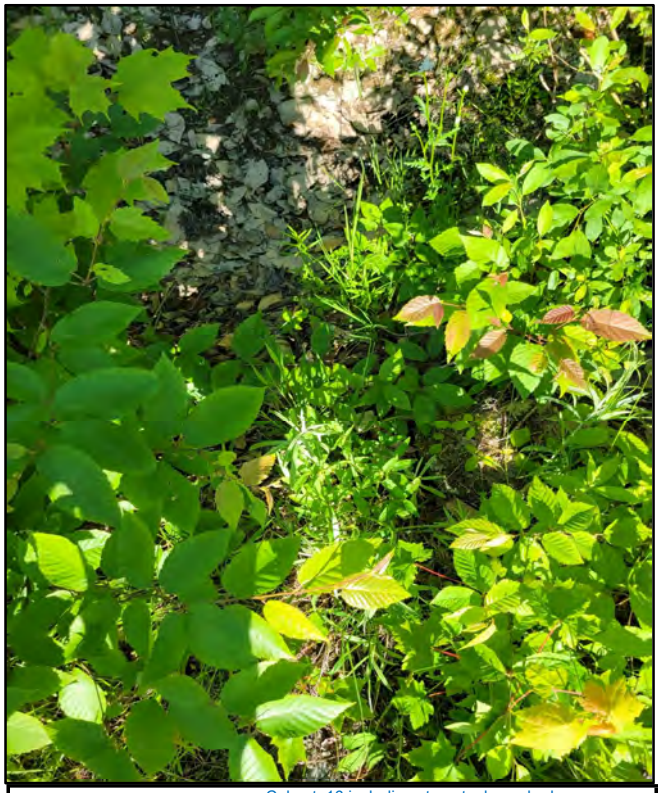


Photo 2: Culvert; 16 inch diameter, steel, crushed
Mile 2.15

Photo 3: Turnout
Mile 2.15

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 19 feet
Mile 2.2

Photo 2: Looking Backward
Mile 2.2

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward
Mile 2.3

Photo 2: Looking Backward
Mile 2.3

Photo 3: Looking Left; Clearing, steep bank slope
Mile 2.3

Photo 4: Looking Right; possibly wet
Mile 2.3

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 16 inch diameter, steel
Mile 2.35

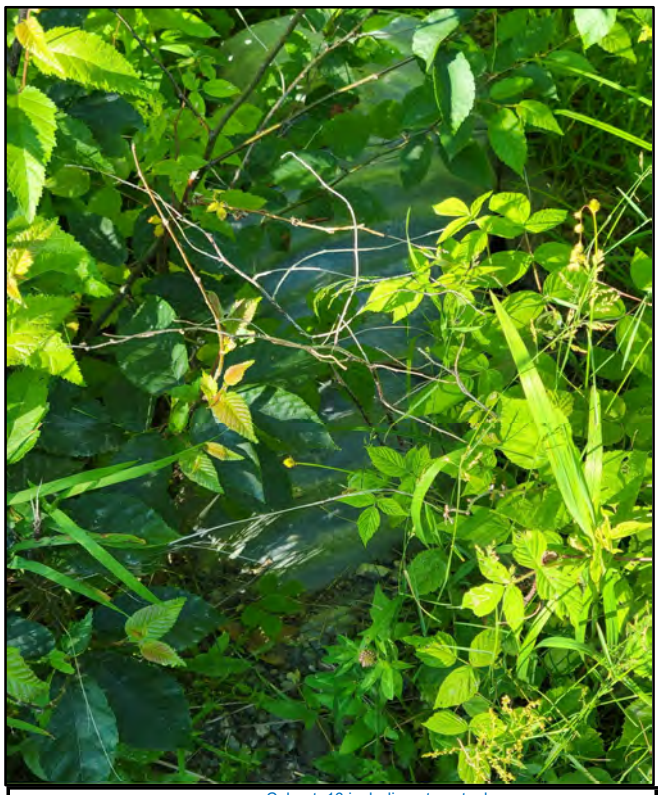


Photo 2: Culvert; 16 inch diameter, steel
Mile 2.35

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

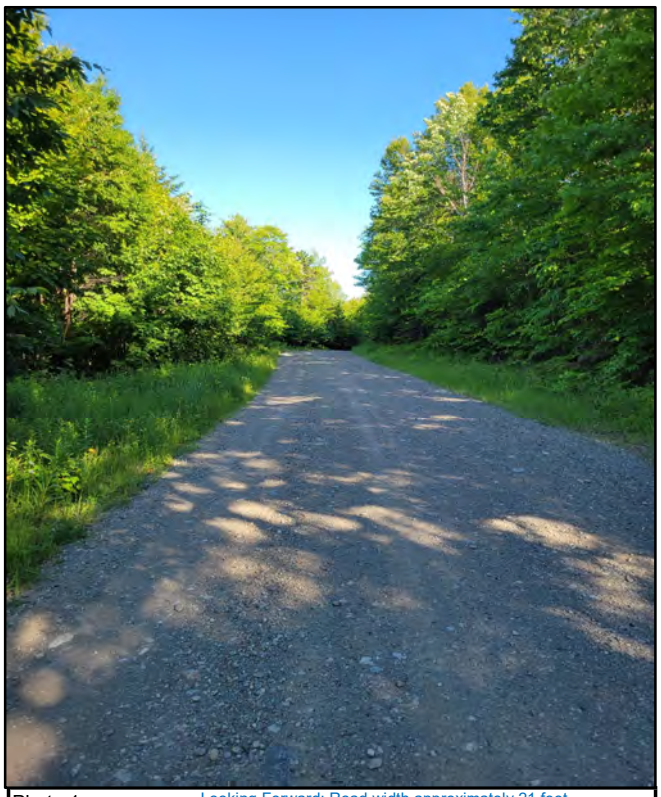


Photo 1: Looking Forward; Road width approximately 21 feet
Mile 2.4

Photo 2: Looking Backward
Mile 2.4

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

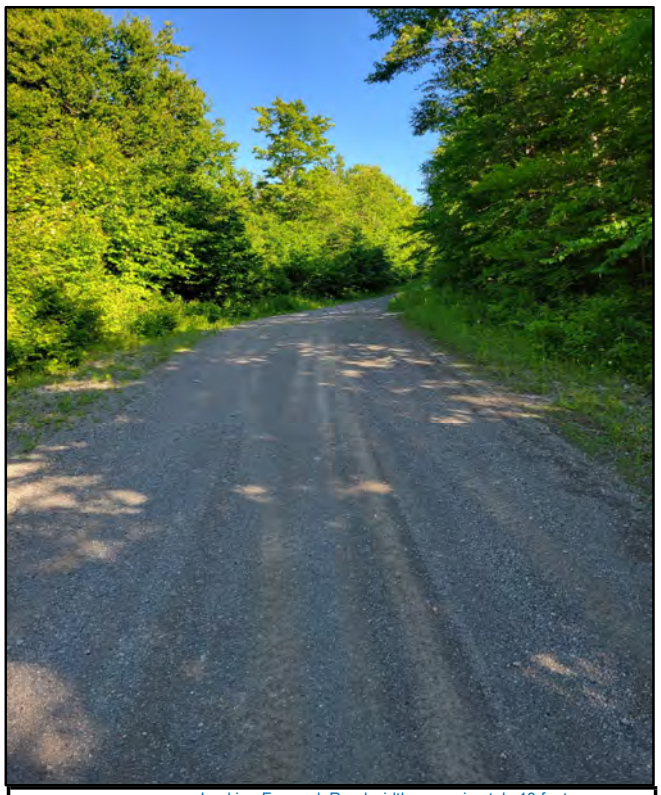


Photo 1: Looking Forward; Road width approximately 18 feet
Mile 2.5

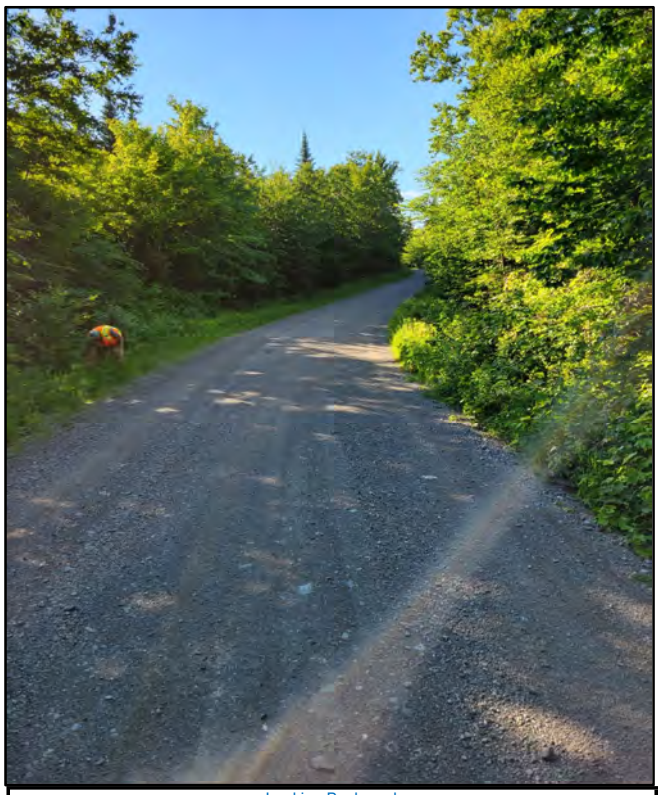


Photo 2: Looking Backward
Mile 2.5

Photo 3: Culvert; 18 inch diameter, steel
Mile 2.5

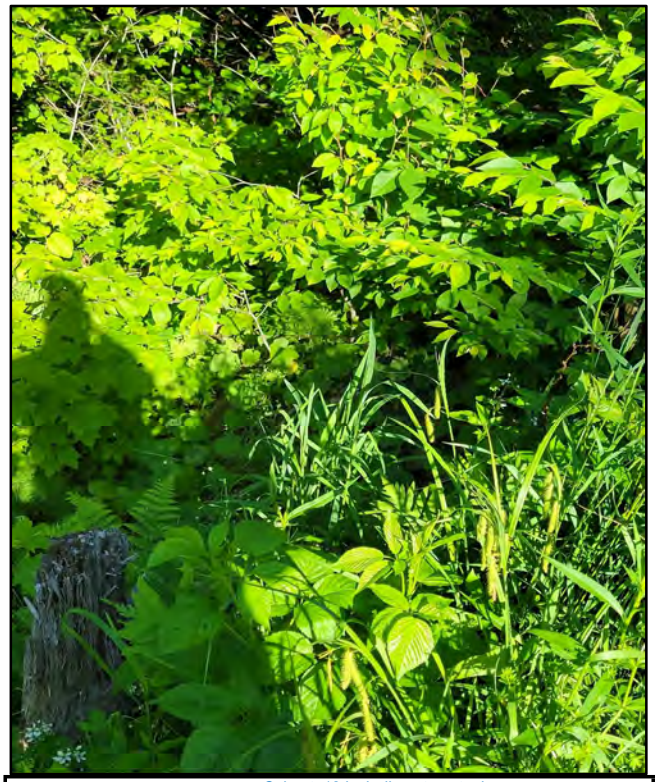


Photo 4: Culvert; 18 inch diameter, steel
Mile 2.5

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 18 inch diameter, steel
Mile 2.55

Photo 2: Culvert; 18 inch diameter, steel
Mile 2.55

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

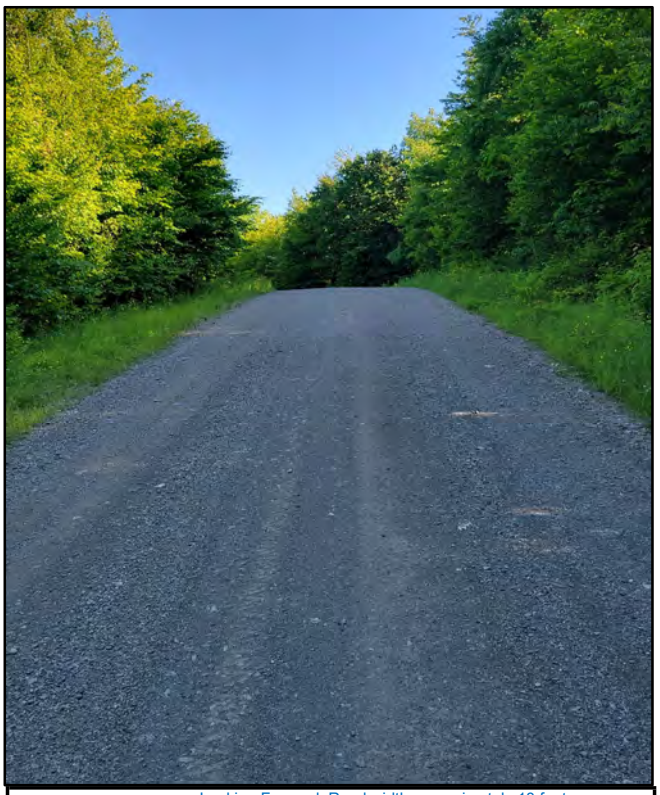


Photo 1: Looking Forward; Road width approximately 18 feet
Mile 2.6

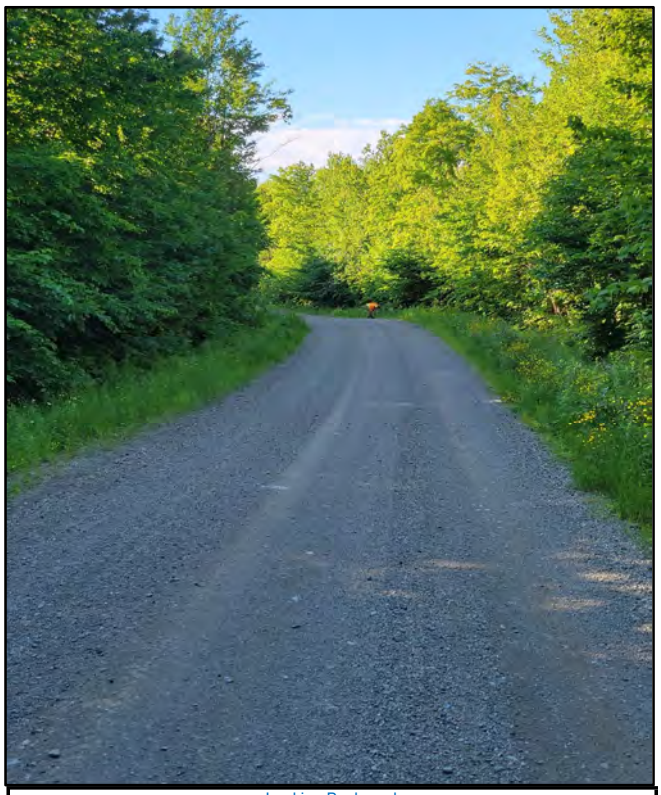


Photo 2: Looking Backward
Mile 2.6

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Turnout; approximately 60 feet wide
Mile 2.65

Photo 2:

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 18 inch diameter, steel
Mile 2.68

Photo 2: Culvert; 18 inch diameter, steel
Mile 2.68

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 20 feet
Mile 2.7

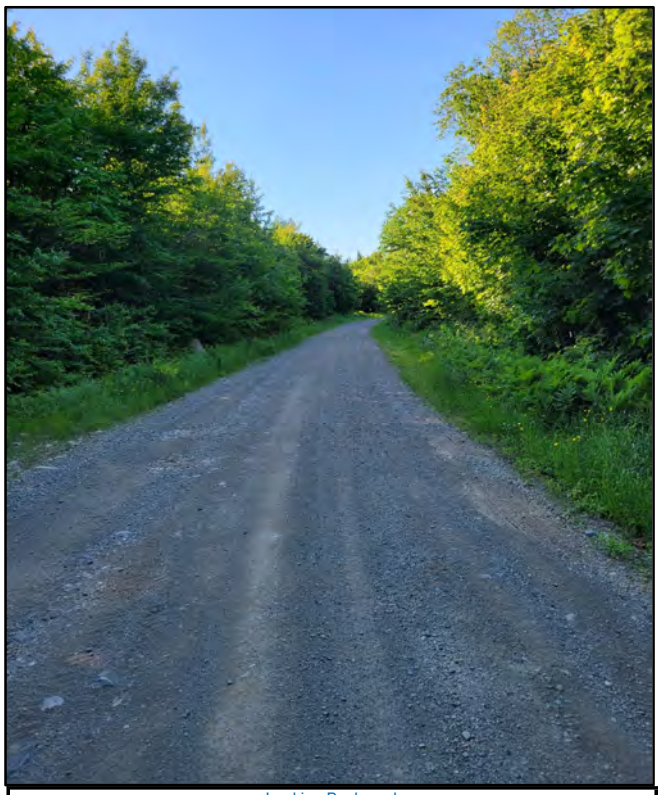


Photo 2: Looking Backward
Mile 2.7

Photo 3: Culvert; 16 inch diameter, steel
Mile 2.7

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

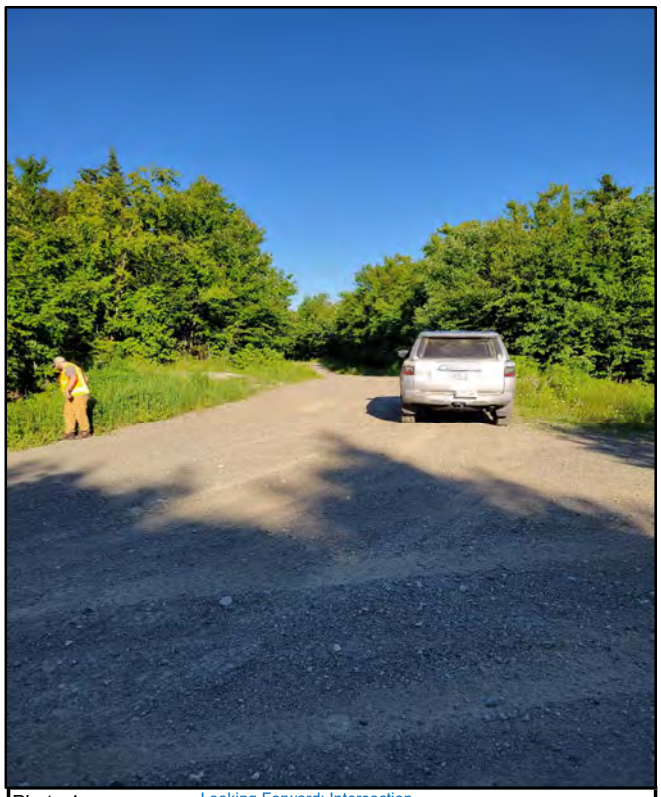


Photo 1: Looking Forward; Intersection
Mile 2.75

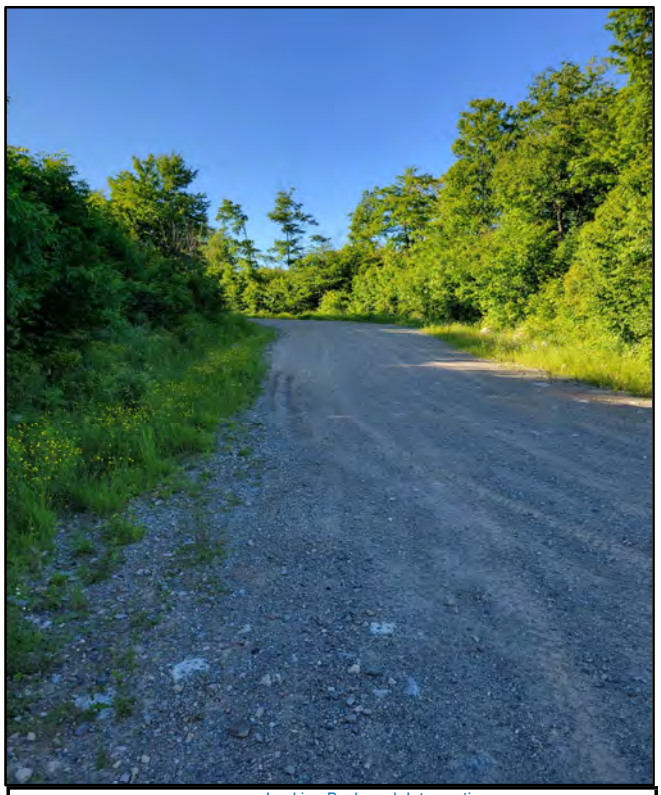


Photo 2: Looking Backward; Intersection
Mile 2.75

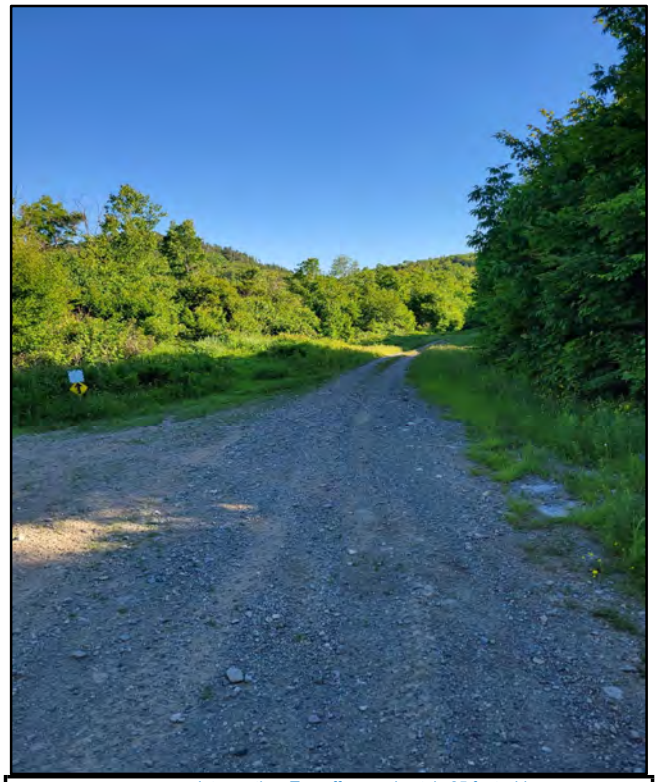


Photo 3: Intersection; Turnoff approximately 25 feet wide
Mile 2.75

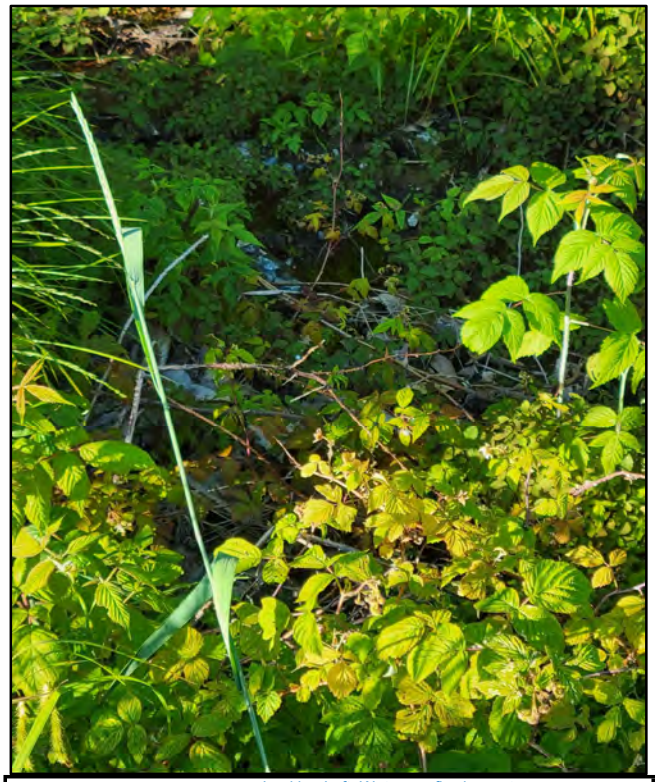


Photo 4: Looking Left; Wet area, flowing water
Mile 2.75

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

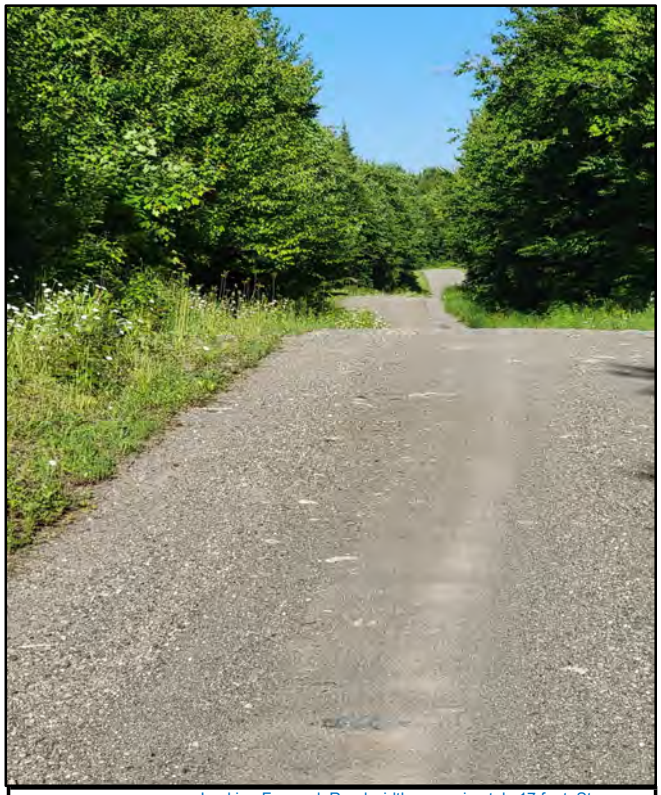


Photo 1: Looking Forward; Road width approximately 17 feet; Steep bank downward on right
Mile 2.8

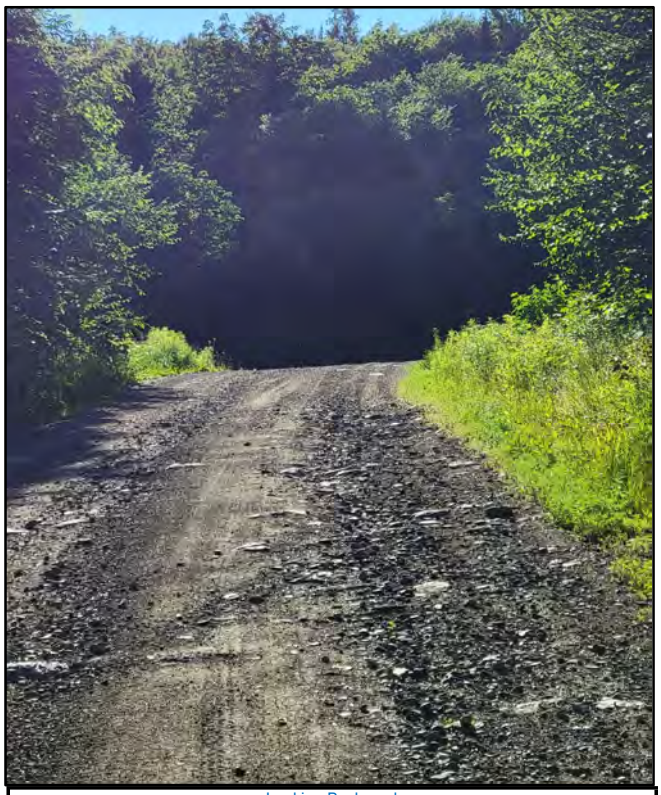


Photo 2: Looking Backward
Mile 2.8

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 17 feet
Mile 2.9

Photo 2: Looking Backward
Mile 2.9

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

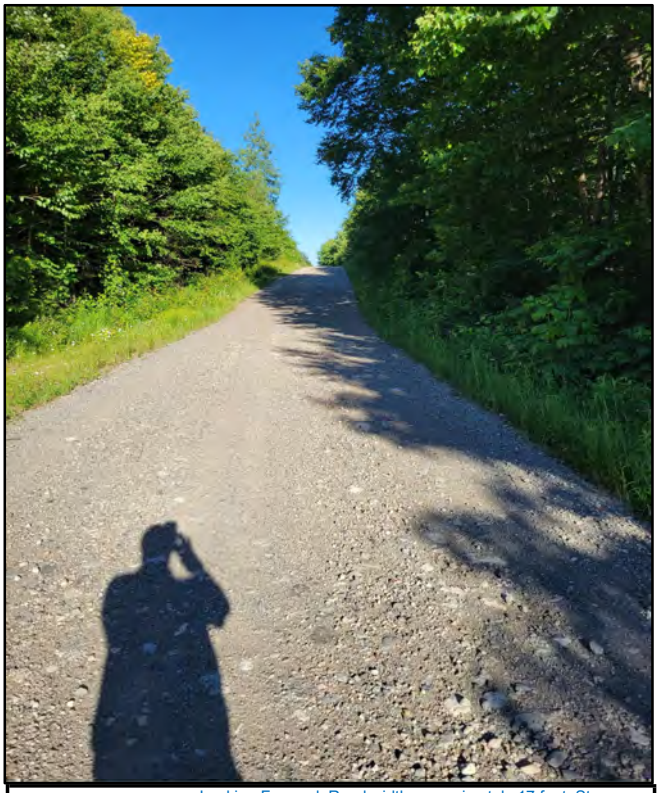


Photo 1: Looking Forward; Road width approximately 17 feet; Steep bank downward on right
Mile 3.0

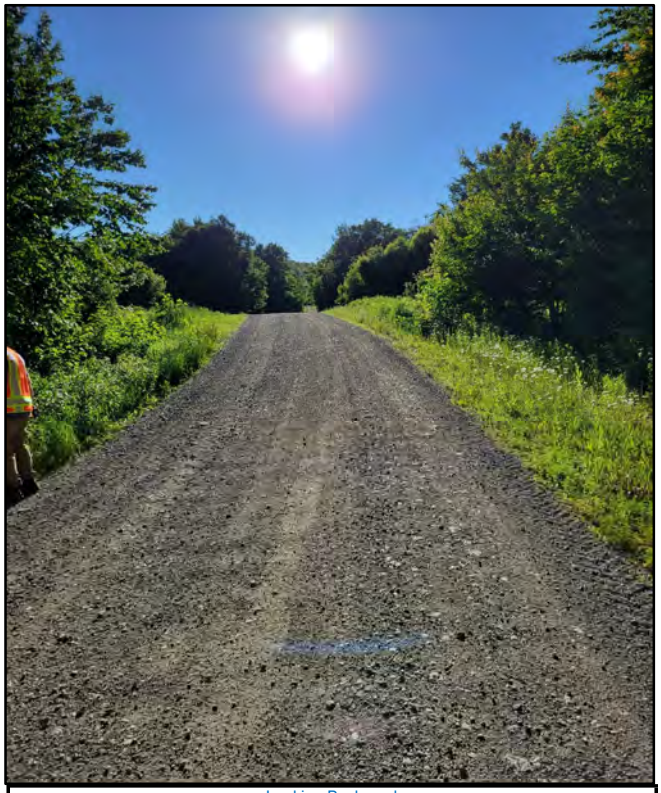


Photo 2: Looking Backward
Mile 3.0

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 17 feet; Steep bank downward on right
Mile 3.1

Photo 2: Looking Backward
Mile 3.1

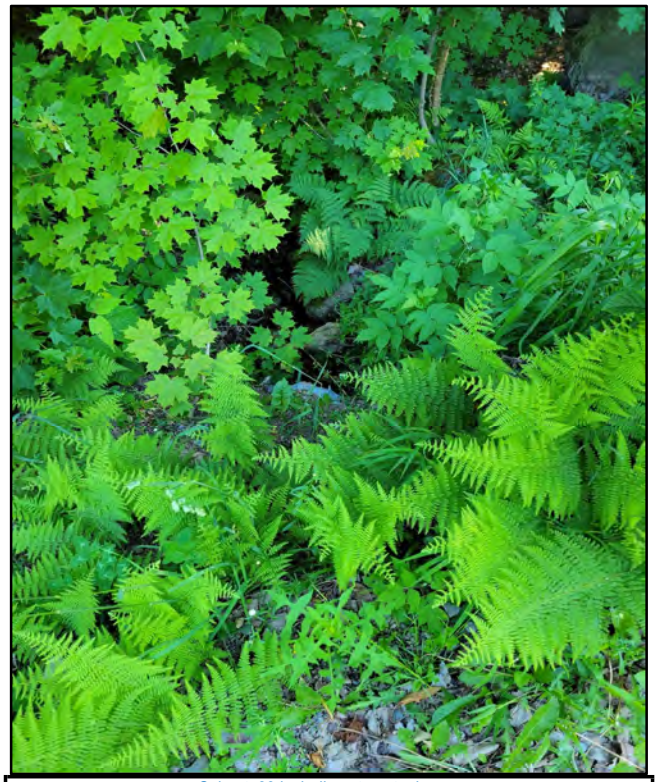


Photo 3: Culvert; 30 inch diameter, steel
Mile 3.1

Photo 4: Culvert; 30 inch diameter, steel
Mile 3.1

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

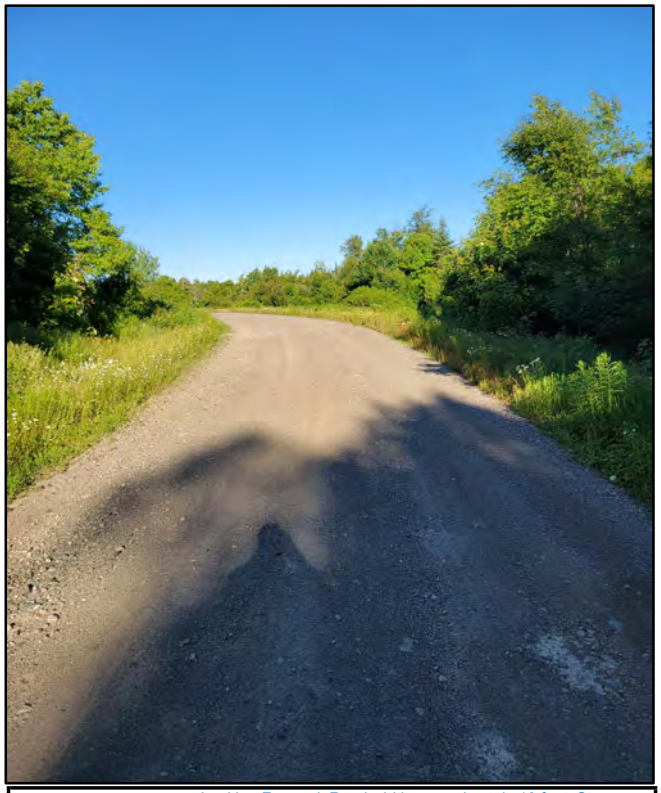


Photo 1: Looking Forward; Road width approximately 16 feet; Steep bank downward on right
Mile 3.2

Photo 2: Looking Backward
Mile 3.2

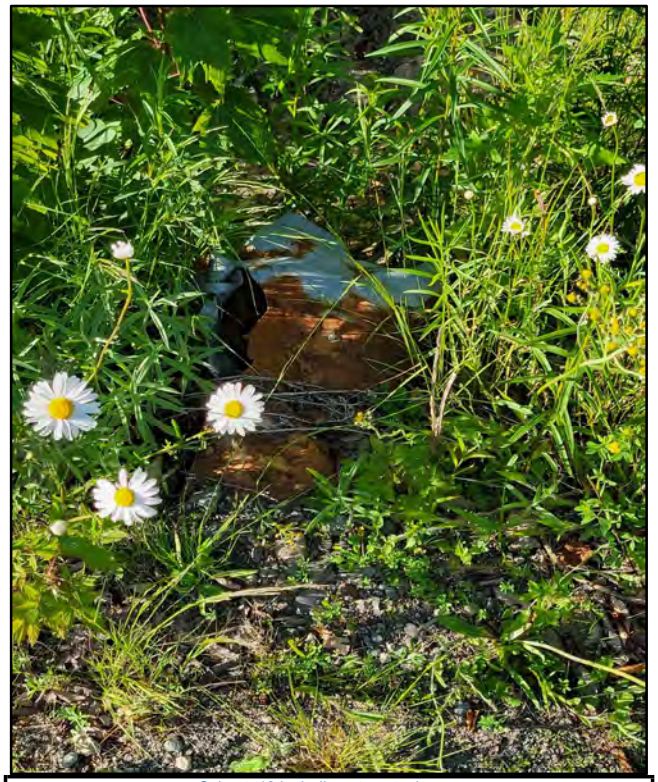


Photo 3: Culvert; 12 inch diameter, steel
Mile 3.2

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 16 feet
Mile 3.3

Photo 2: Looking Backward
Mile 3.3

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 15 feet
Mile 3.4

Photo 2: Looking Backward
Mile 3.4

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Intersection; Turnout
Mile 3.45

Photo 2:

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

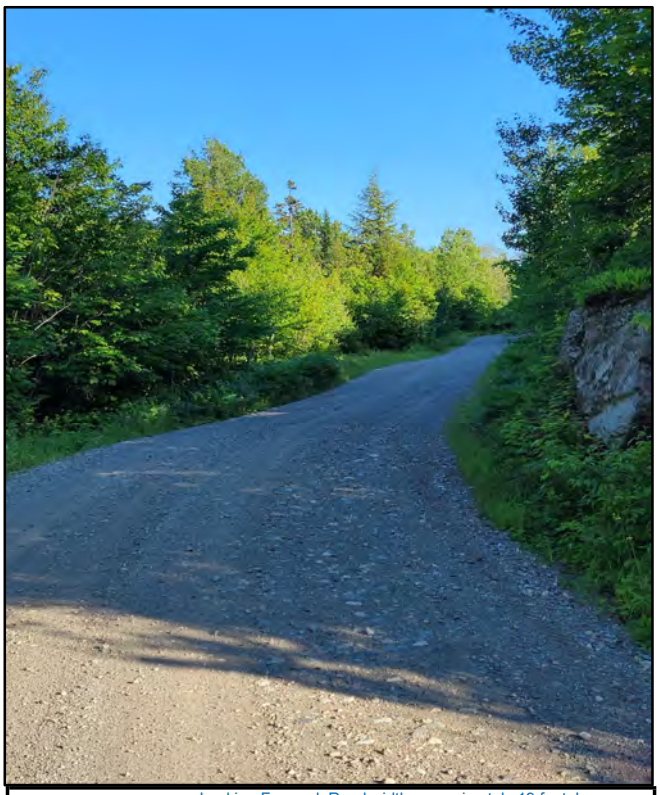


Photo 1: Looking Forward; Road width approximately 19 feet; Large boulder on right
Mile 3.5

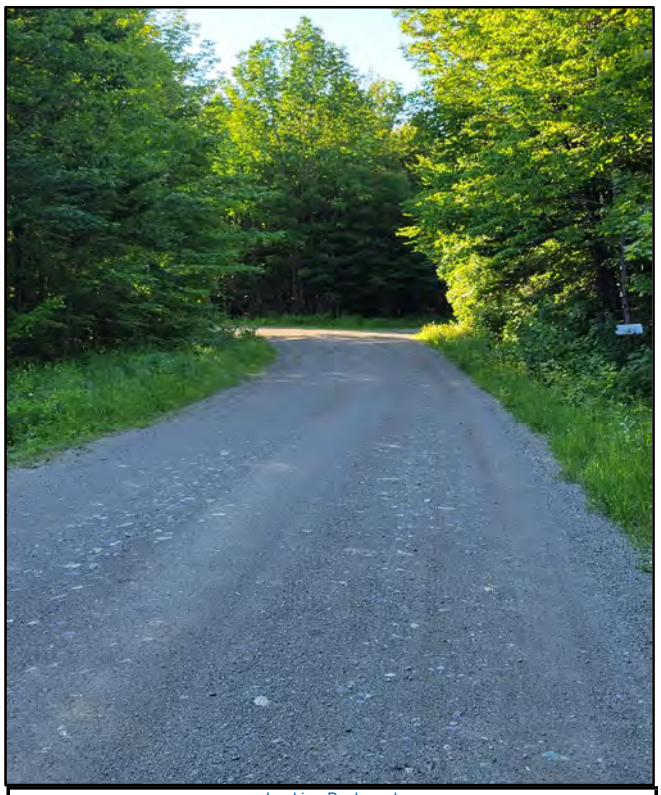


Photo 2: Looking Backward
Mile 3.5

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

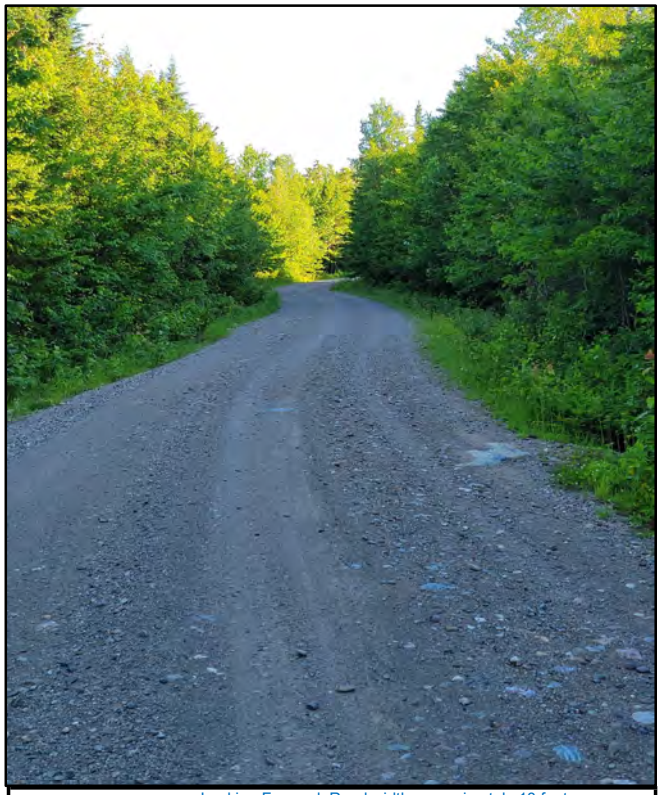


Photo 1: Looking Forward; Road width approximately 18 feet
Mile 3.6

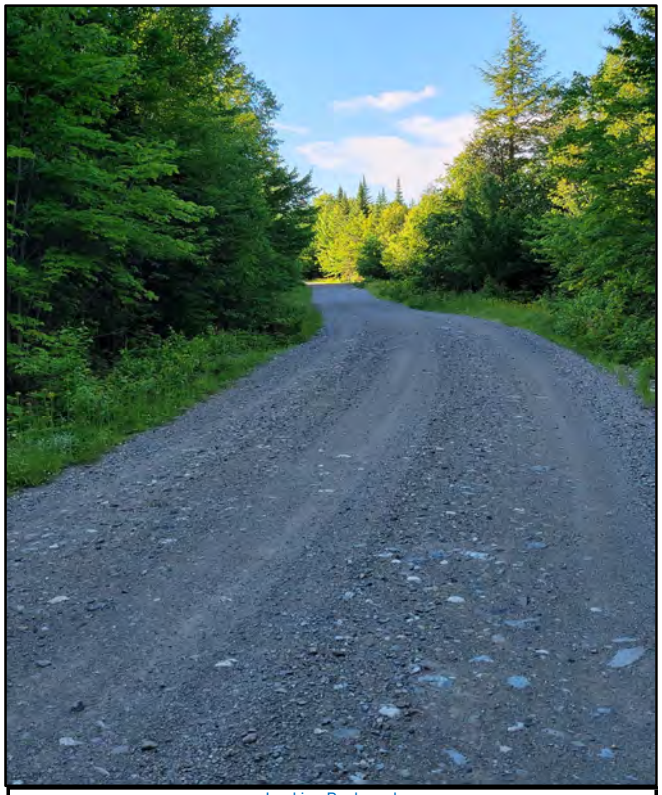


Photo 2: Looking Backward
Mile 3.6

Photo 3: Looking Left
Mile 3.6

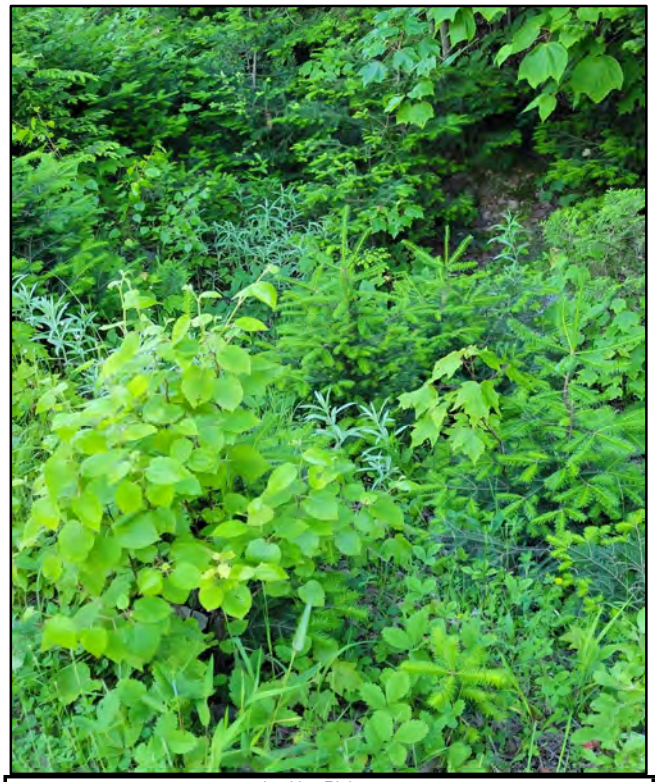


Photo 4: Looking Right
Mile 3.6

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Right; Swamp
Mile 3.68

Photo 2: Looking Right; Swamp
Mile 3.68

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

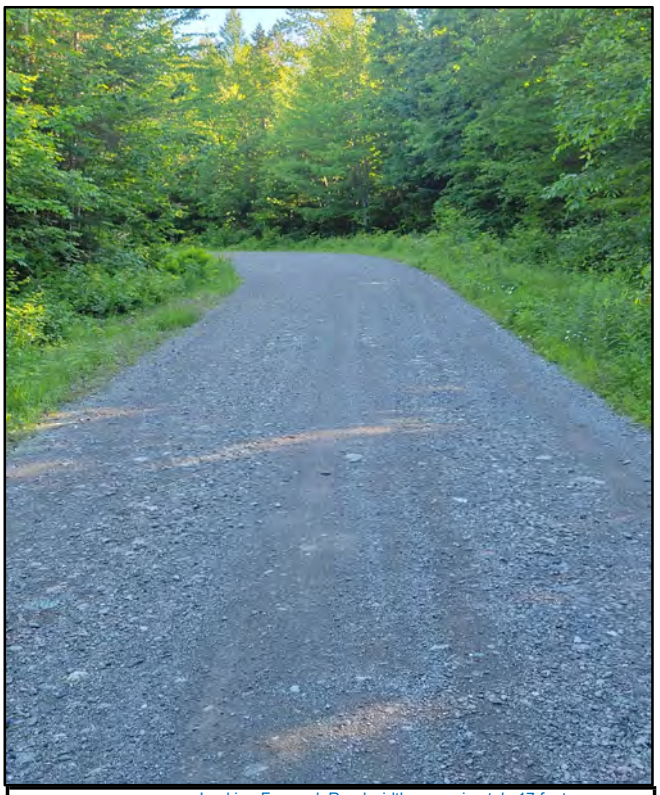


Photo 1: Looking Forward; Road width approximately 17 feet
Mile 3.7

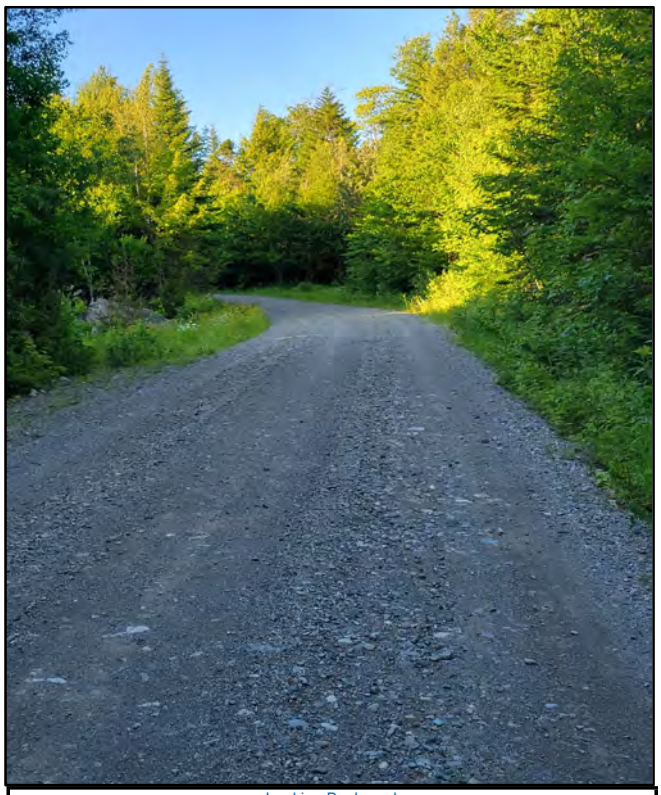


Photo 2: Looking Backward
Mile 3.7

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 24 feet
Mile 3.8

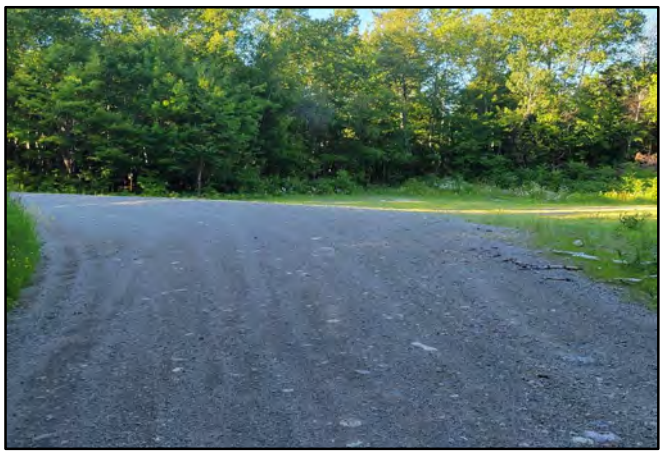


Photo 2: Looking Backward; Turnout
Mile 3.8

Photo 3: Looking Right; Brook/Stream
Mile 3.8

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert Bridge Deck
Mile 3.85

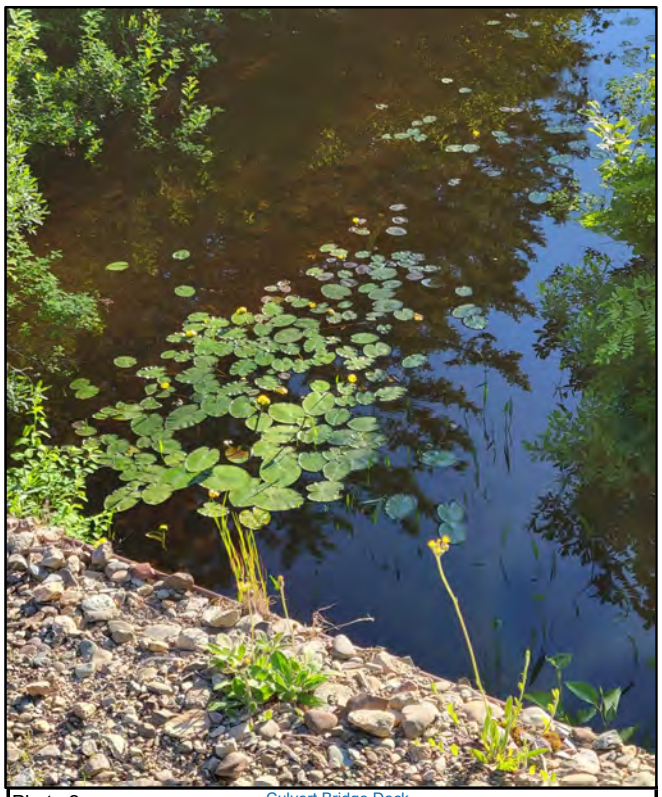


Photo 2: Culvert Bridge Deck
Mile 3.85

Photo 3: Culvert Bridge Deck
Mile 3.85

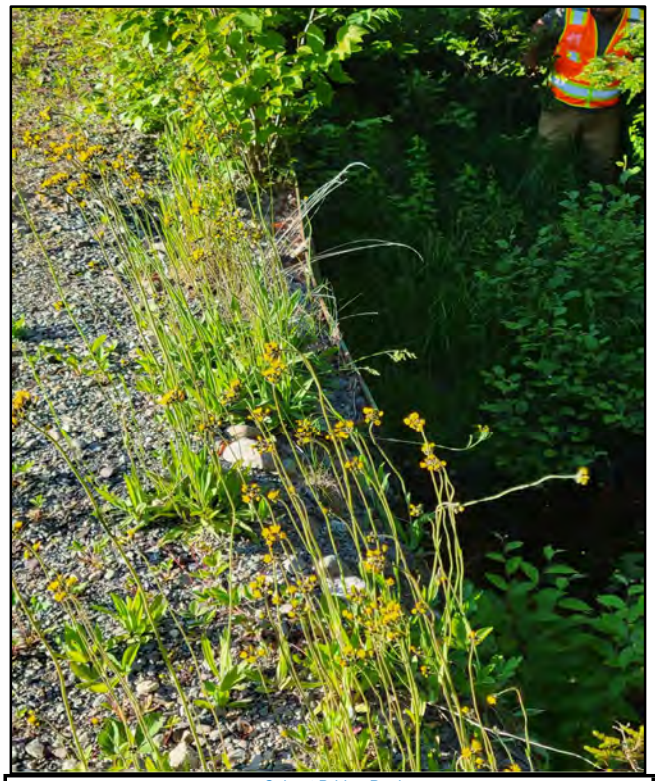


Photo 4: Culvert Bridge Deck
Mile 3.85

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert Bridge, approximately 6 feet tall by 17 feet wide
Mile 3.85

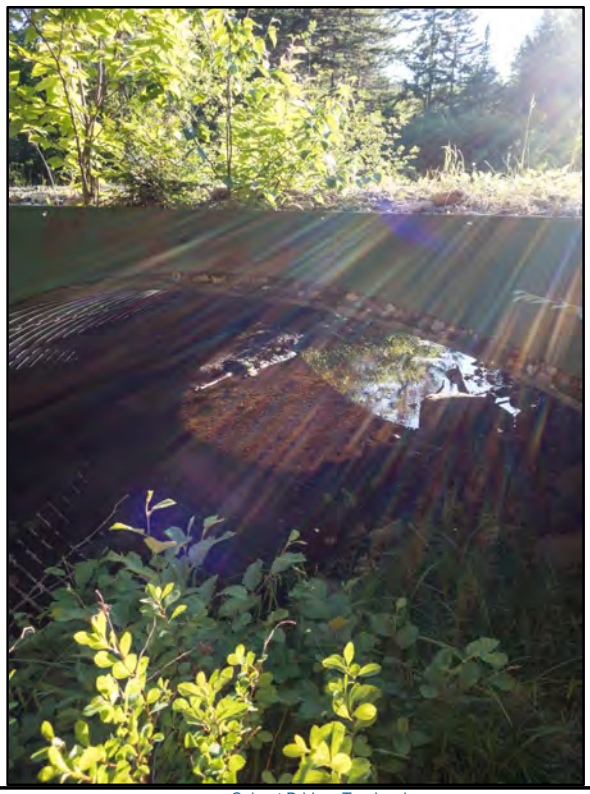


Photo 2: Culvert Bridge; Top bowing
Mile 3.85

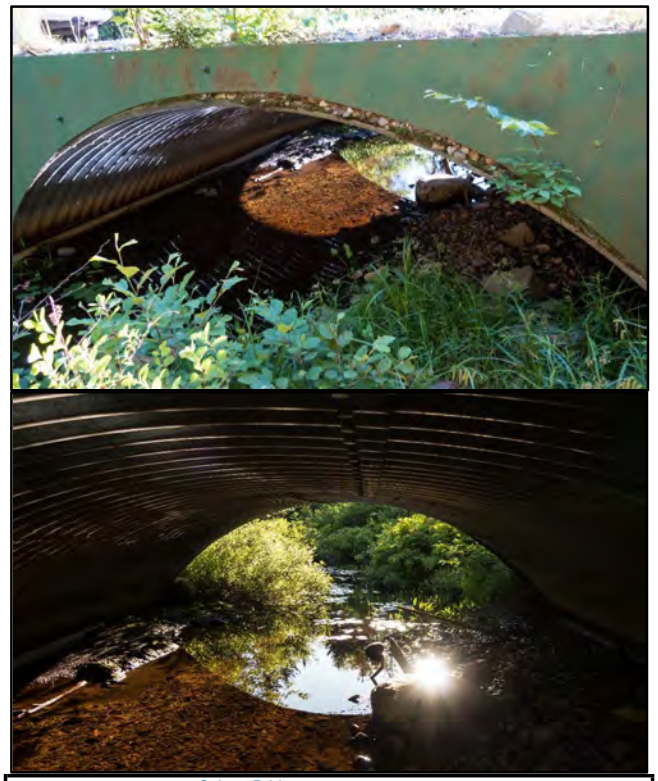


Photo 3: Culvert Bridge
Mile 3.85

Photo 4: Culvert Bridge
Mile 3.85

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

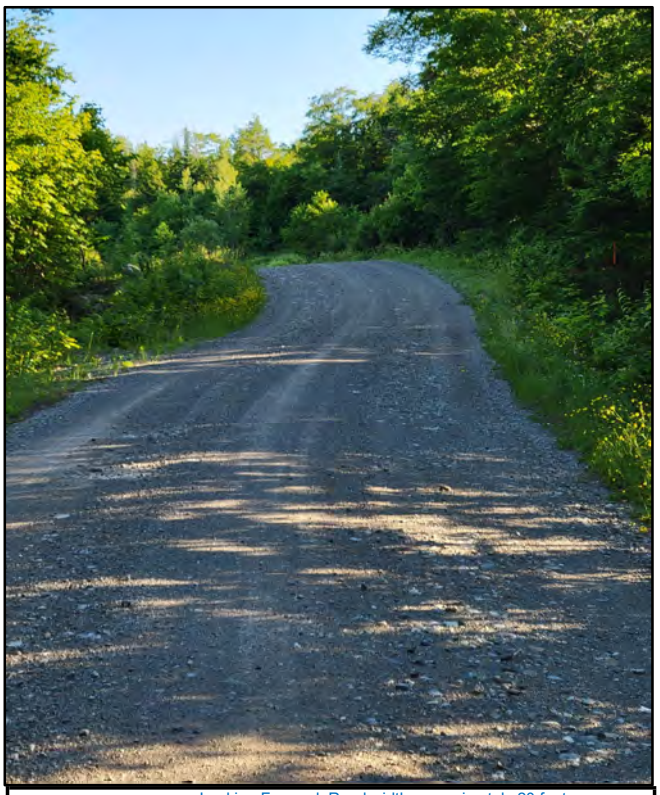


Photo 1: Looking Forward; Road width approximately 20 feet
Mile 3.9

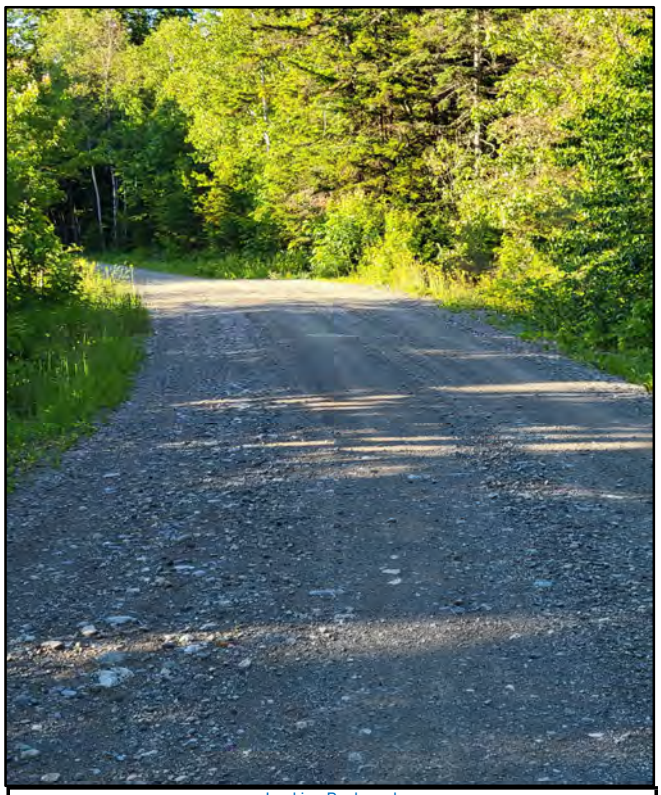


Photo 2: Looking Backward
Mile 3.9

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Road width approximately 20 feet; Pit on left
Mile 4.0

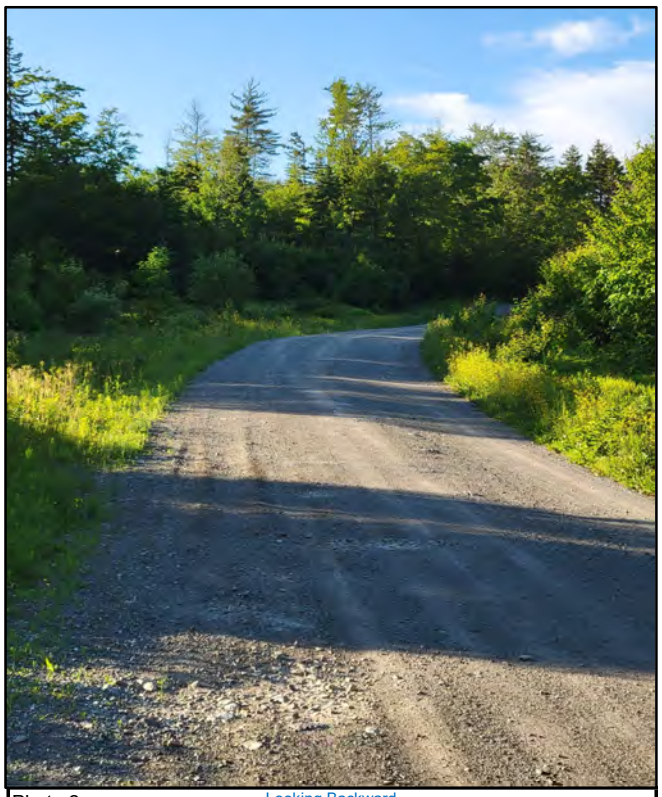


Photo 2: Looking Backward
Mile 4.0

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

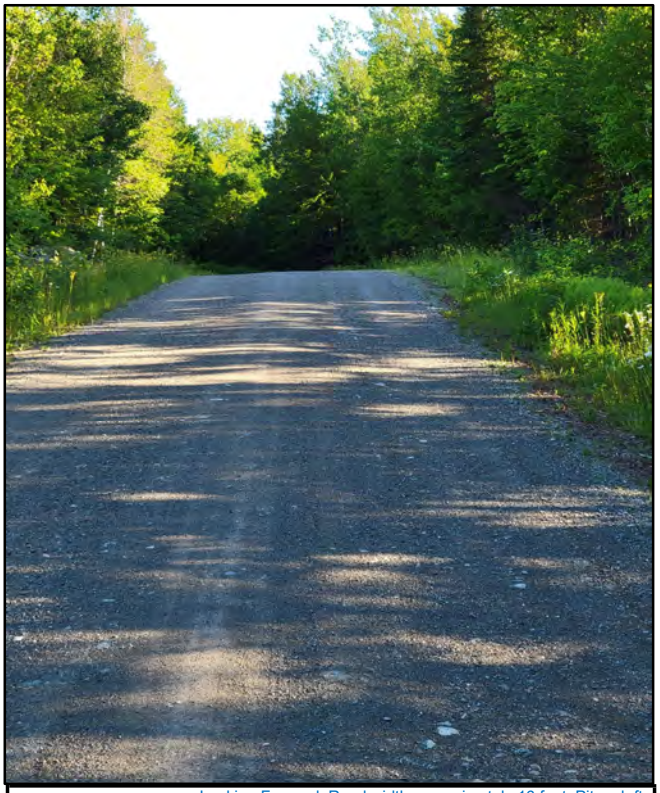


Photo 1: Looking Forward; Road width approximately 16 feet; Pit on left
Mile 4.1

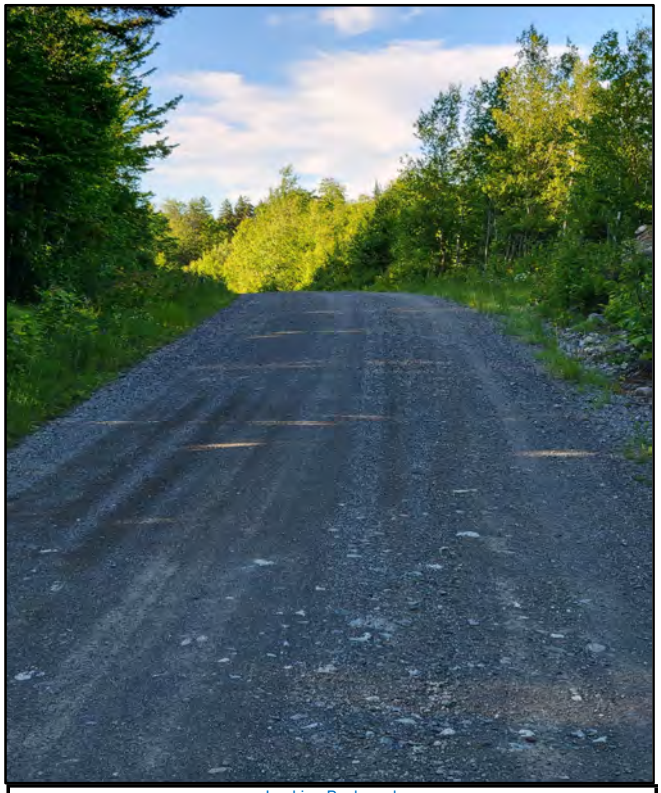


Photo 2: Looking Backward
Mile 4.1

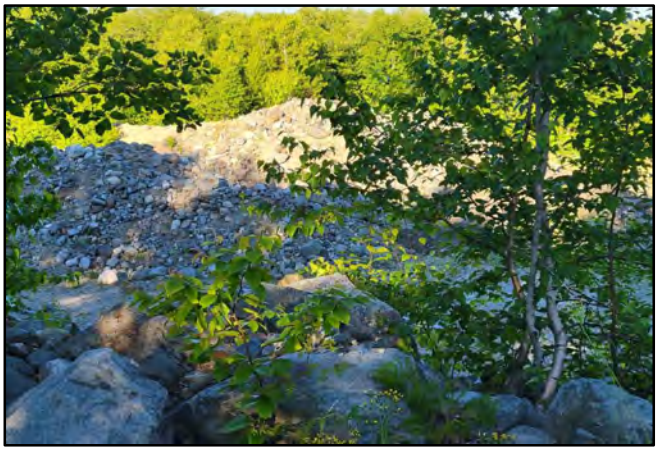


Photo 3: Looking Left; Pit
Mile 4.1

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 26 inch diameter, steel; Flowing water
Mile 4.15

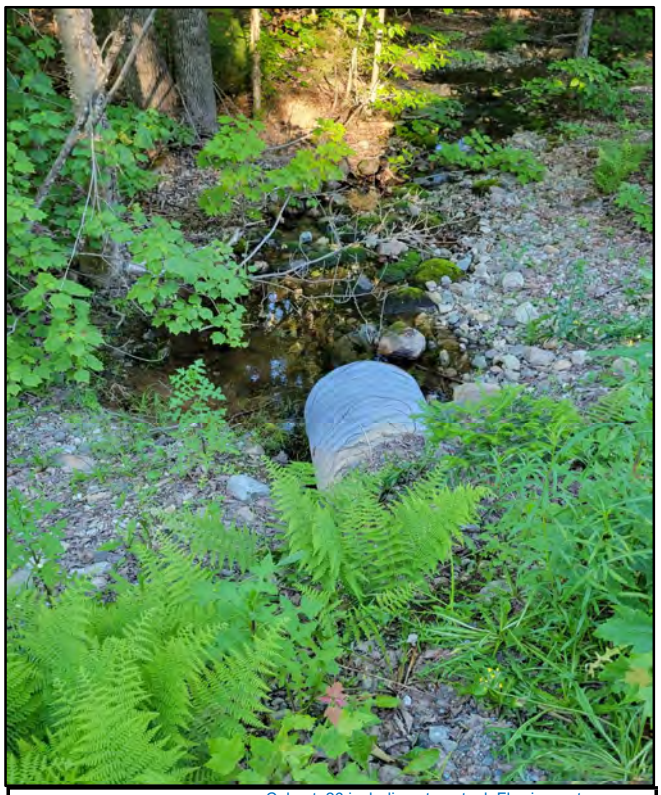


Photo 2: Culvert; 26 inch diameter, steel; Flowing water
Mile 4.15

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

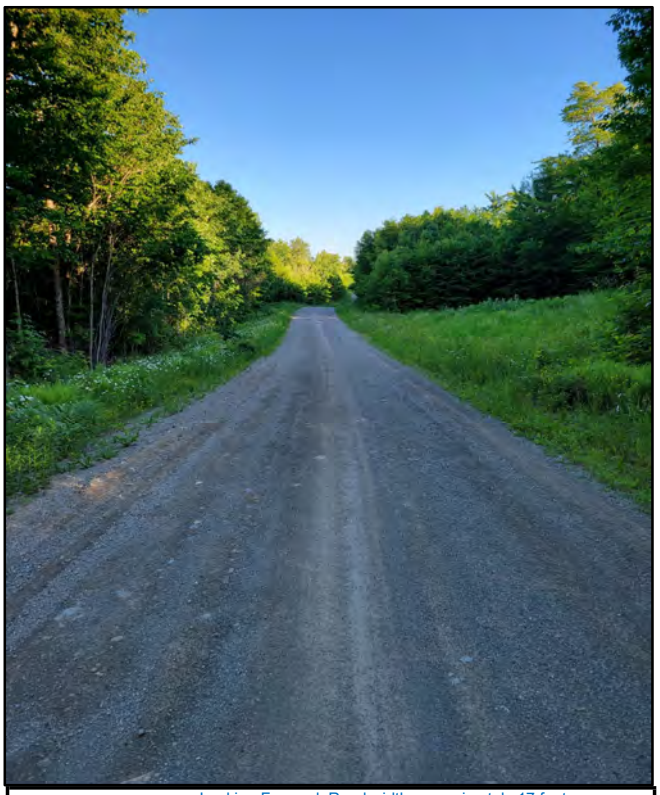


Photo 1: Looking Forward; Road width approximately 17 feet;
Mile 4.2

Photo 2: Looking Backward
Mile 4.2

Photo 3:

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

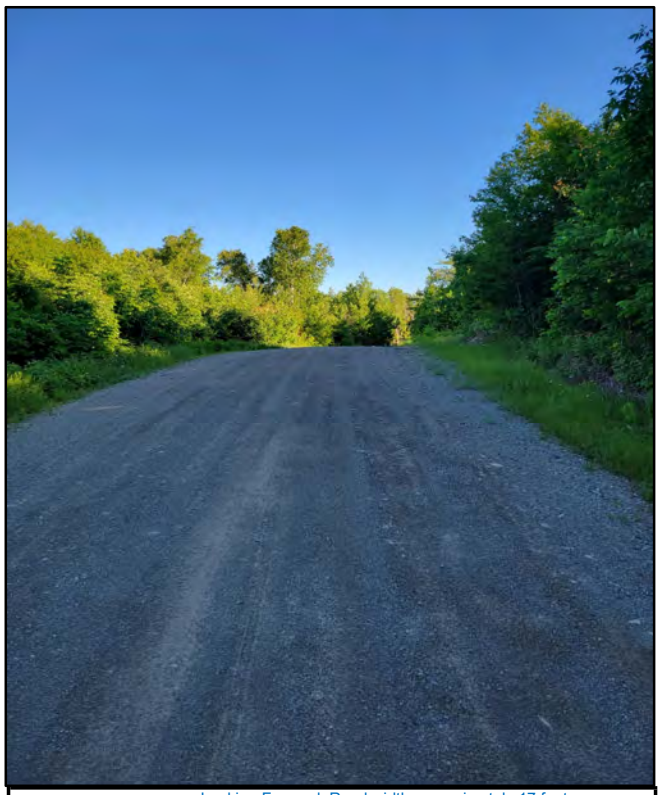


Photo 1: Looking Forward; Road width approximately 17 feet;
Mile 4.3

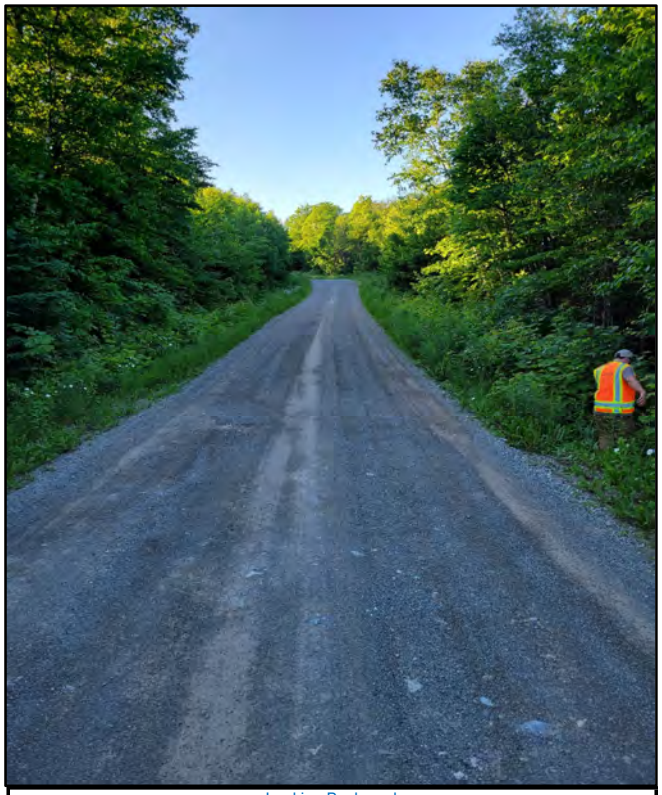


Photo 2: Looking Backward
Mile 4.3

Photo 3: Culvert; 16 inch diameter, steel
Mile 4.3

Photo 4:

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Looking Forward; Intersection at Route 11 approximately 50 feet wide
Mile 4.4

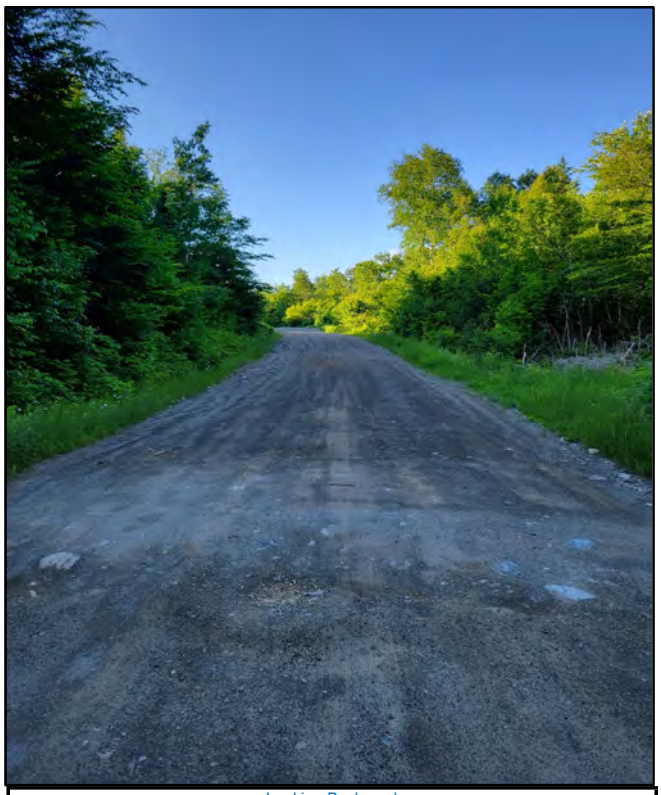


Photo 2: Looking Backward
Mile 4.4

Photo 3: Culvert; 18 inch diameter, steel
Mile 4.4

Photo 4: Culvert; 18 inch diameter, steel
Mile 4.4

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Nick Langlais, P.E.

Photo 1: Culvert; 26 inch diameter, plastic
Mile 4.4

Photo 2: Culvert; 26 inch diameter, plastic
Mile 4.4

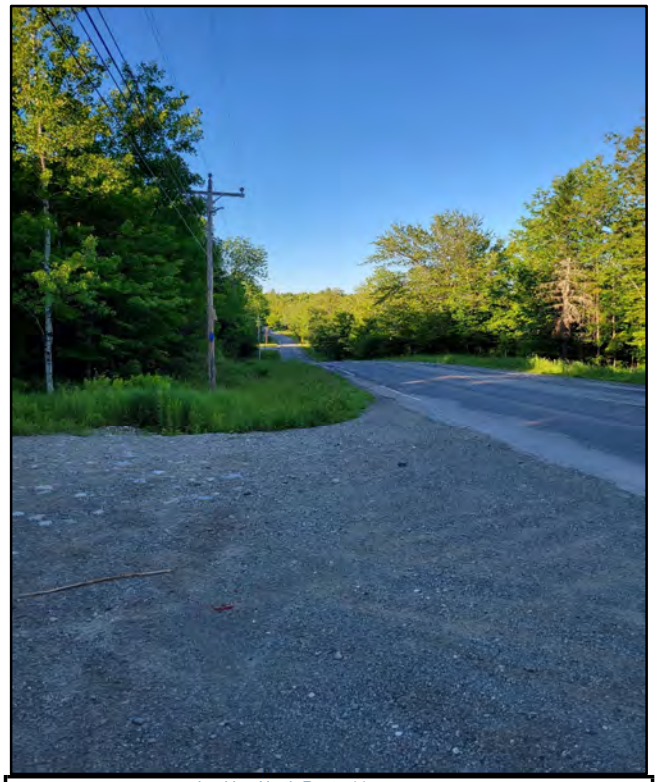


Photo 3: Looking North Route 11
Mile 4.4

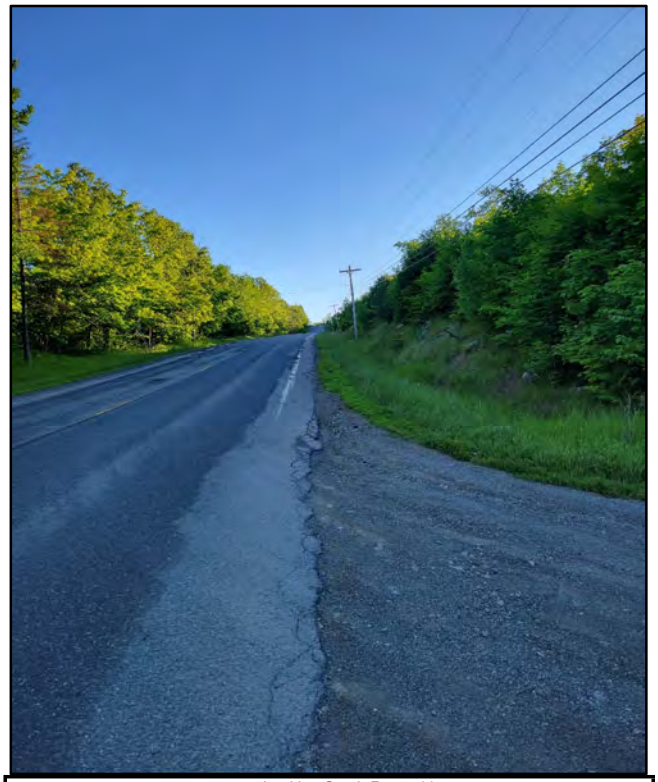


Photo 4: Looking South Route 11
Mile 4.4

# ATTACHMENT 2

## Bridge Photo Log

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Jeffrey Walker, P.E.

Photo 1: Bridge Surface Looking North West
Mile 2.05

Photo 2: Bridge Elevation Looking North East
Mile 2.05

Photo 3: Bridge Elevation Looking North
Mile 2.05

Photo 4: Bridge Wearing Surface Looking North West
Mile 2.05

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Jeffrey Walker, P.E.

Photo 5: West Wing Wall
Mile 2.05

Photo 6: North Wing Wall
Mile 2.05

Photo 7: East Wing Wall
Mile 2.05

Photo 8: South Wing Wall
Mile 2.05

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Jeffrey Walker, P.E.

Photo 9: Northwest Abutment
Mile 2.05

Photo 10: Southeast Abutment
Mile 2.05

Photo 11: Decay and Fungal Growth on Timber Curb
Mile 2.05

Photo 12: Decay on Timber Curb
Mile 2.05

# Photographic Log

**Project:** Wolfden
**Project No.:** 3617227547
**Address:** Pickett Mountain
**Date:** 6/28/2022
**Field Technician:** Jeffrey Walker, P.E.

Photo 13: Decay and Fungal Growth on North East Abutment Timber Bulkhead
Mile 2.05

Photo 14: Decay and Fungal Growth on North East Abutment Timber Beam Bearing Plate
Mile 2.05

# ATTACHMENT 3

## Preliminary Bridge Structural

| | | | |
|---|---|---|---|
| Project: | Pickett Mountain Mine Site | | |
| Job #: | 3617227547 | | |
| Created by: | J Walker | Date: | 7/25/2022 |
| Checked by: | | Date: | |

**Wood E&IS**
511 Congress Street
Portland, ME 04101
1-207-775-5401

## Bridge Decking

### Notes:

1. Design bridge for 80,000 lb Semi End-Dump truck with a total of (5) axles
2. Planks are 4"x7.875" supported on 4"x7.875" stringers spaced at approximately 14" o.c., all members laid flat
3. Assume all lumber is Southern Yellow Pine #2 in a wet condition
4. Planking is installed continuous over multiple supports, therefore reduce simple span moments by a factor of 0.8
5. Do not consider impact forces for timber members

### Design Information:

| | | | | |
|---|---|---|---|---|
| **P** | 8,500 | (lb) | Wheel load | |
| **$A_t$** | 85 | ($in^2$) | Tire patch area / tire pressure | = 0.01P |
| **$p_t$** | 100 | (psi) | Tire patch area pressure | = $P/A_t$ |
| **$l_t$** | 5.83 | (in) | Length of tire patch (parallel to direction of traffic) | = Ö($A_t$/2.5) |
| **$b_t$** | 14.58 | (in) | Width of tire patch (perpendicular to direction of traffic) | = $A_t/l_t$ |
| **b** | 7.878 | (in) | Plank width | |
| **t** | 4 | (in) | Plank thickness | |
| **A** | 31.512 | ($in^2$) | Plank area | |
| **S** | 21.008 | ($in^3$) | Plank elastic section modulus | |
| **I** | 42.016 | ($in^4$) | Plank moment of inertia | |
| **$c_s$** | 7.5 | (in) | Clear spacing between supports | |
| **$b_s$** | 7.878 | (in) | Width of support | |
| **L** | 11.5 | (in) | Plank span | = min($c_s$+$b_s$,$c_s$+t) |

| | Stress (psi) | $C_{fu}$ | $C_m$ | $C_v$ | Adjusted (psi) | |
|---|---|---|---|---|---|---|
| **$F_b$** | 925 | | 1 | | 925 | Bending |
| **$F_v$** | 175 | | 0.97 | 1 | 170 | Horizontal shear |
| **$F_{c,perp}$** | 565 | | 0.67 | | 379 | Bearing |

### Check Bending:

Maximum moment occurs with wheel patch located in center of span

| | | | | |
|---|---|---|---|---|
| **w** | 670 | (lb/in) | Uniform load | = $p_t$b |
| **a** | 2.83 | (in) | Length to load from left | = (L-b)/2 |
| **b** | 5.83 | (in) | Loaded width | = $l_t$ |
| **c** | 2.83 | (in) | Length to load from right | = (L-b)/2 |
| **$R_1$** | 1,952 | (lb) | Left reaction | = (wb/2L)(2c+b) |
| **$R_2$** | 1,952 | (lb) | Right reaction | = (wb/2L)(2a+b) |
| **$M_{max}$** | 6,704 | (lb-in) | Maximum moment | = 0.8 $R_1$(a+$R_1$/(2w)) |
| **$F'_b$** | 925 | (psi) | Allowable bending stress | [See above] |
| **$f_b$** | 319 | (psi) | Actual bending stress | = $M_{max}$/S |
| **U** | *0.34* | | Bending unity | = $F'_b/f_b$ |

| | | | |
|---|---|---|---|
| Project: | Pickett Mountain Mine Site | | |
| Job #: | 3617227547 | | |
| Created by: | J Walker | Date: | 7/25/2022 |
| Checked by: | | Date: | |

**Wood E&IS**
511 Congress Street
Portland, ME 04101
1-207-775-5401

**Bridge Decking**

**Check Shear:**

Loads applied within t of the support are not resisted as shear

| | | | | |
|---|---|---|---|---|
| **w** | 670 | (lb/in) | Uniform load | $= p_t b$ |
| **a** | 4.00 | (in) | Length to load from left | = t |
| **b** | 3.50 | (in) | Loaded width | = L-(a+b) |
| **c** | 4.00 | (in) | Length to load from right | = t |
| **$R_1$** | 1,172 | (lb) | Left reaction | = (wb/2L)(2c+b) |
| **$R_2$** | 1,172 | (lb) | Right reaction | = (wb/2L)(2a+b) |
| **$F'_v$** | 170 | (psi) | Allowable shear stress | [See above] |
| **$f_v$** | 56 | (psi) | Actual shear stress | $= 3R_{max}/2A$ |
| **U** | ***0.33*** | | Shear unity | $= F'_v/f_v$ |

**Check Bearing:**

Maximum bearing stress is equal to the tire pressure

| | | | | |
|---|---|---|---|---|
| **$F'_{c,perp}$** | 379 | (psi) | Allowable bearing stress | [See above] |
| **$f_{c,perp}$** | 100 | (psi) | Actual bearing stress | $= p_t$ |
| **U** | ***0.26*** | | Bearing unity | $= F'_b/f_b$ |

| | | | |
|---|---|---|---|
| Project: | Pickett Mountain Mine Site | | |
| Job #: | 3617227547 | | |
| Created by: | J Walker | Date: | 7/25/2022 |
| Checked by: | | Date: | |

**Wood E&IS**
511 Congress Street
Portland, ME 04101
1-207-775-5401

**Bridge Stringer**

**Notes:**

1. Design bridge for 80,000 lb Semi End-Dump truck with a total of (5) axles
2. Stringers are 4"x7.875" laid flat @ approximately 14"o.c. supported on W12x65 beams spaced @ approximately 33" o.c.
3. Assume all lumber is Southern Yellow Pine #2 in a wet condition
4. Stringers are installed continuous over multiple supports, therefore reduce simple span moments by a factor of 0.8
5. Use a longitudinal load distribution factor of 0.6
6. Do not consider impact forces for timber members

**Design Information:**

| | | | | |
|---|---|---|---|---|
| **DF** | 0.600 | (lb) | Longitudinal load distribution factor | |
| **P** | 8,500 | (lb) | Wheel load | |
| **$A_t$** | 85 | ($in^2$) | Tire patch area / tire pressure | = 0.01P |
| **$p_t$** | 100 | (psi) | Tire patch area pressure | = $P/A_t$ |
| **$l_t$** | 5.83 | (in) | Length of tire patch (parallel to direction of traffic) | = Ö($A_t$/2.5) |
| **$b_t$** | 14.58 | (in) | Width of tire patch (perpendicular to direction of traffic) | = $A_t/l_t$ |
| **b** | 7.878 | (in) | Stringer width | |
| **t** | 4 | (in) | Stringer thickness | |
| **A** | 31.512 | ($in^2$) | Stringer area | |
| **S** | 21.008 | ($in^3$) | Stringer elastic section modulus | |
| **I** | 42.016 | ($in^4$) | Stringer moment of inertia | |
| **$c_s$** | 21 | (in) | Clear spacing between supports | |
| **$b_s$** | 12 | (in) | Width of support | |
| **L** | 25 | (in) | Stringer span | = min($c_s$+$b_s$,$c_s$+t) |

| | Stress (psi) | $C_{fu}$ | $C_m$ | $C_v$ | Adjusted (psi) | |
|---|---|---|---|---|---|---|
| **$F_b$** | 925 | | 1 | | 925 | Bending |
| **$F_v$** | 175 | | 0.97 | 1 | 170 | Horizontal shear |
| **$F_{c,perp}$** | 565 | | 0.67 | | 379 | Bearing |

**Check Bending:**

Maximum moment occurs with wheel patch located in center of span

| | | | | |
|---|---|---|---|---|
| **w** | 350 | (lb/in) | Uniform load | = DF($P/b_t$) |
| **a** | 5.21 | (in) | Length to load from left | = (L-b)/2 |
| **b** | 14.58 | (in) | Loaded width | = $b_t$ |
| **c** | 5.21 | (in) | Length to load from right | = (L-b)/2 |
| **$R_1$** | 2,550 | (lb) | Left reaction | = (wb/2L)(2c+b) |
| **$R_2$** | 2,550 | (lb) | Right reaction | = (wb/2L)(2a+b) |
| **$M_{max}$** | 18,066 | (lb-in) | Maximum moment | = 0.8 $R_1$(a+$R_1$/(2w)) |
| **$F'_b$** | 925 | (psi) | Allowable bending stress | [See above] |
| **$f_b$** | 860 | (psi) | Actual bending stress | = $M_{max}$/S |
| **U** | ***0.93*** | | Bending unity | = $F'_b/f_b$ |

| | | | |
|---|---|---|---|
| Project: | Pickett Mountain Mine Site | | |
| Job #: | 3617227547 | | |
| Created by: | J Walker | Date: | 7/25/2022 |
| Checked by: | | Date: | |

**Wood E&IS**
511 Congress Street
Portland, ME 04101
1-207-775-5401

**Bridge Stringer**

**Check Shear:**

Loads applied within t of the support are not resisted as shear

| | | | | |
|---|---|---|---|---|
| **w** | 350 | (lb/in) | Uniform load | $= p_t b$ |
| **a** | 4.00 | (in) | Length to load from left | $= t$ |
| **b** | 14.58 | (in) | Loaded width | $= b_t$ |
| **c** | 6.42 | (in) | Length to load from right | = L-(a+b) |
| $\mathbf{R_1}$ | 2,797 | (lb) | Left reaction | = (wb/2L)(2c+b) |
| $\mathbf{R_2}$ | 2,303 | (lb) | Right reaction | = (wb/2L)(2a+b) |
| $\mathbf{F'_v}$ | 170 | (psi) | Allowable shear stress | [See above] |
| $\mathbf{f_v}$ | 133 | (psi) | Actual shear stress | $= 3R_{max}/2A$ |
| **U** | ***0.78*** | | Shear unity | $= F'_v/f_v$ |

**Check Bearing:**

Conservatively assume a full wheel load on the stringer/steel beam contact surface

| | | | | |
|---|---|---|---|---|
| $\mathbf{A_b}$ | 94.54 | ($in^2$) | Bearing Area | $= bb_s$ |
| $\mathbf{F'_{c,perp}}$ | 379 | (psi) | Allowable bearing stress | [See above] |
| $\mathbf{f_{c,perp}}$ | 90 | (psi) | Actual bearing stress | $= p_t$ |
| **U** | ***0.24*** | | Bearing unity | $= F'_b/f_b$ |

| | | | |
|---|---|---|---|
| Project: | Pickett Mountain Mine Site | | |
| Job #: | 3617227547 | | |
| Created by: | J Walker | Date: | 7/25/2022 |
| Checked by: | | Date: | |

**Wood E&IS**
511 Congress Street
Portland, ME 04101
1-207-775-5401

## Steel Beam

### Notes:

1. Design bridge for 80,000 lb Semi End-Dump truck with a total of (5) axles
2. Steel beams support stringers and are spaced at approximately 33" o.c.
3. Based on bridge cross section, an entire wheel line can be located directly over steel beam
4. Conservatively design steel beam for full wheel line (i.e. no transverse load distribution)
5. Consider steel beams as not laterally supported by wood framing
6. Consider impact forces for steel members

### Design Information:

| | | | | |
|---|---|---|---|---|
| **L** | 22 | (ft) | Beam span | |
| **I** | 0.300 | | Impact factor | = 50/(L+125) ≤ 0.3 |

| | **P** (lb) | **P+I** (lb) |
|---|---|---|
| **Front** | 6,000 | 7,800 |
| **Tandem** | 8,500 | 11,050 |

| | **Stress** (psi) | $C_{fu}$ | $C_m$ | $C_v$ | **Adjusted** (psi) | |
|---|---|---|---|---|---|---|
| $F_{c,perp}$ | 565 | | 0.67 | | 379 | Bearing |

| | | | |
|---|---|---|---|
| $b_f$ | 12 | (in) | Beam flange width |
| $b_w$ | 7.875 | (in) | Bearing plate width |

### Check Beam:

Maximum moment will occur with tandem pair of axles centered on midspan, or tandem pair with one axle at midspan

Maximum shear will occur with a tandem pair of axles at one end of bridge, and front axle on bridge

***See attached ENERCALC sheets for beam analysis, W12x65's are acceptable***

### Check Bearing:

| | | | | |
|---|---|---|---|---|
| $R_{max}$ | 22,210 | (lb) | Maximum end reaction | [See ENERCALC output] |
| $A_b$ | 94.50 | ($in^2$) | Bearing Area | = $bb_s$ |
| $F'_{c,perp}$ | 379 | (psi) | Allowable bearing stress | [See above] |
| $f_{c,perp}$ | 235 | (psi) | Actual bearing stress | = $p_t$ |
| **U** | ***0.62*** | | Bearing unity | = $F'_b/f_b$ |

Project Title: Pickett Mountain Mine Site
Engineer: J Walker
Project ID: 3617227547
Project Descr: Access Road Bridge

Printed: 26 JUL 2022, 11:05AM

# Steel Beam

File: Bridge Beam.ec6

Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24

Lic. # : KW-06010382 WOOD GROUP, USA, INC.

DESCRIPTION: Bridge Beam - Max Moment #1

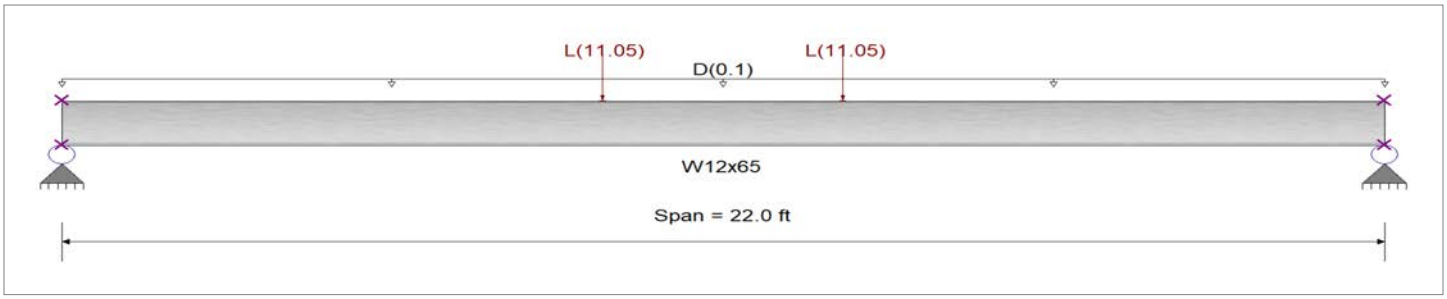
## CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, CBC 2013, ASCE 7-10
Load Combination Set : ASCE 7-16

### Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi




### Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : L = 11.050 k @ 9.0 ft, (Front Axle)

Point Load : L = 11.050 k @ 13.0 ft

Uniform Load : D = 0.0250 ksf, Tributary Width = 4.0 ft

## DESIGN SUMMARY

**Design OK**

| | | | |
|---|---|---|---|
| Maximum Bending Stress Ratio = | 0.462 : 1 | Maximum Shear Stress Ratio = | 0.136 : 1 |
| Section used for this span | W12x65 | Section used for this span | W12x65 |
| Ma : Applied | 109.433 k-ft | Va : Applied | 12.865 k |
| Mn / Omega : Allowable | 237.004 k-ft | Vn/Omega : Allowable | 94.380 k |
| Load Combination | +D+L | Load Combination | +D+L |
| Location of maximum on span | 11.000 ft | Location of maximum on span | 0.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |

Maximum Deflection

| | | | |
|---|---|---|---|
| Max Downward Transient Deflection | 0.524 in | Ratio = | 503 >=360 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <360 |
| Max Downward Total Deflection | 0.581 in | Ratio = | 454 >=180 |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <180 |

### Maximum Forces & Stresses for Load Combinations

| Load Combination | | Max Stress Ratios | | Summary of Moment Values | | | | | | | Summary of Shear Values | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Segment Length | Span # | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| D Only | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.044 | 0.019 | 9.98 | | 9.98 | 380.84 | 228.05 | 1.14 | 1.00 | 1.82 | 141.57 | 94.38 |
| +D+L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.462 | 0.136 | 109.43 | | 109.43 | 395.80 | 237.00 | 1.22 | 1.00 | 12.87 | 141.57 | 94.38 |
| +D+0.750L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.357 | 0.107 | 84.57 | | 84.57 | 395.80 | 237.00 | 1.22 | 1.00 | 10.10 | 141.57 | 94.38 |
| +0.60D | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.026 | 0.012 | 5.99 | | 5.99 | 380.84 | 228.05 | 1.14 | 1.00 | 1.09 | 141.57 | 94.38 |

### Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|---|---|---|---|---|---|---|
| +D+L | 1 | 0.5813 | 11.063 | | 0.0000 | 0.000 |

### Vertical Reactions

Support notation : Far left is #1 Values in KIPS

| Load Combination | Support 1 | Support 2 |
|---|---|---|
| Overall MAXimum | 12.865 | 12.865 |
| Overall MINimum | 1.089 | 1.089 |

# Steel Beam


Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24


DESCRIPTION: Bridge Beam - Max Moment #1

## Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|---|---|---|
| D Only | 1.815 | 1.815 |
| +D+L | 12.865 | 12.865 |
| +D+0.750L | 10.103 | 10.103 |
| +0.60D | 1.089 | 1.089 |
| L Only | 11.050 | 11.050 |

Project Title: Pickett Mountain Mine Site
Engineer: J Walker
Project ID: 3617227547
Project Descr: Access Road Bridge

Printed: 26 JUL 2022, 11:05AM

# Steel Beam

File: Bridge Beam.ec6

Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24

Lic. # : KW-06010382 WOOD GROUP, USA, INC.

DESCRIPTION: Bridge Beam - Max Moment #2

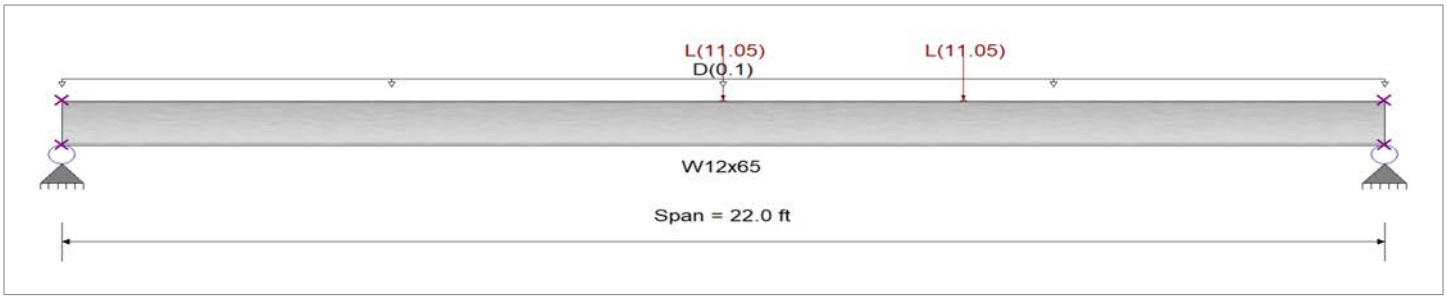
## CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, CBC 2013, ASCE 7-10
Load Combination Set : ASCE 7-16

### Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi




### Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load(s) for Span Number 1
Point Load : L = 11.050 k @ 11.0 ft, (Front Axle)

Point Load : L = 11.050 k @ 15.0 ft

Uniform Load : D = 0.0250 ksf, Tributary Width = 4.0 ft

## DESIGN SUMMARY

**Design OK**

| | | | |
|---|---|---|---|
| Maximum Bending Stress Ratio = | 0.462 : 1 | Maximum Shear Stress Ratio = | 0.158 : 1 |
| Section used for this span | W12x65 | Section used for this span | W12x65 |
| Ma : Applied | 109.433 k-ft | Va : Applied | 14.874 k |
| Mn / Omega : Allowable | 237.004 k-ft | Vn/Omega : Allowable | 94.380 k |
| Load Combination | +D+L | Load Combination | +D+L |
| Location of maximum on span | 11.000 ft | Location of maximum on span | 22.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |

Maximum Deflection

| | | | |
|---|---|---|---|
| Max Downward Transient Deflection | 0.503 in | Ratio = | 524 >=360 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <360 |
| Max Downward Total Deflection | 0.560 in | Ratio = | 472 >=180 |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <180 |

### Maximum Forces & Stresses for Load Combinations

| Load Combination | | Max Stress Ratios | | Summary of Moment Values | | | | | | | Summary of Shear Values | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Segment Length | Span # | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| D Only | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.044 | 0.019 | 9.98 | | 9.98 | 380.84 | 228.05 | 1.14 | 1.00 | 1.82 | 141.57 | 94.38 |
| +D+L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.462 | 0.158 | 109.43 | | 109.43 | 395.80 | 237.00 | 1.22 | 1.00 | 14.87 | 141.57 | 94.38 |
| +D+0.750L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.357 | 0.123 | 84.57 | | 84.57 | 395.80 | 237.00 | 1.22 | 1.00 | 11.61 | 141.57 | 94.38 |
| +0.60D | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.026 | 0.012 | 5.99 | | 5.99 | 380.84 | 228.05 | 1.14 | 1.00 | 1.09 | 141.57 | 94.38 |

### Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|---|---|---|---|---|---|---|
| +D+L | 1 | 0.5598 | 11.440 | | 0.0000 | 0.000 |

### Vertical Reactions

Support notation : Far left is #1 Values in KIPS

| Load Combination | Support 1 | Support 2 |
|---|---|---|
| Overall MAXimum | 10.856 | 14.874 |
| Overall MINimum | 1.089 | 1.089 |

DESCRIPTION: Bridge Beam - Max Moment #2

## Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|---|---|---|
| D Only | 1.815 | 1.815 |
| +D+L | 10.856 | 14.874 |
| +D+0.750L | 8.596 | 11.609 |
| +0.60D | 1.089 | 1.089 |
| L Only | 9.041 | 13.059 |

Project Title: Pickett Mountain Mine Site
Engineer: J Walker
Project ID: 3617227547
Project Descr: Access Road Bridge

Printed: 26 JUL 2022, 11:05AM

# Steel Beam

File: Bridge Beam.ec6

Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24

Lic. # : KW-06010382 WOOD GROUP, USA, INC.

DESCRIPTION: Bridge Beam - Max Shear

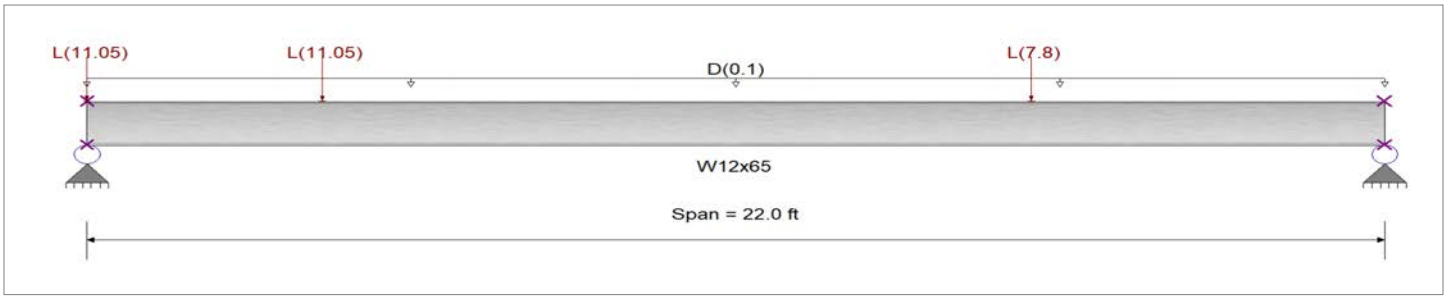
## CODE REFERENCES

Calculations per AISC 360-10, IBC 2012, CBC 2013, ASCE 7-10
Load Combination Set : ASCE 7-16

### Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi




### Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0250 ksf, Tributary Width = 4.0 ft

Point Load : L = 11.050 k @ 0.010 ft

Point Load : L = 11.050 k @ 4.0 ft

Point Load : L = 7.80 k @ 16.0 ft

## DESIGN SUMMARY

**Design OK**

| | | | |
|---|---|---|---|
| Maximum Bending Stress Ratio = | 0.266 : 1 | Maximum Shear Stress Ratio = | 0.255 : 1 |
| Section used for this span | W12x65 | Section used for this span | W12x65 |
| Ma : Applied | 55.577 k-ft | Va : Applied | 24.028 k |
| Mn / Omega : Allowable | 208.573 k-ft | Vn/Omega : Allowable | 94.380 k |
| Load Combination | +D+L | Load Combination | +D+L |
| Location of maximum on span | 11.691 ft | Location of maximum on span | 0.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |

Maximum Deflection

| | | | |
|---|---|---|---|
| Max Downward Transient Deflection | 0.287 in | Ratio = | 918 >=360 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <360 |
| Max Downward Total Deflection | 0.344 in | Ratio = | 768 >=180 |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <180 |

### Maximum Forces & Stresses for Load Combinations

| Load Combination | | Max Stress Ratios | | Summary of Moment Values | | | | | | | Summary of Shear Values | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Segment Length | Span # | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| D Only | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.044 | 0.019 | 9.98 | | 9.98 | 380.84 | 228.05 | 1.14 | 1.00 | 1.82 | 141.57 | 94.38 |
| +D+L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.266 | 0.255 | 55.58 | | 55.58 | 348.32 | 208.57 | 1.04 | 1.00 | 24.03 | 141.57 | 94.38 |
| +D+0.750L | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.211 | 0.196 | 44.17 | | 44.17 | 349.99 | 209.58 | 1.04 | 1.00 | 18.47 | 141.57 | 94.38 |
| +0.60D | | | | | | | | | | | | | |
| Dsgn. L = 22.00 ft | 1 | 0.026 | 0.012 | 5.99 | | 5.99 | 380.84 | 228.05 | 1.14 | 1.00 | 1.09 | 141.57 | 94.38 |

### Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|---|---|---|---|---|---|---|
| +D+L | 1 | 0.3438 | 10.937 | | 0.0000 | 0.000 |

# Steel Beam


Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24


DESCRIPTION: Bridge Beam - Max Shear

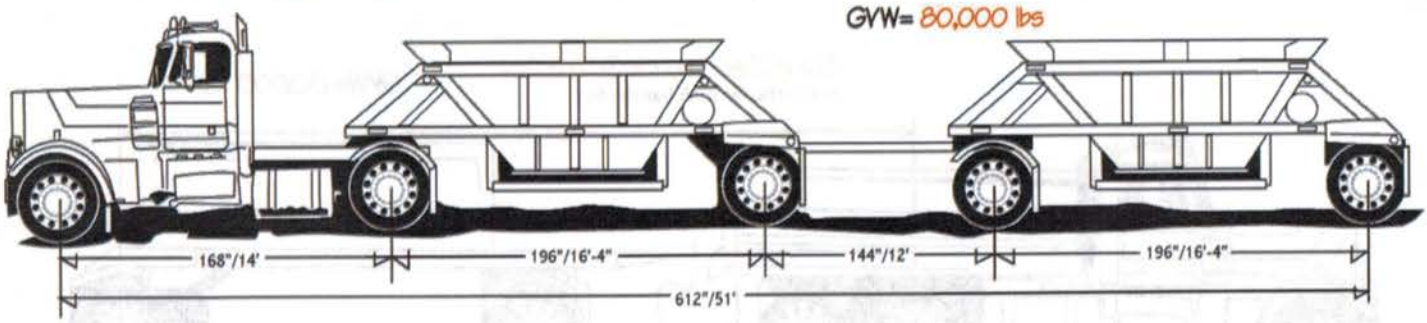
## Vertical Reactions

Support notation : Far left is #1

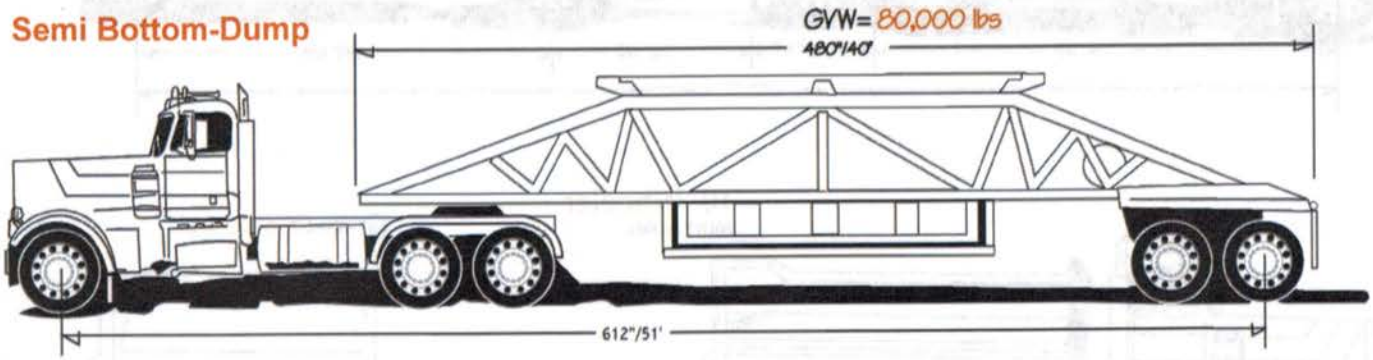
Values in KIPS

| Load Combination | Support 1 | Support 2 |
|---|---|---|
| Overall MAXimum | 24.028 | 9.502 |
| Overall MINimum | 1.089 | 1.089 |
| D Only | 1.815 | 1.815 |
| +D+L | 24.028 | 9.502 |
| +D+0.750L | 18.475 | 7.580 |
| +0.60D | 1.089 | 1.089 |
| L Only | 22.213 | 7.687 |

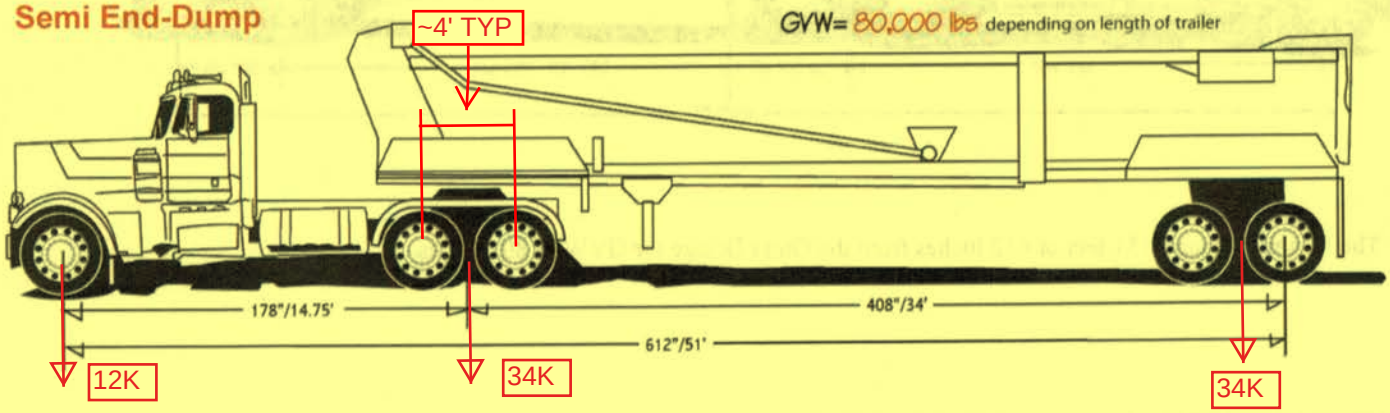
## Double-Bottom Dumps



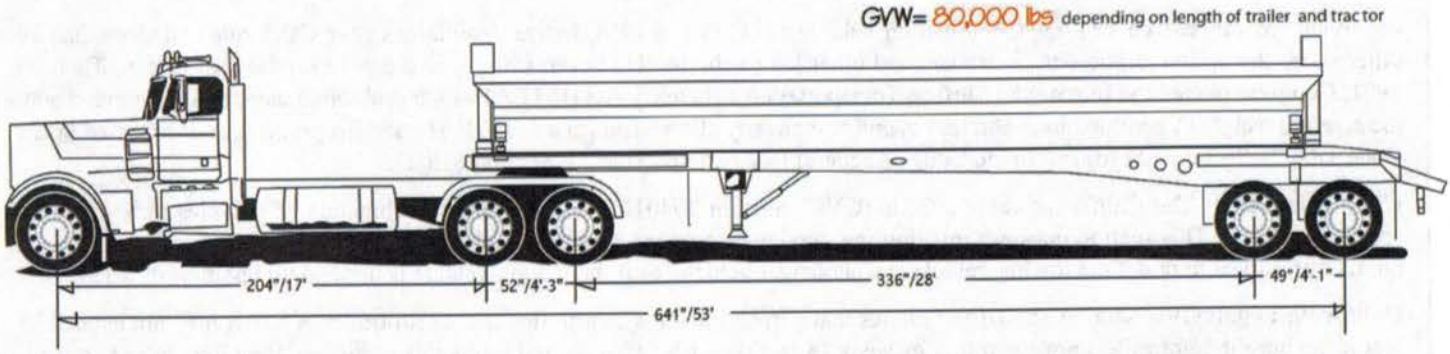

## Semi Bottom-Dump




## Semi End-Dump




## Semi Side-Dump




Note: The Minimum length: 51 feet or 612 inches, Maximum Overall length: 65 feet or 780 inches from the Outer Bridge.

***Source on trailer and tractor configuration:***

**Greg Dineen - Greg Dineen and Associates** - *www.h-e-r-o.org*
**Mark Sturdevant - LA Freightliner, Fontana CA.** - *www.lafreightliner.com/FL_locations_IE.html*
**Rick Lawrence - Smith Co. Side-Dumps Trailers** - *www.sidedump.com*
**Jay Pocock - Superior Trailer Works** - *www.superiortrailerworks.com*
**Keith Hill - Rogue Truck Body** - *www.roguetruckbody.com*

**ATTACHMENT C**

**Road Access and Easement to Route 11 in Hersey, Maine from Dean A. Beaupain, Esq.**

Dean A. Beaupain, Esq.

BLOOMER RUSSELL BEAUPAIN

DIRECT LINE (207) 447 4052 EMAIL: DEAN@BLOOMERRUSSELL.COM

March 17, 2020

Ron Little
President and CEO
Wolfden Mt. Chase LLC
101 Gardner Street
Patten, Maine 04765

Re: Woldfen T6 T6 Road Access and Easement to Route 11 in Hersey, Maine
Our File No.: 0008/2653

Dear Ron:

As you know, I represent Herbert C. Haynes, Inc., and Lakeville Shores, Inc., concerning the property owned by those companies in Moro and Hersey.

My clients' property is bordered on the west by the property owned by Wolfden Mt. Chase LLC in T6 R6 and the access to your property is a road system crossing my clients' land from Route 11in the northwest corner of Hersey.

The purpose of this letter is to confirm that your company has permission from Herbert C. Haynes, Inc., and Lakeville Shores, Inc., to access your property over the road system and to provide utilities as well if that should become necessary.

I further confirm that my clients have agreed to convey an easement to Wolfden for access and utilities over their property, the easement is being drafted and I expect the easement to be executed and recorded in the registry of deeds within the next 30 days which will give you formal deeded access over my clients' property to your company's property. The location of the easement is shown on the attached exhibit which has been prepared for attachment to the formal easement.

Cordially,

Dean A. Beaupain

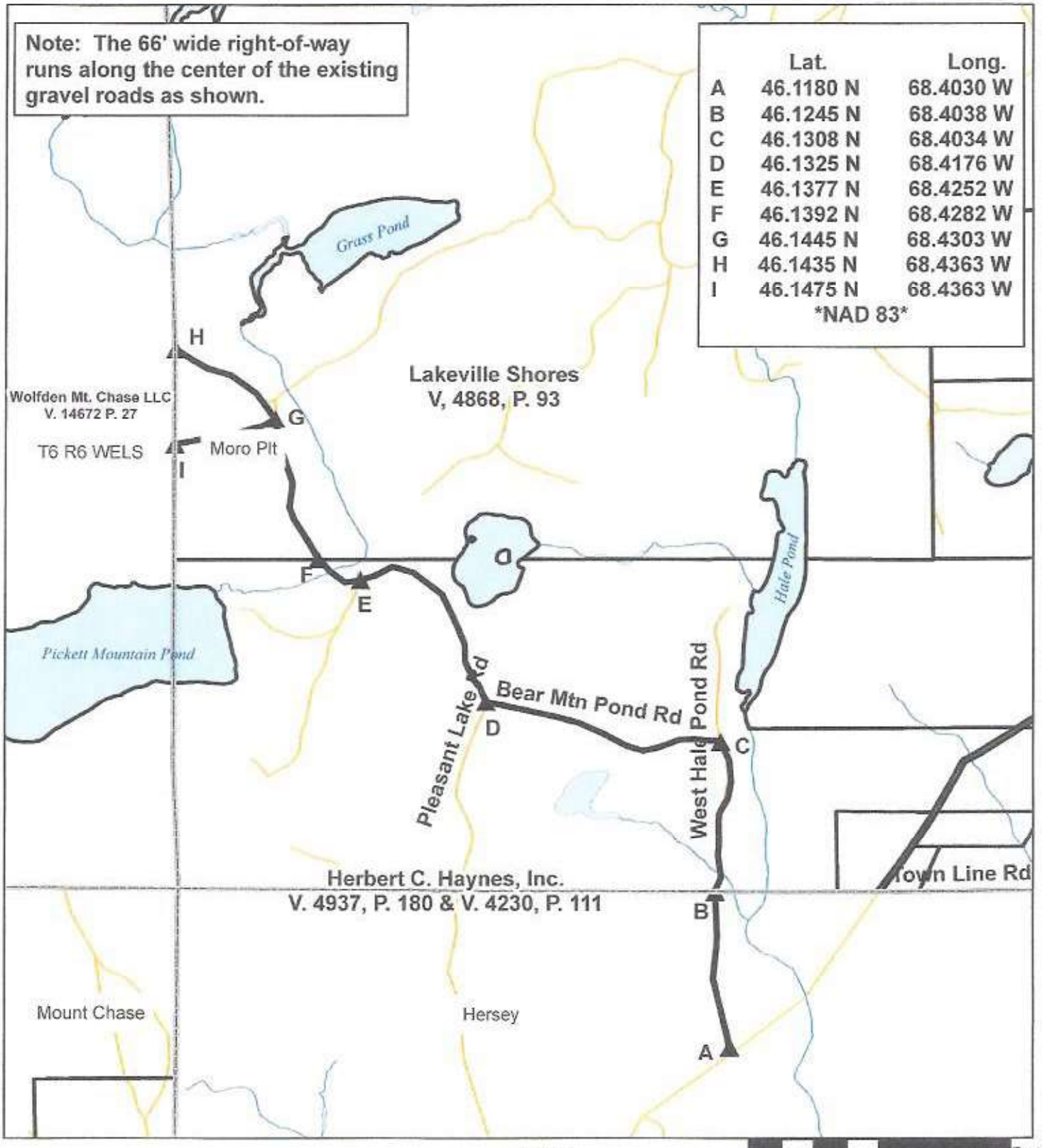
Bangor
175 Exchange Street, Ste. 200
Bangor, ME 04401
Tel. 207.942.7110
Fax. 866.764.6952

Millinocket
96 Central Street
Millinocket, ME 04462
Tel. 207.723.9793
Fax. 207.723.6447

Houlton
77 Main Street
Houlton, ME 04730
Tel. 207.521.5220
Fax. 207.521.5225

bloomerrussellbeaupain.com

# Exhibit A




| | Lat. | Long. |
|---|---|---|
| A | 46.1180 N | 68.4030 W |
| B | 46.1245 N | 68.4038 W |
| C | 46.1308 N | 68.4034 W |
| D | 46.1325 N | 68.4176 W |
| E | 46.1377 N | 68.4252 W |
| F | 46.1392 N | 68.4282 W |
| G | 46.1445 N | 68.4303 W |
| H | 46.1435 N | 68.4363 W |
| I | 46.1475 N | 68.4363 W |

*NAD 83*

1:24,000

Feet
0 1,000 2,000 4,000
1 inch = 2,000 feet

N W E S

# T6-R6 Wels ROW

Drawn By: Bruce Stevens
January 23, 2020

Document Path: C:\BSTEVENS\Maps 2020\T6-R6 WELS Wolfden ROW.mxd

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 21-B: MDOT Correspondence

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
REGION 5
41 RICE STREET
PRESQUE ISLE, MAINE 04769-2259

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

December 14, 2022

Alex Pries
Environmental Scientist/Project Manager
Stantec
5 Dartmouth Drive Suite 200
Auburn NH 03032-3984

Dear Mr. Pries:

This letter is in response to the Technical Memorandum regarding the Pickett Mountain Mine Site – Traffic and Transportation Routes developed by WSP and dated October 14, 2022 and submitted by you on November 18, 2022. The memorandum has been reviewed by MaineDOT and we offer the following information to assist with your project needs.

MaineDOT reviewed the proposed entrance for the Pickett Mountain Access Road. The location has been described as the intersection of Hale Pond Rd. and Rte. 11 in Hersey near GPS Coordinates 46.117830, -68.402970. Due to the amount of additional vehicle trips proposed for the existing access road, a MaineDOT Permit would be required. The type of permit would depend on the additional traffic volume generated by the proposed development. The preliminary traffic volumes provided, suggest that an entrance permit would be required and the threshold for a traffic movement permit wouldn't be exceeded. Also, based on the provided traffic volumes, the Department would require some mitigation to maintain safety and mobility in the vicinity of the Rte. 11 intersection. Intersection geometry improvements, the need for acceleration and deceleration lanes, along with drainage and signage needs are mitigation features that MaineDOT would find necessary at this location.

MaineDOT also reviewed the haul route options. The proposed volumes along the haul route don't suggest that significant roadway impacts would extend further than the Hale Pond Rd./Rte. 11 intersection for any of the options. An entrance permit may also be required for the processing facility.

Hopefully, this information will support your needs. Please contact us if you have any questions.

Sincerely,

Ray DeMerchant, P.E.
Region Traffic Engineer

# EXHIBIT 22.0 SITE ACCESS/LEGAL RIGHT OF ACCESS

Starting with the closest public road (Route 11), **Table 22-1** provides information about each existing road that will be used to access the area proposed for rezoning. There are no limitations on access/egress for roads documented below. **Exhibit 3 Attachment 3-B - Easement** presents the easement granting Wolfden access to their property from H.C. Haynes. and Lakeville Shores Inc.

### Table 22-1: Roads Used for Project Access

| Road Name | Public or Private (if Private, complete rest of the ROW) | Owner Name | Length and Travel Width of Road | ROW Width | Type of Wearing Surface |
|---|---|---|---|---|---|
| Unnamed | Private | Wolfden Mount Chase LLC | 1.12 miles<br>15–25 ft | NA | Gravel |
| Pleasant Lake Road, Bear Mountain Pond Road, Hale Pond Road | Private | Herbert C. Haynes Inc. and Lakeville Shores, Inc. | 3.35 miles<br>15–25 ft | 66 ft | Gravel |

Key: ft = feet; NA = not applicable' row = right of way

# EXHIBIT 22 FIGURES

Not Applicable

# EXHIBIT 22 ATTACHMENTS

Not Applicable

# EXHIBIT 23.0 SOIL SUITABILITY

A soil suitability evaluation was conducted by Atlantic Resources Consultants and Wood based on data collected in the field in 2020 and 2022. The detailed soils report, including a January 2023 addendum evaluating irrigation disposal methods, is provided as **Attachment 23-A** and includes Project Area soil descriptions and soil suitability standard engineering and construction practices. **Figure 23-1** provides available low intensity soil information for the Project Area. More detailed soil mapping and hydrogeologic characterization will be required to design monitoring systems, determine an appropriate location for a domestic wastewater septic field, and to prepare final design of the WRAs for re-injection of treated water back to groundwater. These detailed studies will be implemented as part of the baseline and background studies under MDEP Chapter 200 to support the final design of the above ground facilities. MDEP Chapter 200 requires a study documenting soils and other surficial deposits present, including descriptions of type, extent, thickness, and physical and chemical properties.

The soil assessment of the Project Area showed a mix of soil types and suitability. Generally suitable soils or soils with limited suitability dominate with suitable areas generally located on the better drained, deeper soils. The soil limitations observed include the shallow bedrock conditions, and areas with a seasonal high-water table. Areas of steep slopes, greater than 20% occur in small amounts as part of the landscape and are avoided. Areas with a high-water table include jurisdictional wetlands and the lower slope positions with somewhat poorly drained soils and oxy-aquic conditions are also present and are avoided.

The presence of limitations from the soils here can be overcome with thoughtful planning, careful siting, and the use of the design and construction approaches for the infrastructure discussed in the soils report (**Attachment 23-A**). The current design of the Pickett Mine development addresses potential soil limitations. The concept layout and design integrates the engineering methods and practices recommended in the soil evaluation to identify and address any potential limitations posed by the soil conditions. Maintaining the natural groundwater flow through the Site, avoiding unnecessary surface disturbance and activities during wet weather and spring conditions will help minimize the impacts during construction.

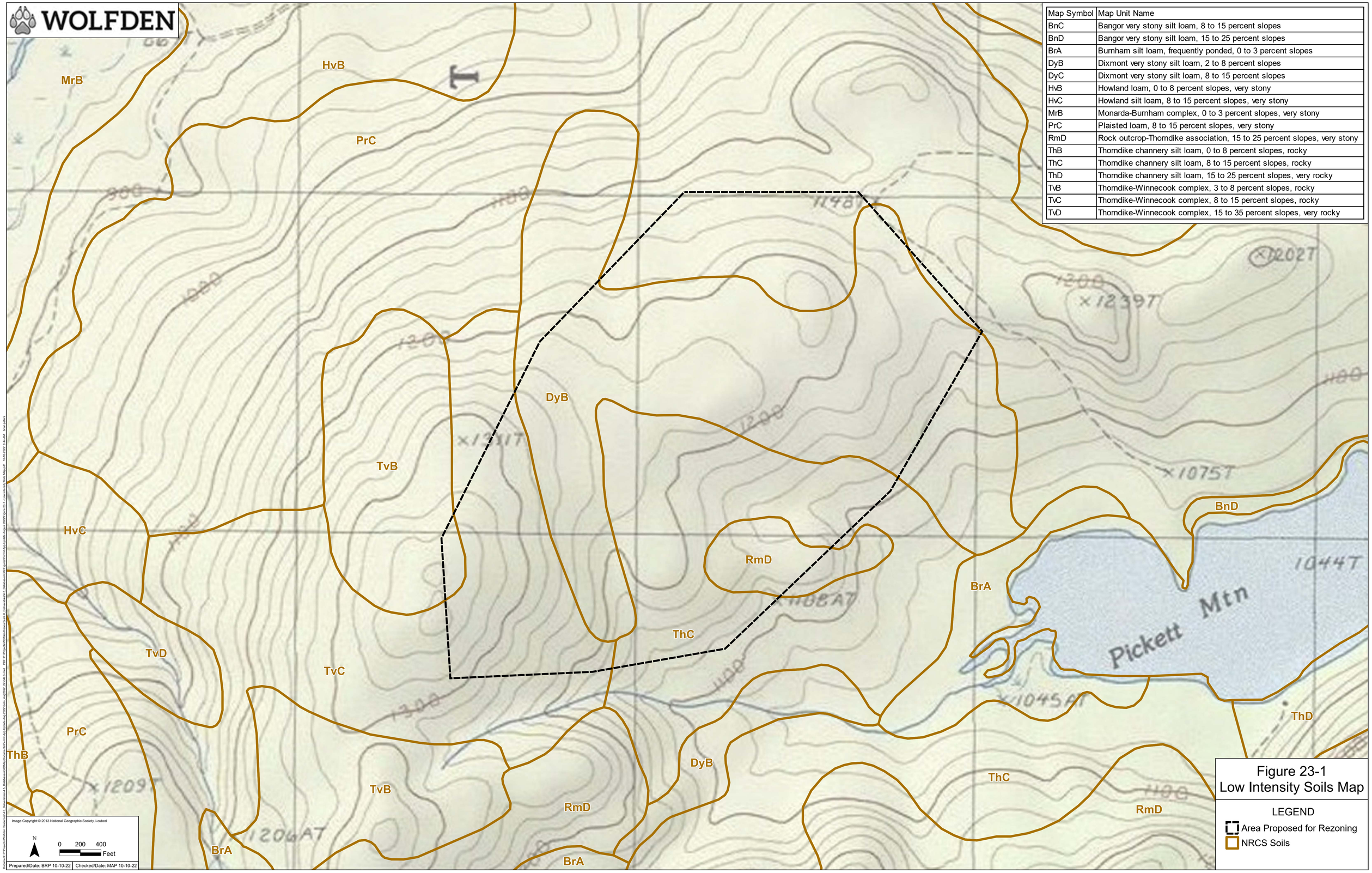
Prior to any development and to support permitting, more detailed surveys will be needed to better identify the most appropriate areas for Site specific development to occur. Ultimately, the nature of the mining operation requires the siting of facilities and infrastructure near the mineral resources. This will require, in some areas, design and construction methods to deal with the limited soil suitability conditions that occur. The conceptual layout maintains the natural groundwater flow through the site, minimizes blasting, limits development in soil areas with a seasonal high-water table and avoids the most unsuitable soil areas with wetlands and steep slopes. The Project site layout does not require blasting for construction of infrastructure, water collection ponds, or pads.

# EXHIBIT 23 FIGURES

Figure 23-1: Low Intensity Soils Map

# EXHIBIT 23 ATTACHMENTS

Attachment 23-A: Soil Suitability Report




| Map Symbol | Map Unit Name |
|---|---|
| BnC | Bangor very stony silt loam, 8 to 15 percent slopes |
| BnD | Bangor very stony silt loam, 15 to 25 percent slopes |
| BrA | Burnham silt loam, frequently ponded, 0 to 3 percent slopes |
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes |
| DyC | Dixmont very stony silt loam, 8 to 15 percent slopes |
| HvB | Howland loam, 0 to 8 percent slopes, very stony |
| HvC | Howland silt loam, 8 to 15 percent slopes, very stony |
| MrB | Monarda-Burnham complex, 0 to 3 percent slopes, very stony |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony |
| ThB | Thorndike channery silt loam, 0 to 8 percent slopes, rocky |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky |
| ThD | Thorndike channery silt loam, 15 to 25 percent slopes, very rocky |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky |
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky |
| TvD | Thorndike-Winnecook complex, 15 to 35 percent slopes, very rocky |

Figure 23-1
Low Intensity Soils Map

LEGEND
Area Proposed for Rezoning
NRCS Soils

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 23-A: Soil Suitability Report

# WATERSHED RESOURCE CONSULTANTS, LLC

## NATURAL RESOURCE AND SOIL SCIENCE CONSULTING

**TECHNICAL MEMORANDUM:**

**SOIL SUITABILITY EVALUATION FOR ADDITIONAL WASTEWATER TREATMENT ALTERNATIVES**

**To:** Alex Pries, Project Manager, Stantec

**From:** Roger St. Amand, CSS

**Date:** January 11, 2023

**Introduction:**

As requested, Watershed Resource Consultants, LLC (WRC) has provided this technical memorandum to the September 2022 "Soil Suitability Evaluation for Wolfden Mt. Chase Pickett Mountain Project" report. The purpose of the memorandum is to address the soil suitability for alternative methods proposed for the treatment of process wastewater identified in the initial Soil Suitability Evaluation report.

**Background:**

The 2022 Soil Suitability Evaluation identified a range of soil types and suitability conditions for development. The report reviewed the general soil suitability for the mining operation, including the recharge of treated water using infiltration galleries (IG). Previously, infiltration galleries or "IG" s were reviewed as the sole method to recharge treated water, also called "process wastewater" in the original reports. Based on comments from LUPC, other alternatives are now being considered to recharge treated water.

**Review of Additional Methods of Water Treatment:**

Based on site reviews and in response to comments from LUPC staff, Wolfden is considering the following additional alternatives to recharge treated water. WRC has reviewed the Sevee and Maher Engineers (SME) report entitled "Water Management and the Pickett Mountain Mine Site" dated December 19, 2022. The report reviewed three alternative wastewater disposal approaches that could be employed in addition to IGs. These include drip irrigation, spray irrigation and snow making, collectively called here "irrigation disposal" methods, as options to re-introduce treated water to the watershed. The SME report included a discussion of the potential application rates based on the soil conditions to treat process wastewater and recharge water to the site. The report indicated that these additional technologies were feasible for use at the site and might require between 15 to 30 acres of disposal areas. SME identified over 60 acres in eight areas of the Site that could be considered. WRC reviewed these alternatives in conjunction with the 2022 soil suitability report.

Spray irrigation and snow making and to a lesser extent drip irrigation take advantage of the natural soil profiles, organic layers and vegetation. These natural processes maximize use of the soil structure for infiltration, evaporation and evapotranspiration processes and could allow the recharge of treated water in areas that might be limiting for IGs. Additional soil considerations for the irrigation disposal technologies include siting recharge areas where the topographical surface is gentle to moderately sloping

**Bar Harbor Office**
1366 State Highway 102, #6
Bar harbor, ME 04609
(207) 944-7288

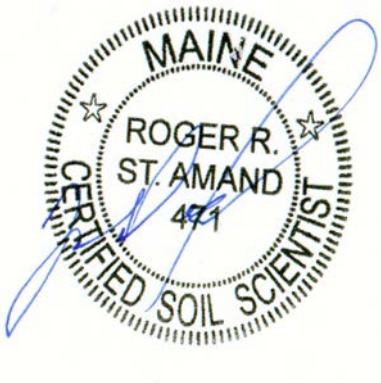
**Orrington Office**
P.O. Box 145
Orrington, ME 04474
(207) 385-6056

(less than 15%) with slope shapes that are level to convex and avoiding areas of concave slopes with drainage channels that might concentrate the runoff. The soil areas identified as being "suitable" or "limited suitability" for IGs in the 2022 report would also be suitable for these additional technologies.

**Summary:**

The addition of irrigation disposal alternatives for treated water recharge allows for additional options that can be employed based on site-specific soil conditions. From a soil suitability perspective, the additional technologies of drip irrigation, spray irrigation and snow making technologies would all be acceptable alternatives to IGs and would fall under the same category when reviewing the report. Areas identified in the 2022 report as suitable for IGs would also generally be suitable candidates for the new alternatives proposed.

Sincerely,




**Roger St. Amand CSS**

**Maine Certified Soil Scientist # 471**

**PRINCIPAL|*WATERSHED RESOURCE CONSULTANTS, LLC***

# SOIL SUITABILITY EVALUATION
# FOR THE
# WOLFDEN- PICKETT MOUNTAIN MINE REZONING PETITION

***Prepared for:***

**WOLFDEN MT. CHASE, LLC**
**1100 Russell Street, Unit 5**
**Ontario, Ca P7B 5N2**

**REVISED SEPTEMBER 2022**

***Prepared by:***

**WSP USA Earth & Environment, Inc.**
**(Formerly Wood Environment and Infrastructure Solutions, Inc.)**
***AND***
**WATERSHED RESOURCE CONSULTANTS, LLC**

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## APPENDICES

Appendix A Maps
Appendix B Soil Test Pit logs
Appendix C NRCS Soil Survey
Appendix D Site Photographs
Appendix E Engineering Details

## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ARC | Atlantic Resource Co. LLC |
| BMP | Best Management Practices |
| GIS | Geographical Information Systems |
| GPS | Global Positioning System |
| LUPC | Land Use Planning Commission |
| MEDEP | Maine Department of Environmental Protection |
| MSWR | Maine Subsurface Wastewater Disposal Rules |
| NRCS | Natural Resources Conservation Service |
| Site | Pickett Mountain Project Area |
| SPR | NRCS publication "Soil Potential Rating for Low Density Development in the Unorganized Areas of Maine" |
| TMF | Tailings Management Facility |
| TSF | Tailings Storage Facility |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |
| Wolfden | Wolfden Mt. Chase, LLC |
| Wood | Wood Environment and Infrastructure Solutions, Inc. |
| WSP | WSP Earth & Environment, Inc. |
| WRC | Watershed Resource Consultants, LLC |
| WSS | Web Soil Survey |
| WTP | Water Treatment Plant |

# 1.0 INTRODUCTION

Watershed Resource Consultants, LLC (WRC) in consultation with WSP Earth & Environment, Inc. (WSP) (formerly Wood Environment and Infrastructure Solutions, Inc. [Wood]) has completed a general soil suitability review to support the Land Use Planning Commission (LUPC) Rezoning Petition for the Wolfden Mt. Chase, LLC (Wolfden) Pickett Mountain Mine project. The Pickett Mountain project area (Site) is in Township T6-R6 WELS in Penobscot County, approximately 9 miles north of the town of Patten, Maine (see Figure 1). Wolfden is submitting a new petition application for a mine only option to the Maine Land Use Planning Commission (LUPC) to rezone approximately 374 acres from General Management to a Planned Development Subdistrict. This rezoning process is the first step in the review process for the permitting and development of a potential mining operation.

The original 2020 soil suitability report is being revised in 2022 to address changes to the proposed Pickett Mountain Mine Project (Project). Major changes that affect the soil suitability report include:

- Revised project area ;
- Removal of ore rock material processing from T6-R6 WELS;
- Removal of the Tailings Management Facility (TMF) from T6-R6 WELS ; and
- Addition of a solar array.

The field work and soil data collected in 2020 was used to update the report. No additional field work was completed in 2022 for this amendment. The 2020 soils assessment was completed by Roger St. Amand, Certified Soil Scientist (CSS #471) and Principal at Atlantic Resource Co, LLC (ARC). In 2022, ARC merged into a new firm, Watershed Resource Consultants, LLC (WRC) and this report is revised under WRC by the same certified soil scientist[1].

The purpose of this preliminary soil assessment is to provide an overview of the general suitability of the soils present for the proposed mining operation. As part of the rezoning review, the LUPC requires evidence be provided that the soils are generally suitable for the proposed uses in the subdistrict. Specifically, the LUPC requested a soil suitability review for this rezoning application include[2]:

*"…. Soil Suitability, Exhibit J*

*a. Submit evidence supporting the statement that "soils are generally suitable for the proposed project for construction of facilities and the tailings material storage (TMF)" (Exhibit J). This evidence should be a report containing sufficient detail to demonstrate that soils and site conditions are generally*

[1] Watershed Resource Consultants, LLC (WRC) is the result of a consolidation of the natural resource service areas of Burman Land & Tree, LLC (Aleita Burman) and Atlantic Resource Co, LLC (Roger St.Amand). The official start of business date for WRC was April 17, 2022. The fieldwork and some of the reporting work for these services was conducted by Burman Land & Tree, LLC or Atlantic Resource Co, LLC prior to April 17, 2022. Reference to WRC in this report includes information gathered prior to April 17, 2022, by Burman Land & Tree, LLC or Atlantic Resource Co, LLC

[2] 9/11/2020 email from Stacie R. Beyer, Planning Manager, Land Use Planning Commission

*suitable for all allowed uses in the proposed subdistrict. The report should include information on the depth to groundwater, the depth to bedrock, and the slopes in the project area. A field investigation to assess general suitability, based on hand shovel or auger borings, may be used in preparing the soil suitability report provided the method used is well documented in the report.*

b. *If the soil suitability is limited for any proposed uses, include a description of the extent of those limitations (relative percentage of the overall area for redistricting), general location, and how the limitations could be overcome using standard engineering and construction practices. Of particular concern for this site, based on the site visit, are the somewhat poorly drained soils and soils with a shallow oxygenated groundwater table, and what measures could be used to overcome associated limitations to ensure that downgradient ground and surface water hydrology will not be adversely impacted. ....."*

This soil suitability review was based on information and data gathered from a wide range of sources, including existing published Natural Resources Conservation Service (NRCS) soil surveys, LiDAR topography, geotechnical drilling data from past explorations and onsite field review of the soils by certified soil scientists from ARC. The engineering review to overcome soil limitations (**Section 4**) was completed by professional engineers from WSP. The soil suitability assessment was focused on the currently proposed rezone Site.

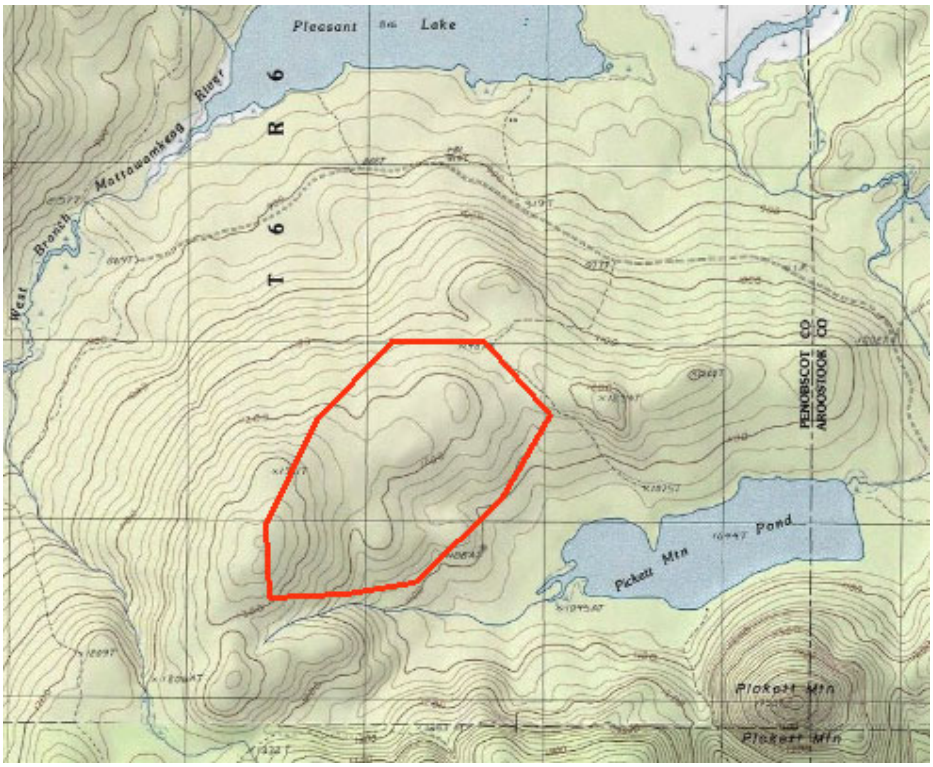



**Figure 1. Wolfden Site Location**

The assessment identified and rated the soil map units within the proposed Site for suitability for the proposed development. This includes development for access roads, buildings, mining operation pads, parking, and laydown areas, and wastewater management and dispersal. This report focuses on the soil criteria portion of the full rezoning application. It is not intended to be a standalone document and should be reviewed in conjunction with the full Rezoning petition submission.

Using the NRCS Soil Potential Ratings and criteria established by LUPC as a starting point the soils were reviewed and rated as *"Generally Suitable", "Limited Suitability"* or *"Unsuitable"* for development potential. The details are described further in **Section 2** Methodology. The "Soil Potential" rating criteria was originally developed to review "low density residential" type development in the unorganized areas of Maine. The soil suitability rating criteria used to generate the ratings, while useful for broad planning of houses, septic systems, and driveways, does not translate directly to a complex site-specific industrial development such as this, so the ratings should be reviewed in context with the proposed development.

The specific soil limitation for a site, such as steepness and wetness are relevant to any development. The original Soil Potential Ratings publication heavily weighted the expense required to address soil limitations for residential development as an indication of soil suitability. Expenses to overcome soil limitations are not as relevant to industrial projects where significant site engineering is being completed anyway. For example, blasting for a foundation may be a major expense for residential lot and the soil would be rated as "unsuitable", where in an industrial development such as this, the blasting and rock removal may be a reasonable cost with a useful material byproduct and not a soil limitation for the proposed use. This scenario highlights the importance of considering soil limitations in context with the intended development.

The suitability ratings are a general assessment of the potential of the soils to have soil conditions suited to the intended use. Soil areas shown as *"Generally Suitable"* have a higher potential of containing suitable soil conditions for the intended use and are the least costly to develop from a soil limitation perspective. Areas shown as *"Limited Suitability"* may have smaller areas of better soil conditions within larger areas of less suitable soils or specific limitations that need to be addressed. *"Unsuitable"* areas have the least likelihood of finding soil conditions suitable for development, and from a soil limitation perspective, are the most expensive to develop and should be avoided when possible. The Soil Evaluation identified a range of soil types and suitability for development. These soil series and site conditions are typical of the region.

# 2.0 METHODOLOGY

## 2.1 General Methodology

This preliminary soil suitability review consisted of two phases, the initial desktop review of published soil information, and onsite field review of the soil conditions. The review is intended to be a broad overview of the soil conditions commensurate with the rezoning process to provide more information than existing published NRCS surveys but it is not a detailed soil survey. If the Site is rezoned, the Chapter 200 permit application under Maine Department of Environmental Protection (MEDEP) will require more detailed information such as a high intensity soil survey. For this review, detailed onsite soil exploration was limited and used to verify general conditions as determined during the desktop review. The proposed mining development program, rezone boundary and a preliminary concept plan (see **Maps in Appendix A**) provided by Wolfden was used as a starting point in the soil suitability review. The various development uses were incorporated into a base plan.

Available data used included:

- Published NRCS Soil Surveys for Penobscot County
- USGS topographical maps and aerial photography
- Web Soil Survey online soils information
- Wolfden overburden and bedrock mapping
- Wolfden geotechnical borings
- LiDAR topography (5' contour interval)
- Onsite wetland and resource delineations

The base information was compiled using Geographical Information Systems (GIS) software, ESRI ArcGIS 10.8 and ArcGIS Pro 2.9. A geographical database was developed that incorporated the available information. The use of a GIS system allowed data from various sources and times to be coordinated and compiled in a comprehensive map for analysis of the Site, proposed development areas soil characteristics, landform and geology.

After reviewing the existing data, a Maine Certified Soil Scientist completed limited onsite field investigations of the Site and examined the soils. Soil scientists completed hand dug test pits, auger borings and field observations in roadcuts and mining explorations throughout the proposed rezoning area to assess the soil conditions. The published data and field information were then compiled in GIS and used to determine the suitability for the intended uses based on the observed soil characteristics.

The assessment of the NRCS soil survey data was informed, in part, by the guidelines under the *LUPC Chapter 10.25.G "Soil Suitability"*. These standards are generally used for permit applications and subdivision review and are not necessarily required by LUPC for a Concept Plan review but do provide a baseline for determining the soil suitability.

In general, soils most suitable for development:

- Are located on moderate to gentle slopes (0-15%);
- Are not shallow to bedrock;
- Do not have a high groundwater table;
- Are not subject to flooding;
- Are not prone to erosion;
- Are not excessively stony; and
- Have suitable textures.

By contrast, soils generally unsuitable for development:

- Are located on steep or very steep slopes (greater than 20%)
- Are shallow to bedrock (less than 10")
- Contain a groundwater table at or near the surface
- Have very stony or bouldery surfaces
- Contain fine textured soils and deep organics or clay horizons.

These criteria were used to develop general suitability ratings for the development area. Existing soil survey information from the NRCS *"Soil Survey of Northern Penobscot County"*, published soil maps and *WebSoil Survey*, the USDA NRCS on-line soil mapping application were used to rate the soils within the proposed Site. The soil ratings were used along with factors such as drainage class, slope, and depth to bedrock to develop a soil suitability rating for the soils. The assessment is an indication of the potential for a given soil map unit to have soil conditions or areas that would be amenable for the intended use.

In general, a conservative approach was taken to assess suitability. For example, in assessing suitable slopes, a 15% slope or "Class C "slope is used as maximum slope, where most development guidelines allow up to 20%. The review also relied on available data from Wolfden, including recent LiDAR topographical contour information to better assess slope conditions. The following classes are used in the maps and throughout the report.

**Soil Suitability Classes**

- **Generally Suitable:**
    - Well and moderately well drained soils (>16" to a water table)
    - Deep or very deep to bedrock. (>40" to bedrock)
    - Slopes less than 15%.

- **Limited Suitability:**
    - Somewhat poorly drained soils (7-16" to a water table)
    - Moderately deep or to bedrock (20-40" to bedrock)
    - Slopes less than 15%.

- **Unsuitable:**
    - Poorly drained or "oxyaquic" soils. (<7" to water table)
    - Shallow to bedrock or soil limiting factor. (<10" to bedrock)
    - Contains hydric soils or mapped wetlands
    - Slopes greater than 15%.

Soils rated as *"Generally Suitable"* have a reasonable likelihood of finding soil conditions conducive to development. Soil areas rated as *"Limited Suitability"* have some limiting factor, such as depth to a seasonal high-water table or bedrock that reduce the potential to find suitable soils or require some engineering to overcome the limitation. For domestic wastewater, this could be soils that include somewhat poorly and moderately well drained soils in the same map unit, or shallow bedrock conditions.

## 2.2 Field Review of Soil Conditions

The desktop NRCS review was supplemented with a field review to assess soil conditions and compare against published data. ARC soil scientists visited the Site and spot-checked existing soil map units using soil augers and hand shovels to confirm NRCS mapping. Over 30 test pits and observations were completed throughout the Site. The field review was conducted in September and October of 2020 while the region was under moderate to severe drought condition. These very dry conditions made assessing soil characteristics challenging. Soil test pit excavations with hand tools was limited to upper soil horizons. The soil field review was enhanced and supplemented using data and field observations gathered in the spring of 2020 during wetland and vernal pool surveys. This additional information was very helpful in analyzing the test pits observed under very dry conditions during fall field review.

The soil series determinations provided here are adequate to identify limiting factors within the upper soil horizons but should be considered preliminary and will require verification with deeper machine dug test pits to document subsoil conditions to confirm soil series. A detailed soil survey or remapping of existing data was not completed for this report.

# 3.0 DISCUSSION

## 3.1 General Site Overview

The project area is situated in northeastern Penobscot County nine miles north of Patten. The land is dominated by commercial forestland. A network of gravel access roads extends through the area and throughout the Site. The topography is dominated by moderate to steep slopes. The lower elevation areas are generally moderately well to poorly drained glacial till soils with inclusions of water-worked and glacio-lacustrine material. The upper slopes are dominated by well drained deep to shallow glacial till soils over bedrock-controlled landforms. Soil textures are generally loam and silt loam.

The proposed mining project development will include access roads, facility and building development, temporary rock and ore storage pads, process and mine wastewater storage and disposal, and domestic wastewater treatment. Refer to the Wolfden Rezoning application for additional details on the Site, region, and proposed development.

## 3.2 NRCS Soil Survey Overview

The primary resources used to assess the existing soil surveys were the *Soil Survey of Penobscot County Maine*, issued October 1963 by the United State Department of Agriculture (USDA) Soil Conservation Service now known as the NRCS; and the NRCS Web Soil Survey (WSS) online database https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. The WSS provides the most up to date and comprehensive information on publicly available soil data. The Penobscot County soil survey was completed in 1963. The soils were generally mapped at a "Class D" level, suitable for broad planning at a scale of 1:20,000 or 1" = 1,667'. The individual map units are commonly 16 to 40 acres in size and often contain two or more soil series within a map unit. The soil assessment and the NRCS soils within the Site detailed on the attached Maps (**Appendix A**) show the areas and soil suitability rating. The NRCS soil survey identified the soils in the project area as dominated by the "Plaisted-Thorndike-Howland Association" soil catena. A "soil catena" or soil association consists of soils with similar parent materials that occur over a repeatable pattern on the landscape. See **Figure 2**. The soil map units are differentiated by slope, soil texture, stoniness, and depth to bedrock and a seasonal high-water table.

| PARENT MATERIAL | SOIL DRAINAGE CLASS | | | | | | |
|---|---|---|---|---|---|---|---|
| Of the soils catena & selected characteristics of the deepest, best drained member | Excessively Drained | Somewhat Excessively Drained | Well Drained | Moderately Well Drained | Somewhat Poorly Drained | Poorly Drained | Very Poorly Drained |
| **A. Soils formed in Glacial Till** | | | | | | | |
| 1. Dark gray fine-grained quartzite, slate, phyllite, metasiltstone and some calcareous sandstone | | | | | | | |
| a. Coarse-loamy soils | | | Bangor / Penquis3 | Dixmont | → | | |
| b. Loamy-skeletal soils | | Thorndike2 | Danforth / Winnecook3 | Shirley | → | | |
| c. Coarse-loamy soils formed in lodgment till w/ >10% clay | | Monson2 | Elliottsville3 | Chesuncook / Ragmuff3 | Telos | Monarda | Burnham |
| d. Coarse-loamy soils formed in lodgment till w/ <10% clay | | | Plaisted# | Howland# | | Monarda | Burnham |
| e. Fine-loamy soils formed in lodgment till | | | | Perham | Daigle | Aurelie | |

**Figure 2. Excerpt of State of Maine Soil Series Catena Table**

The NRCS soil survey describes and identifies the soil map units that are named for the dominant soil type in a particular area and the slope phase. For example, a map unit noted as "**DyB"** indicates the Dixmont soil series are dominant on B slopes (2-8%). The Dixmont ***DyB*** soil map unit contains moderately well drained soils with inclusions of rock outcrops and somewhat poorly drained soils. See **Figure 3**.

cleared silt loams. (Capability unit VIs-3.)

**Dixmont very stony silt loam, 2 to 8 percent slopes** (DyB).—This moderately well drained soil is gently sloping and has medium runoff. It is extensive in the southwestern and central-eastern wings of the county. In stoniness it is similar to the nearly level Dixmont very stony silt loam.

Included with this soil are areas with occasional rock outcrops and areas with poor or very poor drainage where seepage or springs occur. Small, well-drained areas of very stony Bangor silt loam are also included in places.

Although a few stony areas are cleared and used for pasture, this gently sloping soil is generally wooded. It supports good stands of mixed northern hardwoods and conifers—mainly spruce, fir, poplar, birch, maple, white-cedar, and hemlock. In the moderately well drained areas, scattered ash, beech, and white pine also occur. Lumbering can be carried on without difficulty, although the roads may be wet for a time in spring.

This soil is excellent for sawtimber and pulpwood, as a good many kinds of trees grow rapidly. If cleared and cultivated, it can be managed like the Dixmont silt loams on similar slopes. (Capability unit VIs-3.)

**Figure 3. Dixmont soil description from the 1963 NRCS soil survey**

The NRCS Soil Survey of the Site shows three dominant soil series present. These soil series include the following:

- ***Plaisted very stony loam***,
- ***Dixmont very stony silt loam,***
- ***Thorndike very stony silt loam***,

Slope phases are dominated by B (2-8%) and C (8-15%) slopes. Plaisted soil map units make up about 13% of the Site, mostly in the northern section. Plaisted soils are well drained loam glacial till soils. The Plaisted soils as mapped in the 1963 survey included areas of moderately deep to deep bedrock. Today these would be differentiated as the Ragmuff or Elliotsville series. These soil types are rated generally suitable for development.

Dixmont soils make up approximately 45% of the Site and contain both generally suitable and limited suitability soils. See **Figure 3**. When mapped, the Dixmont series include both somewhat poorly drained (Limited Suitability) and moderately well drained (Generally Suitable) soil classes. Soil textures are loams and silt loams. Thorndike soils occur on approximately 24% of the Site and are limited suitability due to the presence of bedrock within 20". The remaining 1% is Rockland- Thorndike that is generally unsuitable due to either steep slopes, or very shallow bedrock conditions. See **Figure 4** and Table 1 below summarizing the soils present.

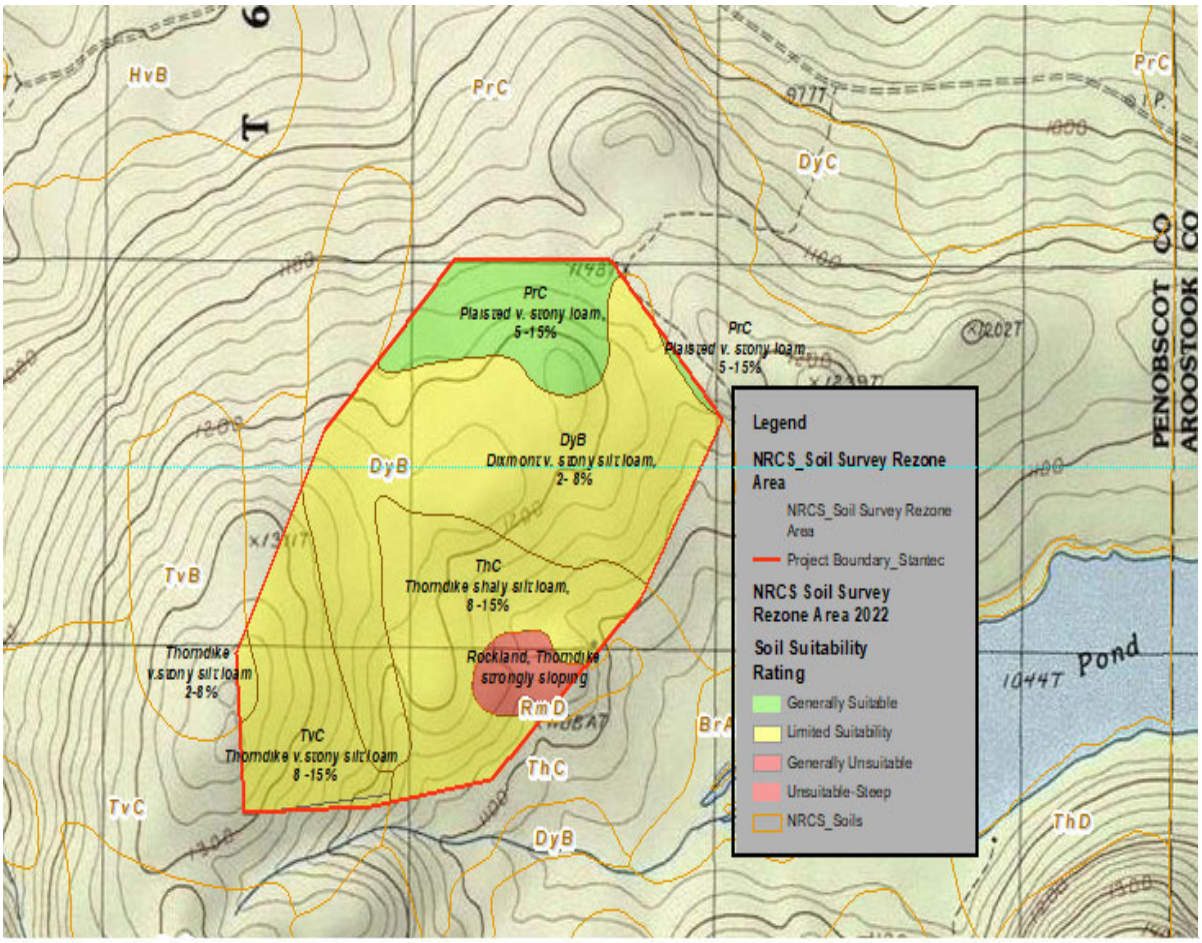



**Figure 4. Published NRCS Soil survey rated for suitability. See Appendix A Map 1**

**Table 1. Summary of soil map unit characteristics from the NRCS Soil Survey**

| | Map Unit | Map Unit | Soil_Suitability | Drainage Class | Acres | PCT |
|---|---|---|---|---|---|---|
| | DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | Limited Suitability | SPD-MWD | 168 | 45% |
| | PrC | Plaisted very stony loam, 5 to 15 percent slopes | Generally Suitable | WD(MWD) | 49 | 13% |
| | RmD | Rockland, thorndike material, strongly sloping | Unsuitable-Steep | SWED | 14 | 04% |
| | ThC | Thorndike shaly silt loam, 8 to 15 percent slopes | Limited Suitability | SWED | 85 | 23% |
| | TvB | Thorndike very stony silt loam, 2 to 8 percent slopes | Limited Suitability | SWED | 3 | 0.8% |
| | TvC | Thorndike very stony silt loam, 8 to 15 percent slopes | Limited Suitability | SWED | 53 | 14% |

The field review found the 1963 NRCS soil survey to be generally representative of the Site conditions, considering the soil series criteria used at the time. The field review showed presence of soil series and soil types that would be classified differently now than what was historically done. See **Section 3.2** for

additional details. Notable differences between published mapping included somewhat poorly drained Telos soils along the northern section at mid and lower slope positions, and Monarda hydric soil in wetlands areas in the central section.

The NRCS Soil map units within these areas were assessed and rated using the "Low Density Residential Development" method which includes onsite wastewater disposal. "Low Density Development" is a term derived from the NRCS publication *"Soil Potential Rating for Low Density Development in the Unorganized Areas of Maine"* (SPR). This document is referenced in LUPC guidelines and rates soil potential for residential development of single-family residences with basements, onsite water and wastewater disposal, and associated gravel roads. While the proposed uses for this area are commercial and industrial, not residential, the same concepts apply. For example, the Site will need roads, wastewater disposal, and foundations and require similar construction activities on the soils. The Soil Potential Ratings do not include a published rating for Plaisted or Dixmont soils. However, similar soils in the region, and the formulas in the SPR publication, were used to establish soil potential ratings. See Table 2. The Soil Potential Rating was supplement with the soil suitability rating based on the criteria described in Section 2.

**Table 2: NRCS Soil Series Mapped in the Rezone Site with NRCS Soil Potential Ratings**

| SOIL SERIES | SOIL POTENTIAL RATING* | Drainage Class | Depth to Bedrock | SUITABILITY |
|---|---|---|---|---|
| **Plaisted** | High | Well drained | Deep | Generally Suitable |
| **Dixmont** | Low/Medium | Moderately well and somewhat poorly drained | moderately deep | Limited Suitability |
| **Thorndike** | Low | Somewhat excessively drained | shallow | Unsuitable |
| **Rockland** | Very Low | Excessively drained | Very shallow | Unsuitable |

* *Soil Potential Rating for Low Density Development in the Unorganized Areas of Maine. USDA NRCS*

## 3.3 Field Review:

In September and October of 2020, a Maine Certified Soil Scientist from ARC completed a field review of the rezoning Site, which was a larger area than the currently proposed Site. Soil Scientists performed transects generally perpendicular to the topography and reviewed the major soil map units within the area. Base maps and Site info data were loaded on submeter Global Positioning System (GPS) units to assist in surveying the Site. A 20-acre grid was overlaid on the Site for siting test pits and establishing consistent coverage. Additional observations were made with the developed areas. Test pits and observations included hand-dug test pits, auger borings, and road cuts or existing excavations. Approximately 30 test pits, dozens of auger borings and many observations were completed throughout the Site and within each of the NRCS Soil map units. Test pits and observations were GPS located and

incorporated into the base mapping to assess the soil conditions, suitability, and compare against the NRCS soil maps. See test pit log summary in **Appendix B.**

The soil types were generally consistent with NRCS mapping. Much of the original Penobscot soil survey contains map units and descriptions that would be classified differently under present day soil taxonomy. The Dixmont soil map units shown on the survey, for example, were mapped in 1963 as both somewhat poorly drained and moderately well drained. Today, these would be split out as moderately well drained Chesuncook and somewhat poorly drained Telos soil series. This soil map unit appeared to be dominated by moderately well drained Chesuncook and somewhat poorly drained Telos soils on mid and lower slope positions, and by Elliottsville and Monson bedrock-controlled soils on upper slopes and ridge tops.

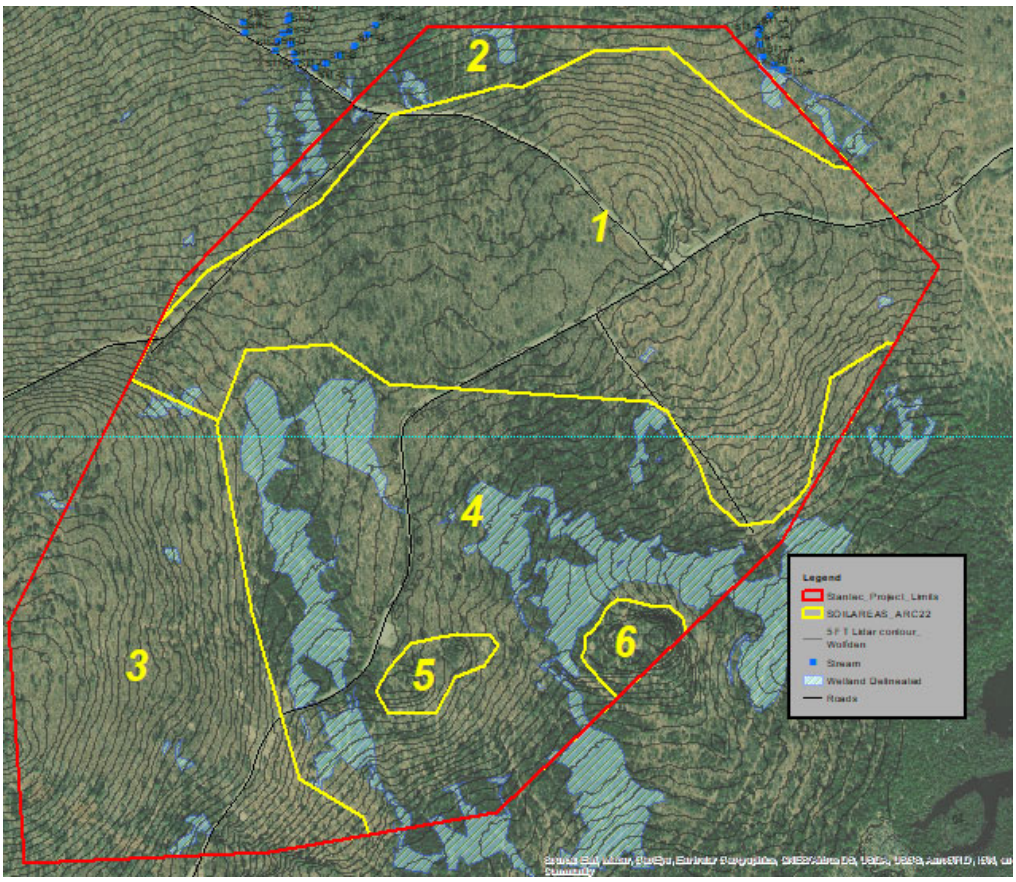



**Figure 5. ARC Soil Suitability Areas within Site. See Appendix A Map 2**

## 3.4 Soil Area Review

Using the published soil survey data, onsite field investigations, as well as available LiDAR data, the Site areas are discussed below. The proposed Site was generally broken out into broad landscape areas with similar soil characteristics for the suitability review. See **Figure 5**. The soil characterization areas are discussed below and include a general overview, general soil conditions observed, and an assessment of the development potential and limitations for each.

**Area 1:** Beginning in the northeast, Area 1 extends from the easterly limit of the Site across to the central area. This approximately 144-acre area is characterized by smooth, convex gentle to moderate slopes at the upper ridge top position. The soils observed were loam and silt loams with a limiting factor of bedrock or restrictive layer at 16″ or greater. The soil drainage is well drained to somewhat excessively drained at upper elevations, and moderately well drained soils with a restrictive layer or over bedrock at mid elevations. This area is located on convex slopes at top of the landform. Test Pit RTP-10 in Photo 1is representative of the soils here.

**Photo *1. RTP-10 with generally suitable soil conditions. Taken 9.25.2020***

The soil conditions here are generally suitable for the proposed development. The slopes range from 3% to 10% and are smooth or convex. The seasonal high-water table is generally greater than 15″ and bedrock, where present is dominated by smooth shield type ledge that is located below a mantle of glacial till, rather than rock outcrops. Bedrock was observed generally greater than 20″ below the ground surface.

The current proposed site plans show the majority of the mining development, wastewater treatment, infiltration galleries (IGs) and solar facility to be located within Area 1. The soil conditions are rated as Generally Suitable and Limited Suitability for the intended uses. Limitations for construction include the bedrock depth at less than 40″. The bedrock limitations can be mitigated by adding granular fill and minimizing cuts and ditching. This area would be suitable for disposal of the properly treated process wastewater where the soils are deeper and contains adequate slopes. In Area 1, the infiltration capacity of the soils is a primary consideration for designing the Infiltration Galleries (IG) or dispersal areas. Spreading out the process wastewater disposal areas along the contour and adding granular fill to increase depths to the limiting factor, both common practices when developing on these types of soils, will mitigate the limitations of shallow bedrock or a seasonal high water table. The finer textures of the loams and silt loams warrant special attention during construction or when soils are saturated to minimize puddling, compaction and impacting the natural soil structure. The area will drain and dry out relatively quickly. Avoiding and minimizing construction activities immediately after periods of wet weather will mitigate the limitations. See Section 4 for additional engineering practices to overcome the limitations.

**Area 2:** Area 2 covers the northern and northwestern section of the Site. This approximately 22-acre area is characterized by gentle to moderate concave slopes at the mid and lower slope position.

**Photo 2. Skid trail disturbance in Telos soils by RTP-14 *Taken 9.25.2020***

The soils observed were loam and silt loams with a seasonal high-water table or restrictive layer at less than 16". The soil drainage class is somewhat poorly to poorly drained and contains long slopes that accumulate groundwater and create oxyaquic soil conditions with a water table at or near the surface during normal conditions. Photo 2 shows the effects of disturbance in a skidder trail with wetland vegetation and hydric soil conditions after logging operations.

**Photo 3. Soil test Pit RTP-14 with oxyaquic conditions. *Taken 9.25.2020***

The soils in Area 2 are rated Limited Suitability due primarily to the shallow water tables. Test Pit RTP-14, shown in Photo 3, is representative of the prevailing soil conditions. These soils are prone to disturbance in wet weather. Where the slopes are concave, less than 10%, and/or located at the lower end, managing the groundwater will be challenging. The concave and upper slope areas have the best potential for development and least limitations.

There is no new development planned here, but if future roads or maintenance of existing roads is needed, the limitations from the seasonal high water tables and fine soil textures can be overcome by avoiding ditching and channeling groundwater or stormwater, constructing roads and access areas in fill with appropriate construction techniques such as rock sandwich[3] layers to maintain the integrity of the groundwater flow. Limitations for the wastewater disposal can be overcome by increasing fill amounts and limiting the amount of wastewater disposal in areas that are somewhat poorly drained or wetter and collect water. See **Section 4** for additional engineering practices to overcome the limitations.

**Area 3:** Area 3 covers the western section of the Site. This approximately 75-acre area is characterized by moderate convex slopes at the upper slope position. The soils observed were shallow to bedrock

[3] A rock sandwich engineering and construction practice is comprised of a permeable road base made of large rock fragments wrapped in filter fabric that allows groundwater or stormwater to flow under roads, pads or fills.

soils with loam and silt loam textures. Soil depths range from 10″ to more than 20″ to bedrock and are somewhat excessively drained to excessively drained. These would be mapped as Thorndike or Elliotsville and Monson soil series and would be rated Limited Suitability with inclusion of Generally Suitable soils where the bedrock depths exceed 20″.

Currently, the proposed site plans show storage pads, IGs, and structures developed in this area. The moderate slopes and well to excessively drained soil present minor to moderate limitations for construction with bedrock depths at less than 40″. The bedrock limitations can be mitigated by adding granular fill and minimizing cuts and ditching. Avoiding steeper slopes and shallow bedrock areas will also help.

**Area 4:** Area 4 dominates the central section of the Site in a gentle bowl-shaped area. This approximately 124-acre area is characterized by, gentle to moderate concave slopes at the mid side-slope positions. Slopes range from 0-8% within inclusions of moderately slopes from 8-15%. The soils observed were loam and silt loam textured soils over glacial till or bedrock. There are areas of outcrops and shallow ledge conditions interspersed with poorly and somewhat poorly drained soils. The general soil conditions are rated Unsuitable with inclusions of Limited Suitability conditions where the soils are better drained and on convex slopes. Approximately 30 acres of this area contains delineated wetlands with hydric soil conditions. Wetlands occur in the lowest topographical areas as well as areas disturbed from past logging activities resulting in altered hydrology. The soils in the wetland areas are Monarda and Burnham soil series and are generally unsuited to development. These were not broken out as a separate "Area" at this review level of scale..

Surrounding the wetlands are areas of somewhat poorly drained Telos soils with a seasonal high-water table and/or oxyaquic conditions. These are Limited Suitability areas due to the presence of a water table and the concave topography that tends to concentrate groundwater. The remainder of the area is made up of a mix of Chesuncook and Elliottsville (Dixmont) soil series with a limiting factor at 16″ or greater. These soils, where present, provide the least limiting conditions and the most potential for development.

The proposed Site plan has some development, largely restricted to the northeast section of Area 4 located on the more suitable soil areas. Development in this area includes a small part of the ore storage pad and IGs sited on higher topographic locations. Avoiding the jurisdictional wetlands and hydric soils and siting of facilities to maximize uses on the moderately well and better drained soils will mitigate the limitations posed by a highwater table. Soils with shallow bedrock conditions present limitations for road construction and ditches. Development in this area should focus on maintaining the natural groundwater flow through the area and minimizing erosion of the soils. Construction practices such as minimizing cutting and ditching and use of rock sandwich construction techniques on roads and pad/laydown areas can be used to help overcome the limitations in this area . Additional engineering measures are further addressed in **Section 4**.

**Area 5 and 6:** Areas 5 and 6 are smaller areas in the southern central section of the Site and are similar in soils and topography. These areas occupy around 9 acres combined. The soils are dominated by

shallow ledge and/or steep slopes. Areas of bedrock outcrops and complex terrain are common. The slopes range from 15-30% and are broken. The soils are fine textured silt loams over bedrock at 10-20" in the Monson and Abram soils series.

These areas are generally Unsuitable for development and should be avoided where possible. No development or construction is planned for these areas. If development here cannot be avoided, careful selection of routes for roads, using deeper soils, moderate slopes and benches can be employed. Additional limitations could be overcome by blasting and re-grading the terrain where needed.

# 4.0 SOIL SUITABILITY STANDARD ENGINEERING AND CONSTRUCTION PRACTICES

**Introduction:**

Based on the results of the field investigation of the suitability of existing soils for the Project, the most common limitations in the current Site plan areas are generally, shallow bedrock and poor draining soils with a high-water table at or near the surface. These poorly drained soils present limitations for roadway/parking/laydown area construction, waste rock and temporary ore storage facilities construction and operations, building and foundation construction, and wastewater disposal construction and operations. However, limitations of these soils can be overcome using appropriate engineering and construction practices.

The limitations presented in the results of the field investigation can be overcome in the Project areas by following a development hierarchy that includes the following:

- Locating and maximizing development on areas with better drained soils where practical;
- Siting development areas to maximize use of the existing infrastructure including existing roads; and,
- When development must occur on soils that have limitations, employ the appropriate construction techniques.

The Project is located at distances greater than 400 feet from any property line, will be reasonably self-sufficient and self-contained, and will provide for its own water and domestic sewage services, maintenance of roads, solid waste disposal and to the extent possible, fire protection and security.

The Project will include the construction and operation of comprehensive engineered facilities to collect and treat waters that encounter rock and earthen materials that are mined in the subsurface and brought to the land surface for beneficiation or long-term management. These water collection, treatment, and treated water recharge facilities (infiltration galleries) will substantially protect groundwater and surface water quality during and after active mining. Affected areas from mine reclamation operations will be restored and returned to pre-existing or comparable conditions including forested habitat at the end of the Project.

**Design Criteria:**

Standard engineering and construction practices that will be implemented to overcome limitations of the existing soils for the Project will need to meet the regulatory requirements and design criteria in accordance with the following:

- Department of Agriculture, Conservation and Forestry, Maine LUPC Chapter 13 - Metallic Mineral Exploration and Mining Certifications for all exploration activity and all mining activity, including advanced exploration, in the unorganized and de-organized areas of the State.

- Maine Department of Environmental Protection (MEDEP) Chapter 200 – Metallic Mineral Exploration, Advanced Exploration and Mining for all metallic mineral exploration, advanced exploration, and mining activities (September 2018).
- MEDEP Chapter 500 – Stormwater Management regulations for Basic, General, and Flooding Standards to confirm that the planned development will not result in any significant impacts and will not create potential degradation of surface water quality to locations downstream of the developments Site (November 2005, and amendments effective December 27, 2006).
- Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices (March 2003) to provide a strategy for controlling soil erosion and sedimentation during and after construction.
- 38 M.R.S. §413 for discharges of pollutants to groundwater via an underground injection well or discharges of pollutants to surface waters of the State
- 38 M.R.S. Chapter 3, Subchapter 1, Article 5-A (*Natural Resources Protection Act*)
- Federal hazardous waste management requirements under 40 CFR §261.4(b)(3) or (b)(7)
- Construction and industrial discharge permits issued by the MEDEP pursuant to 40 CFR §122.26
- Department of Health and Human Services, Division of Environmental Health Subsurface Wastewater Disposal Rules for onsite sanitary wastewater .

The following descriptions of commonly utilized standard engineering and construction practices highlight techniques that could be implemented to overcome shallow bedrock and poor draining soils with a high-water table at or near the surface for roadway/parking/laydown area construction, tailings storage facility construction and operations, building and foundation construction, and wastewater disposal construction and operations.

**Road/Parking/Laydown Area Construction:**

The Project is located in an industrial forest that has existing gravel access road infrastructure used by foresters/loggers and their machinery to harvest timber.. The right-of-way has been established and may require upgrading to meet safety standards for higher volumes of heavy load traffic that will occur with the initiation of construction and operation of the mine. The access road from the paved Route 11 is approximately 4.4 miles to the proposed Site. See **Appendix E** for **Figure 1** – Project Roadway Access.

**Roadway Design:**

A field reconnaissance was performed that included inspection of the existing unpaved gravel roads connecting the proposed Mine Site to State Route 11 on June 28, 2022. The existing unpaved roads will be used year-round to access the Mine Site and are currently used for logging. The existing unpaved roadway was found to be in generally in good condition with very little rutting, consisting of sandy gravel or gravelly sand with cobbles. Several bedrock outcrops were also observed within the limits of the roadway. Observations of the road indicate that no seasonal limitations are anticipated. With the

recommended improvements implemented provided in **Exhibit 21 – Attachment B-1 Pickett Mountain Mine Site – Gravel Road and Bridge Field Reconnaissance Summary** and periodic fine grading maintenance of the road conducted; the road will function adequately for the project.

During detailed design, additional geotechnical investigation will be conducted along the gravel access roads to identify areas of shallow bedrock and poor draining soils with a high-water table at or near the surface are fine textured soils with a dense basal till layer that impedes water movement. A seasonal high-water table and the fine texture of the soils restrict road base and surface water drainage and increase the potential for frost heaving. Construction in these areas can be accomplished by excavation of the existing finer textured soils and replacing them with a suitable granular fill or gravel base elevated above the existing ground.

The extent of the over-excavation in poor draining soil areas may approach approximately two feet below the proposed roadway final grade. The finished result may provide a roadway build-up of approximately two to three feet of clean gravel for these areas. Roads, parking areas, and laydown areas constructed in this manner will maintain a well-drained sub-base that will resist frost action and provide extended lifetime service.

Additionally, the reduced bearing strength of the finer textured soils can be improved by increasing the width of a granular roadway base to spread the load out and using geotextiles or geogrids in the construction. The native soils below and beside the road can be excavated and replaced with suitable granular fill material. See **Appendix E** for **Figure 2** – Typical Road Cross Section for Poor Soils Conditions.

**Roadway Drainage:**

The design intent for roadways is to use engineering and construction practices to mitigate the channelization of stormwater runoff. To facilitate the movement of stormwater runoff from areas upgradient to roadways and along the slopes of roadways, the rock sandwich construction technique referenced earlier in this report may be employed such that stormwater runoff flows are conveyed through the soil profile to downgradient, stable areas without channelization of stormwater runoff. A rock sandwich engineering and construction practice allows stormwater runoff flows to be conveyed through the roadway cross-section. See **Appendix E** for **Figure 3** - Typical Road Cross Section W/Sandwich Material and Ditch Detail.

In areas where the roadway is to be constructed along a vertical slope with shallow bedrock and poor draining soils with a high-water table at or near the surface it may not be possible to mitigate the channelization of stormwater runoff using a rock sandwich engineering and construction practice. In those areas, MEDEP Best Management Practices (BMP) ditch turnouts may be utilized to transfer roadway and ditch stormwater runoff as sheet flow into a downgradient stable area (a buffer that is stable, level, well vegetated and protected from disturbance). MEDEP ditch turnouts BMPs should blend smoothly with existing contour elevations without any sharp drops or irregularities

MEDEP ditch turnout BMP design criteria includes the following:

- Ditch turnouts should discharge stormwater runoff as sheet flow.

- Ditch turnouts should be placed as far away from a stream as possible and on existing contours.
- The spacing of ditch turnouts is a function of the road grade and volume of stormwater runoff. One turnout should be provided every 200 feet for a roadway with a 2% grade and 30-40 feet for roadways steeper than 10%.

**Main Pad**:

Based on the size of the operation, existing Site topography, and existing natural resource area constraints, it has been determined to utilize an approximately 1830-foot by 625-foot as the main mine operations support and waste rock and temporary ore storage. This area requires accommodation for the various buildings and have the room necessary to safely operate the various components of the process. The Main Pad sits in soil suitability Soil Area 1, an area identified as having generally suitable soils for development.

**Base Design:**

Due to the topography differential, a single level pad is not likely feasible. Therefore, appropriate engineering and construction practices could include terraced or benched pad construction approach. Blasting may be needed, and materials could be crushed to size and placed as necessary to level out the bench areas proposed for buildings and structures. The pad placement would consist of various grades of cleaned crushed stone covering the area. The pad thicknesses could be constructed with sufficient depth to accommodate underground piping, electrical utilities and other infrastructure that needs protection from mine equipment or staging areas.

**Foundations and Buildings:**

Offices and a maintenance complex could be comprised of office and equipment trailers and dry-storage shipping containers to speed construction and to minimize foundation work. Compressors and a stand-by generator could be housed in container units. Primary buildings will include offices and mine rescue, water treatment, electrical sub-station, and other outer buildings including warehouse bunks.

Existing slopes within the areas proposed for buildings and structures approach 2.5 to 10%. Blasting materials could be crushed to specification and then placed as necessary to level out the areas proposed for buildings and structures pad constructions.

To facilitate the movement of stormwater runoff from areas upgradient to and away from pads and buildings, a suitable granular fill or gravel base, elevated above the existing grade, could be employed such that shallow groundwater would flow under and stormwater runoff flows would be conveyed around the structures to downgradient areas, maintaining hydrology to wetlands and streams, without channelization of stormwater runoff.

**Foundation Design:**

As with the roadways, shallow bedrock, and poor draining soils with a high-water table at or near the surface impedes water movement. These limitations of the soils can be overcome using appropriate

engineering and construction practices by locating buildings and foundations in built-up areas or by over-excavation of the finer textured soils and replacing them with a suitable granular fill or gravel base elevated above the existing ground.

Poorly drained soils have limitations for foundations. In general, construction in these conditions should favor a slab-on-grade design on a crushed stone base which will minimize the impacts of a seasonal high-water table and provide for reduced long term maintenance by minimizing moisture conditions.

**Foundation Drainage:**

For foundation footings, a spread footing that expands the footprint of the foundation can be employed to overcome the fine textured soils lack of strength. The design for any foundations located approximate to poor draining soils with a high-water table will be to provide foundation drainage by utilizing exterior footing drains that would discharge to daylight with stabilized outfalls.

**Materials Pads:**

The majority of the storage pads are located in Area 1. These pads will be a self-contained system where leachate and runoff are collected. Water will be pumped to a pre-treatment water storage pond and then pumped for treatment to the water treatment plant (WTP). The pads will be lined with a HPDE geomembrane liner, then a drainage layer with a leachate collection system overlain by a compacted gravel surface. Earthen berms around the storage pads will be permanently stabilized and stormwater runoff will be directed around and away from the pads. Surface sumps inside the bermed pads would collect and discharge impacted water to the pre-treatment water storage pond and then pumped to the WTP for treatment.

To facilitate the movement of shallow groundwater and stormwater runoff from areas upgradient to and away from pads, a suitable granular fill or gravel base, elevated above the existing ground surface, could be employed such that stormwater runoff flows would be conveyed around the structures to downgradient areas and shallow groundwater allowed to flow beneath, maintaining hydrology to wetlands and streams, without channelization of stormwater runoff.

**Treated Water and Wastewater Disposal**:

There are two types of wastewater disposal systems proposed for the Project. One is a subsurface wastewater disposal system for sewage. This system is proposed to be constructed in Area 1, just south of the Main Pad. Area 1 has limited/generally suitable soils for development.

The second system is for the discharge of treated water from the WTP. These facilities are labeled infiltration galleries (IGs). Six IG areas are proposed for the discharge of the daily flows of treated water. Three of the IGs are located in Soil Area 1 (generally suitable for development), one is located in both Soil Area 1 and Soil Area 4 (limited suitability/unsuitable for development), and one is located in Soil Area 3 (limited suitability/unsuitable for development). A test pit conducted in the proposed IG location in this area was categorized as limited suitability.

Poorly drained soils are generally not well suited handle to subsurface wastewater disposal systems due very low infiltration, the water table typically being within 7 inches and the fine textures of the surface soils. For onsite wastewater disposal, the current Maine Subsurface Wastewater Disposal Rules (MSWR) require a minimum of 9 inches of suitable soils.

The first option will be to locate and construct onsite subsurface wastewater disposal systems in areas of better drained soils, and for the sewage leachfield, to meet the 9-inch minimum requirement for onsite subsurface wastewater disposal systems. Alternatively, where Site conditions don't meet the MSWR requirements, the high-water table can be overcome by increasing the separation distance of the bottom of the system to the water table. This is commonly done by adding suitable gravel fill below the system and constructing a raised system that meets MSWR requirements. See **Figure 4** - Typical Mounded Wastewater Disposal System Design for Soils with High Water Table.

Limitations of the soils for the IGs in areas with limited suitability can be overcome using similar construction methods for a sewage treatment leachfield by constructing a raised infiltration system or moving the IG to a more suitable soil location and/or increasing the size of an IG located in more suitable soils. Additionally, the Project will overcome the limitations of the soils with engineering and construction practices by constructing a WTP on the Site to provide treatment for mine influenced water within the WTP instead of the soils. This approach will provide treated clean water for groundwater recharge at the IG areas.

**Stormwater Management**:

Maine's Stormwater Management Law provides stormwater standards for projects that include one acre of more of disturbed area. The major design goal is to filter and recharge the smaller, more frequent runoff events and provide for the stabilized release of stormwater runoff generated from larger development sites.

MEDEP Chapter 500 regulations include Basic, General, and Flooding Standards to confirm that a planned development will not result in any significant impacts downstream of the development Site above the predevelopment conditions and will not create potential degradation of water quality to locations downstream of the developments Site.

Key design criteria will include the following:

- Provide treatment measures to runoff that will mitigate for the increased frequency and duration of channel erosive flows due to the runoff generated during smaller, more frequent rainfall events (<1-year, 2.5-inch)
- Provide for effective treatment of pollutants for 75% of proposed impervious areas if possible and 50% of the developed areas for the linear portion of the project. Provide for effective treatment of pollutants for 95% of the proposed impervious areas if possible and 80% of the developed areas for the non-linear portions of the Project. If Treatment is less than 95%, then an additional 5% of treatment volume shall be added to BMP measures for each 1% below 95%

down to 90%. Any new access roads for the project will be permitted as a linear portion of the project.

- Provide for effective treatment of pollutants in stormwater by filtration, and infiltration to the extent practical, of runoff from development areas to control runoff volume for proposed impervious surfaces equal to 1.0-inch times the subcatchment impervious area (or as adjusted up to 1.25-inches) plus 0.4 times the subcatchment non-impervious developed area.
- Provide mitigation for potential temperature impacts.
- Developments creating 3 acres or more of impervious surface are required to meet the flooding standard. If a project must meet the flooding standard, the project must be designed to control the peak flow rates from the 2-, 10- and 25-year, 24-hour storms events.

Stormwater runoff from most of the development areas will discharge to a series of MEDEP vegetated under drained soil filter fields. These systems will provide water quality benefits and serve to provide quantity control discharges to stormwater runoff for this development project. The filter fields will discharge via riprap spillways and level lip spreaders as sheet flow into a downgradient stable area (a buffer that is stable, level, well vegetated and protected from disturbance).

Soil filters are designed to provide pollutant removal and channel protection as they provide the slow release and/or infiltration of runoff. The filters also provide cooling of the discharge reducing thermal impacts.

Soil filters must be designed to meet the general standards and be designed to meet the requirements of MEDEP Chapter 500 – Stormwater Management regulations. The regulations include requirements for storing and treating stormwater by filtering at least 1.0 inch of stormwater runoff from the impervious area draining to it, and 0.4 inches of stormwater runoff from the landscaped area draining to it. A stable overflow outlet must be provided for stormwater greater than the volume to be stored for treatment.

Soil filters consist of depressional surface storage over a densely vegetated soil filter that is underlain with underdrain bedding and drained by perforated underdrain pipe. The soil filter material must be fine enough to filter fine sediments and provide effective adsorption of pollutants, but coarse enough to drain the stored volume over a period of no less than 24 hours and no greater than 48 hours. The soil filter material must be well blended and graded and must contain sufficient organic matter to facilitate the removal and treatment of hydrocarbons. Unless otherwise approved by the Department on a case-by-case basis, the soil filter must be at least 18 inches thick, and the surface area of the filter must be no less than 5% of the contributing impervious drainage area.

There is a separation requirement in in-situ soils of at least 18 inches between the bottom of the underdrain bedding material and bedrock, and the bottom of the filter media is no lower than the elevation of the seasonal high-water table.

**Embankments:**

A geotechnical evaluation by a geotechnical engineer should be developed for any embankments over 10 feet in effective height to mitigate hazards to downstream property or life.

**Erosion and Sediment Controls:**

An Erosion Prevention and Sediment Control Plan will be developed for the Project to provide a strategy for controlling soil erosion and sedimentation during and after construction. This plan will incorporate the standards and specifications for erosion prevention for development projects contained in the Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices (March 2003).

The erosion and sediment control strategy to be employed during the construction and stabilization of the Project will be to contain sediment on the Site. This strategy will not allow the introduction of sediment-laden runoff to enter any nearby waterways. To accomplish this strategy, temporary erosion and sediment control measures will be used at the Site during construction and will stay in effect until the Site has been stabilized permanently. Permanent erosion and sediment control provisions will ensure the long-term protection of the Site from erosion and sedimentation concerns. These control measures will consist of the stabilization by paving or seeding the disturbed areas.

The primary emphasis of the erosion and sedimentation control to be implemented for this project will be as follows:

1. Developing a project layout that avoids excessive earth disturbance in areas of steep slopes or near resources including wetlands and drainage ways.
2. Development of a careful construction sequence that limits the area and duration of soil exposure.
3. Rapid stabilization of denuded areas to minimize the period of soil exposure.
4. Rapid stabilization of drainage paths to avoid gully erosion.
5. The use of on-site measures to capture initial sediment (hay bales/silt fence, erosion control blanket, etc.).
6. The provision for the filter fields to act as temporary sedimentation basins and to be fully functional early in the construction process.
7. Inclusion of special provisions for winter construction.
8. Protection of natural resource areas including wetlands through buffering and BMPs.
9. The implementation of long-term measures for erosion/sediment and pollutant treatment through the construction of permanent water quality measures.
10. Any loam stockpiles will be in suitable areas approved by the Contracting officer.

11. Additional erosion control methods will be implemented during winter construction, between November 1 and April 15.

**Construction Standards:**

The following measures will be undertaken to provide maximum protection to the soil, water, and abutting lands:

1. Prior to grubbing or any earth moving operation, siltation fence or erosion control mix berms will be installed across the slope on the contour at the downhill limit of the work as protection against construction related erosion. In areas being disturbed adjacent to the wetlands, parallel siltation fence and hay bale barriers or erosion control mix berm will be installed as a double line of erosion and sedimentation defense.
2. Stone check dams will be installed in the drainage swales to prevent erosion prior to the stabilization of the channels. Erosion control mesh will also be installed in all ditches to be re-vegetated.
3. Permanent soil erosion control measures for all slopes, channels, ditches, or any disturbed land area will be completed within seven (7) calendar days after final grading has been completed. When it is not possible or practical to permanently stabilize disturbed land, temporary erosion control measures will be implemented.
4. Any exposed slopes greater than 3:1 and newly constructed drainage swales will be stabilized with erosion control mesh to prevent erosion during construction and to facilitate re-vegetation after placement of topsoil and seeding.
5. To provide protection against erosion, riprap will be placed at all storm drain inlets and outlets as shown on the attached drawings.
6. In areas of construction dewatering, pumped discharge sediment devices will be utilized adjacent to the activity. Sediment traps will be constructed utilizing dirtbags, or other similar devices that do not require additional soil disturbance. Additional sedimentation protection will be provided by the installation of hay bale barriers between the sediment traps and the receiving drainage course.
7. Native topsoil shall be saved, stockpiled, mulched, and reused as much as possible on the Site. Siltation fence shall be installed at the base of stockpiles at the downhill limit to protect against erosion. Stockpiles will be stabilized by seeding and mulching upon formation of the piles. Uphill of the stockpiles, stabilized ditches and/or berms will be constructed to divert stormwater runoff away from the piles.
8. All siltation fence and hay bale barriers will be inspected by the contractor on a weekly basis or following any significant rainfall (1/2 inch or more) or snowmelt. All damaged erosion control devices will be repaired and/or replaced immediately. Trapped sediment will be removed before it has accumulated to one-half of the installed siltation fence or hay bale barrier height. Devices

no longer serviceable due to sediment accumulation will also be repaired and/or replaced as necessary.

9. If final seeding of the disturbed areas is not completed by September 15 of the year of construction, then within the next 10 calendar days these areas will be graded and smoothed, then seeded to a winter cover crop of rye at a rate of 3 lbs. per 1,000 sq. ft. The following will be incorporated into the soil prior to rye seeding ground limestone at the rate of 130 lbs. per 1,000 sq. ft., followed by 10-10-10 fertilizer at the rate of 14 lbs. per 1,000 sq. ft. Hay mulch will be applied at a rate of 100 lbs. per 1,000 sq. ft. following seeding. If the rye seeding cannot be completed by October 1, then on that date hay mulch shall be applied at the rate of 2 tons per acre to provide winter protection. If rye does not make adequate growth by November 5, then on that date, hay mulch shall be applied at the rate of 100 lbs. per 1,000 sq. ft. A suitable binder such as Curasol or RMB Plus shall be used on hay mulch for wind control. Biodegradable netting will be installed on steep slopes (3:1 and steeper) and on areas of concentrated flows.
10. Intercepted sediment will be returned to the Site and incorporated into the project area.
11. Should construction occur after November 15, additional erosion control methods will be implemented. All disturbed areas will be minimized as much as possible. Prior to freezing, additional erosion control devices will be installed as appropriate. Inspection of these erosion control items will be constant, with particular attention paid to weather predictions to ensure that these measures are properly in place to handle large amounts of runoff from heavy rains or thaws.
12. Dewatering occurs in 3 phases: removing the water from the excavation area (gravity drain, mechanical pumping, siphoning or using the bucket of construction equipment); providing settlement from the collected water (sediment basin or trap, bag, etc.); and providing a stable discharge point. A water diversion consists of a channel constructed across or above a work site to direct runoff away from a disturbed area to a stable discharge point that is unlikely to erode. It can either be an excavated ditch that intercepts groundwater and surface water, or a berm that diverts surface runoff.
13. If dusty conditions occur on-site during dry conditions, dust control measures will need to be implemented.
    1. Water: Water should be applied at a rate to moisten exposed soil to prevent dust transport but not at a rate that produces any amount of silt-laden runoff or muddy pools in the travel way.
    2. Calcium Chloride: Liquid of fine-flaked calcium chloride may be used. Calcium chloride should not be applied adjacent to wetlands, lakes, pools or other naturally sensitive areas. Limit application rates to 30% calcium chloride or as recommended by manufacturer.
    3. Stone: Coarse gravel should be placed in areas that routinely experience dusty conditions. Use only chemically stable aggregates.

## 5.0 SUMMARY OF FINDINGS

The soil assessment of the proposed Site showed a mix of soil types and suitability. Generally suitable soils or soils with limited suitability dominate with suitable areas generally located on the better drained, deeper soils.

In general, the NRCS soil map units were correlated to the on-site field investigations. The main differences identified were the presence of bedrock-controlled soils and somewhat poorly to poorly drained oxyaquic soils in some of the well-drained Plaisted map units, which are classified as very deep to bedrock. These moderately deep to shallow to bedrock conditions present additional development costs and limitations.

The second major difference was the soil series classification of Dixmont soils that cover two drainage classes, mapped over much of the Site. A large amount of this map unit is in concave areas (Area 4) and is somewhat poorly drained or poorly drained and would be mapped today as Telos soil series or Monarda series, respectively. Because the mapping is very broad, the Dixmont unit, which have a "Low" rating, tend to dominate the landscape, and include larger areas of potentially "Medium" soil rating soils that have a better development potential. The moderately well drained phase is better mapped as a Chesuncook and /or Ragmuff series with "Medium" development potential and the somewhat poorly drained Telos with a "Low" potential.

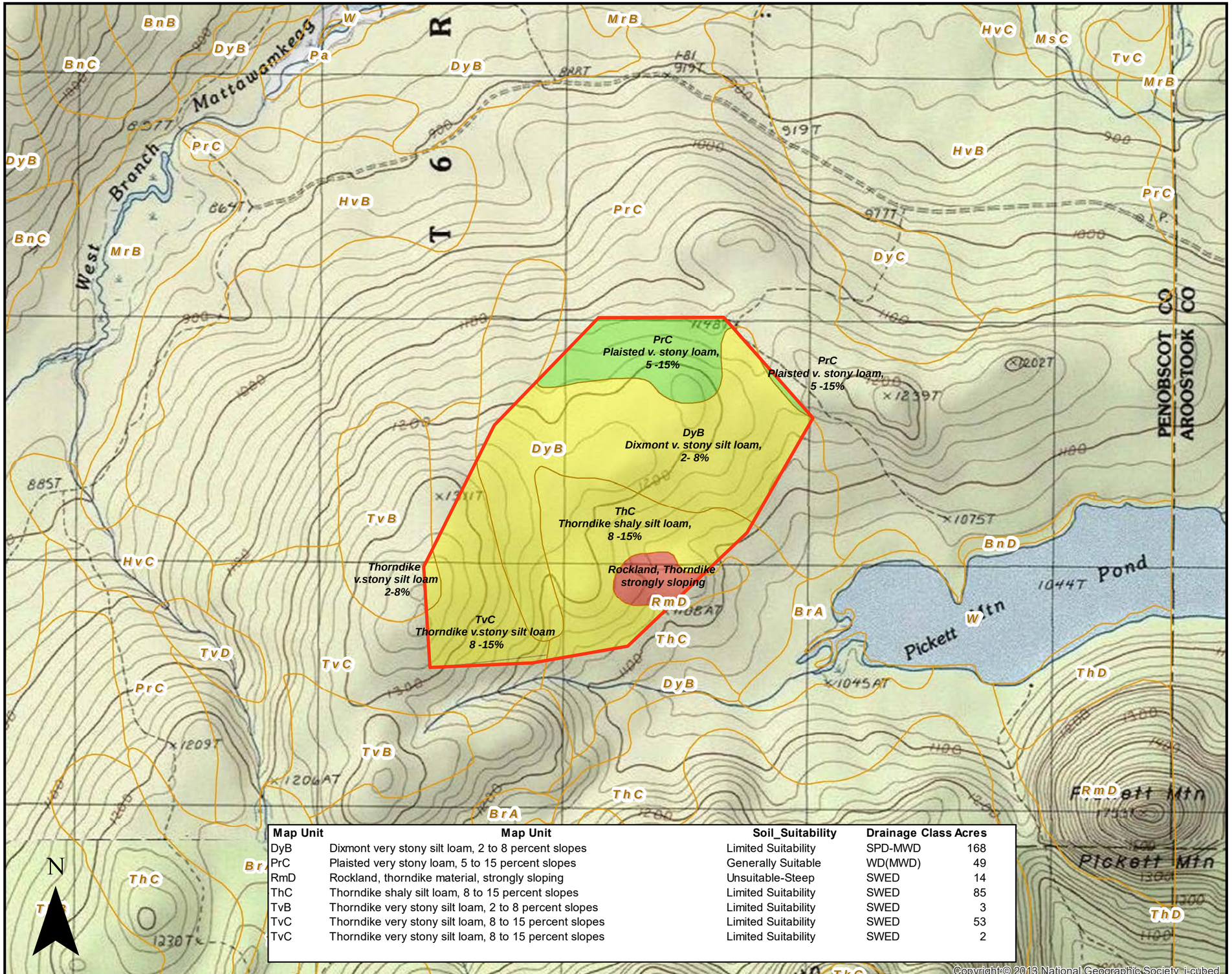
In general, the Site contains soils that are either generally suitable or have limited suitability for the proposed development. See **Soil Suitability Map 2** as well as **Figure 2-1** in **Exhibit 2** for specific mine infrastructure components. The soil limitations observed include the shallow bedrock conditions, and areas with a seasonal high-water table. These can be overcome using standard engineering practices as outlined in Section 4. Areas of steep slopes, greater than 20% occur in small amounts as part of the landscape and should be avoided when possible. Areas with a high-water table include jurisdictional wetlands and the lower slope positions with somewhat poorly drained soils and oxy-aquic conditions are also present and should be avoided when possible.

The presence of limitations from the soils here can be overcome with thoughtful planning, careful siting, and the use of the design and construction approaches for the infrastructure discussed in this report. Maintaining the natural groundwater flow through the Site, avoiding unnecessary disturbance and activities during wet weather and spring conditions will help minimize the impacts during construction. Prior to any development and to support permitting, more detailed surveys will be needed to better identify the most appropriate areas for Site specific development to occur. Ultimately, the nature of the mining operation requires the siting of facilities and infrastructure near the mineral resources. This will require in some areas, thoughtful design and construction methods to deal with the limited soil suitability conditions that occur. Detailed soil surveys and Site development plan will be required prior to the mine development and permitting.

# APPENDIX A
# MAPS

# WOLFDEN PROJECT
# MOUNT CHASE, MAINE
# SOIL SUITABILITY REVIEW

## NRCS SOIL MAP 1
## REVISED SEPTEMBER 2022




| Map Unit | Map Unit | Soil_Suitability | Drainage Class | Acres |
|---|---|---|---|---|
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | Limited Suitability | SPD-MWD | 168 |
| PrC | Plaisted very stony loam, 5 to 15 percent slopes | Generally Suitable | WD(MWD) | 49 |
| RmD | Rockland, thorndike material, strongly sloping | Unsuitable-Steep | SWED | 14 |
| ThC | Thorndike shaly silt loam, 8 to 15 percent slopes | Limited Suitability | SWED | 85 |
| TvB | Thorndike very stony silt loam, 2 to 8 percent slopes | Limited Suitability | SWED | 3 |
| TvC | Thorndike very stony silt loam, 8 to 15 percent slopes | Limited Suitability | SWED | 53 |
| TvC | Thorndike very stony silt loam, 8 to 15 percent slopes | Limited Suitability | SWED | 2 |

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**Legend**

- Rezone Boundary

**NRCS Soil Survey Rezone Area 2022**

**Soil Suitability Rating**

- Generally Suitable
- Limited Suitability
- Generally Unsuitable
- Unsuitable-Steep
- NRCS_Soils

**PLAN NOTES:**
1.) ALL LOCATIONS AND AREAS AS SHOWN ON THIS PLAN SHOULD BE CONSIDERED APPROXIMATE.
2.) PROJECTION: NAD 1983,STATE PLANE, MAINE EAST, US FEET.

**PLAN SOURCES:**
1.) Wolfden/Stantec: Plan Area, LiDAR data
2.) USDA: USDA NRCS Soil Survey of NE Aroostook County Published 1964, original map scale=1:20,000
3.) USFWS: NWI Wetland Data
4.) MEGIS, USGS: contours, parcels

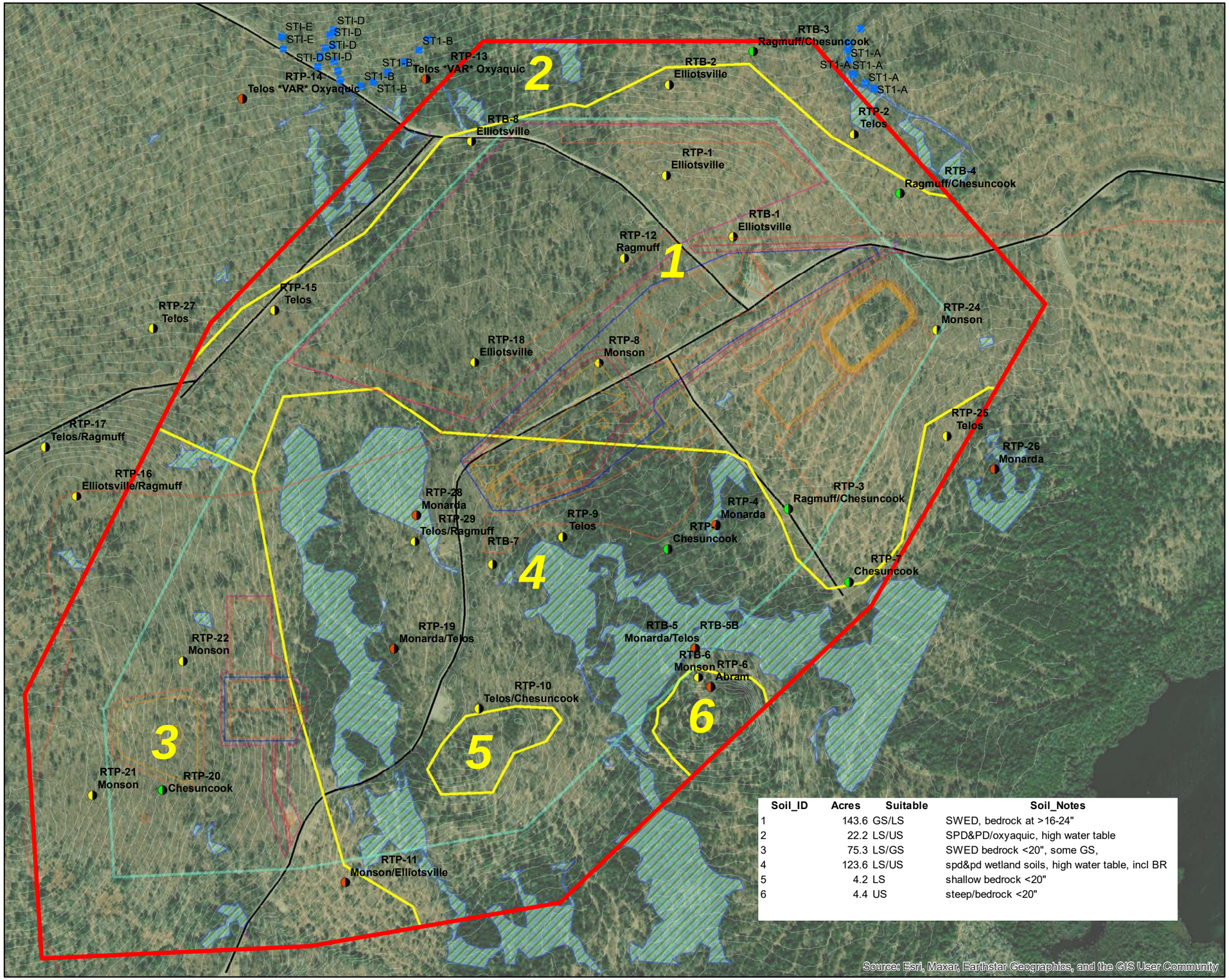
0 750 1,500 3,000 Feet

1:15,840

REV DATE: SEPTEMBER 28,2022 20034

# WOLFDEN PICKETT MT. MINE PROJECT
# TWP T6-R6, MAINE
# SOIL SUITABILITY MAP 2

**REVISED SEPTEMBER 2022**




| Soil_ID | Acres | Suitable | Soil_Notes |
|---|---|---|---|
| 1 | 143.6 | GS/LS | SWED, bedrock at >16-24" |
| 2 | 22.2 | LS/US | SPD&PD/oxyaquic, high water table |
| 3 | 75.3 | LS/GS | SWED bedrock <20", some GS, |
| 4 | 123.6 | LS/US | spd&pd wetland soils, high water table, incl BR |
| 5 | 4.2 | LS | shallow bedrock <20" |
| 6 | 4.4 | US | steep/bedrock <20" |

**Legend**

Rezone Boundary

**Conceptual Site Plan V10_Wood**

**LAYER**

- C-400FT Buffer
- C-Boundary
- C-DRAINAGE DIVADE
- C-FENCE
- C-Gate
- C-NEW REZONING
- C-NPLT
- C-PHASE II
- C-ROAD
- C-ROAD EXIST
- C-WATER COLLECTION AREA
- Mine Only Layout

**Soil Test Pit_ARC**

- NOT RATED

**ID/SERIES/SUITABLE**

- GENERALLY SUITABLE
- LIMITED SUITABILITY
- UNSUITABLE
- SOILAREAS_ARC22
- 5 FT Lidar contour_ Wolfden
- Stream Delineated_Wood
- Wetland Delineated_Wood
- Roads_Wood

N

**PLAN NOTES:**
1.) ALL LOCATIONS AND AREAS AS SHOWN ON THIS PLAN SHOULD BE CONSIDERED APPROXIMATE.
2.) PROJECTION: NAD 1983,STATE PLANE, MAINE EAST, US FEET.

**PLAN SOURCES:**
1.) Wolfden: Plan Area, LiDAR data
2.) USDA: USDA NRCS Soil Survey of NE Aroostook County Published 1964, original map scale=1:20,000
3.) USFWS: NWI Wetland Data
4.) MEGIS, USGS: contours, parcels

500 250 0 500 Feet

1 inch = 500 feet

REV DATE: SEPTEMBER 28,2022

20034

# APPENDIX B
# SOIL TEST PIT LOGS

FORM E Rev. 07/11

# SOIL CONDITIONS SUMMARY TABLE

**SUMMARY LOG OF SUBSURFACE EXPLORATIONS AT PROJECT SITES**

| Project Name: | Applicant Name: | Project Location (municipality): |
|---|---|---|
| PICKETT MT. | MT CHASE LLC | T6R6 WELS |

| Lot No. | Exploration Symbol *(TP 1, B 2, etc.)* | ✘ if at SSWD Field | Description of subsurface materials by: ● Soil profile/condition *(if by S.E.)*, ● Soil series name *(if by C.S.S.)*, or by ● Geologic unit *(if by C.G.)* | Depths to *(inches)*: Redoximorphic Features | Bedrock | Hydraulically Restrictive Layer | Limit of Exploration | Ground Surface Slope (%) | Ground Surface Elevation |
|---|---|---|---|---|---|---|---|---|---|
| | RTP-1 | ☐ | Elliotsville-Thorndike | NONE | 22 | - | 22 | 5 | |
| | RTP-2 | ☐ | Telos | 10 | - | 17 | 30 | 3 | |
| | RTP-3 | ☐ | Ragmuff/ Chesuncook | - | 36 | 18 | 36 | 5 | |
| | RTP-4 | ☐ | Monarda | 3 | - | 11 | 24 | 5 | |
| | RTP-5 | ☐ | Chesuncook (Dixmont) | 15-20 | - | 20 | 30 | 9 | |
| | RTP-6 | ☐ | Abrams | - | 4 | - | 4 | 28 | |
| | RTP-7 | ☐ | Chesuncook/ (Dixmont) | - | | 23 | 36 | 10 | |
| | RTP-8 | ☐ | (Thorndike)/Monson | - | 17 | - | 17 | 2 | |
| | RTP-9 | ☐ | Telos | 10 | 20 | 10 | 20 | 5 | |
| | RTP-10 | ☐ | Telos/ Chesuncook (Dixmont) | - | - | 16 | 30 | 5 | |
| | RTP-11 | ☐ | Monson | - | 18 | - | 18 | 18 | |
| | RTP-12 | ☐ | Ragmuff (Dixmont) | 16 | - | 16 | 32 | - | |
| | RTP-13 | ☐ | Telos *VAR* Oxyaquic | 0 | - | 8 | 16 | 10 | |
| | RTP-14 | ☐ | Telos *VAR* Oxyaquic | - | - | 11 | 16 | 13 | |
| | RTP-15 | ☐ | Telos | 3 | - | 15 | 60 | 6 | |
| | RTP-16 | ☐ | Elliotsville/Ragmuff (Thorndike) | - | 22 | 16 | 22 | 4 | |
| | RTP-17 | ☐ | Telos/Ragmuff | 14 | 40 | 14 | 40 | 15 | |
| | RTP-18 | ☐ | Elliotsville | - | 24 | 17 | 24 | 2 | |
| | RTP-19 | ☐ | Monarda/Telos | 2 | - | 8 | 20 | - | |
| | RTP-20 | ☐ | Chesuncook (Dixmont) | - | - | 15 | 31 | 13 | |
| | RTP-21 | ☐ | Monson/(Thorndike) | - | 16 | - | 16 | 12 | |
| | RTP-22 | ☐ | Monson (Thorndike) | - | 16 | - | 16 | 11 | |
| | RTP-23 | ☐ | Telos | 13 | - | 20 | 60 | - | |
| | RTP-24 | ☐ | Monson (Thorndike) | 0 | 17 | - | 17 | 8 | |
| | RTP-25 | ☐ | Telos | 0 | - | 13 | 13 | 5 | |
| | RTP-26 | ☐ | Monarda | 6 | - | 16 | 16 | 5 | |
| | RTP-27 | ☐ | Telos (Dixmont) | 12 | - | - | 20 | 9 | |
| | RTP-28 | ☐ | Monarda | 3 | - | 8 | 15 | 3 | |
| | RTP-29 | ☐ | Telos/Ragmuff | 10 | - | 15 | 30 | 4 | |
| | | ☐ | | | | | | | |
| | | ☐ | | | | | | | |
| | | ☐ | | | | | | | |

## INVESTIGATOR INFORMATION AND SIGNATURE

| | | | |
|---|---|---|---|
| Signature | | Date | 09-29/20 |
| Name Printed | Roger St.Amand | Cert/Lic/Reg. # | SS471/LSE372 |
| Qualification | ☒ Licensed Site Evaluator<br>☐ Certified Geologist | ☒ Certified Soil Scientist<br>☐ Other: | |

MAINE ROGER R. ST. AMAND 471 CERTIFIED SOIL SCIENTIST

FORM E Rev. 07/11

# SOIL CONDITIONS SUMMARY TABLE

**SUMMARY LOG OF SUBSURFACE EXPLORATIONS AT PROJECT SITES**

| Project Name: | Applicant Name: | Project Location (municipality): |
|---|---|---|
| PICKETT MT. | MT CHASE LLC | T6R6 WELS |

| Lot No. | Exploration Symbol *(TP 1, B 2, etc.)* | ✘ if at SSWD Field | Description of subsurface materials by: ● Soil profile/condition *(if by S.E.)*, ● Soil series name *(if by C.S.S.)*, or by ● Geologic unit *(if by C.G.)* | Depths to *(inches)*: Redoximorphic Features | Bedrock | Hydraulically Restrictive Layer | Limit of Exploration | Ground Surface Slope (%) | Ground Surface Elevation |
|---|---|---|---|---|---|---|---|---|---|
| | RTB-1 | ☐ | ELLIOTSVILLE | - | 22 | - | 22 | - | |
| | RTB-2 | ☐ | ELLIOTSVILLE/MONSON | - | 22 | - | 22 | 15 | |
| | RTB-3 | ☐ | CHESUNCOOK/RAGMUFF | - | 18 | - | 18 | 9 | |
| | RTB-4 | ☐ | CHESUNCOOK/RAGMUFF(DIXMONT) | - | - | 29 | 29 | 7 | |
| | RTB-5 | ☐ | MONARDA/TELOS* | 8 | - | - | 16 | 5 | |
| | RTB-6 | ☐ | MONSON (THORNDIKE) | - | 18 | - | 18 | 16 | |
| | RTB-8 | ☐ | ELLIOTSVILLE (DIXMONT) | - | 22 | - | 22 | - | |
| | | ☐ | | | | | | | |
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## INVESTIGATOR INFORMATION AND SIGNATURE

| | |
|---|---|
| Signature | Date 03/29/20 |
| Name Printed Roger St.Amand | Cert/Lic/Reg. # SS471/LSE372 |
| Qualification ☒ Licensed Site Evaluator ☐ Certified Geologist | ☒ Certified Soil Scientist ☐ Other: |

MAINE ROGER R. ST. AMAND 471 CERTIFIED SOIL SCIENTIST

# APPENDIX C
# NRCS SOIL SURVEY

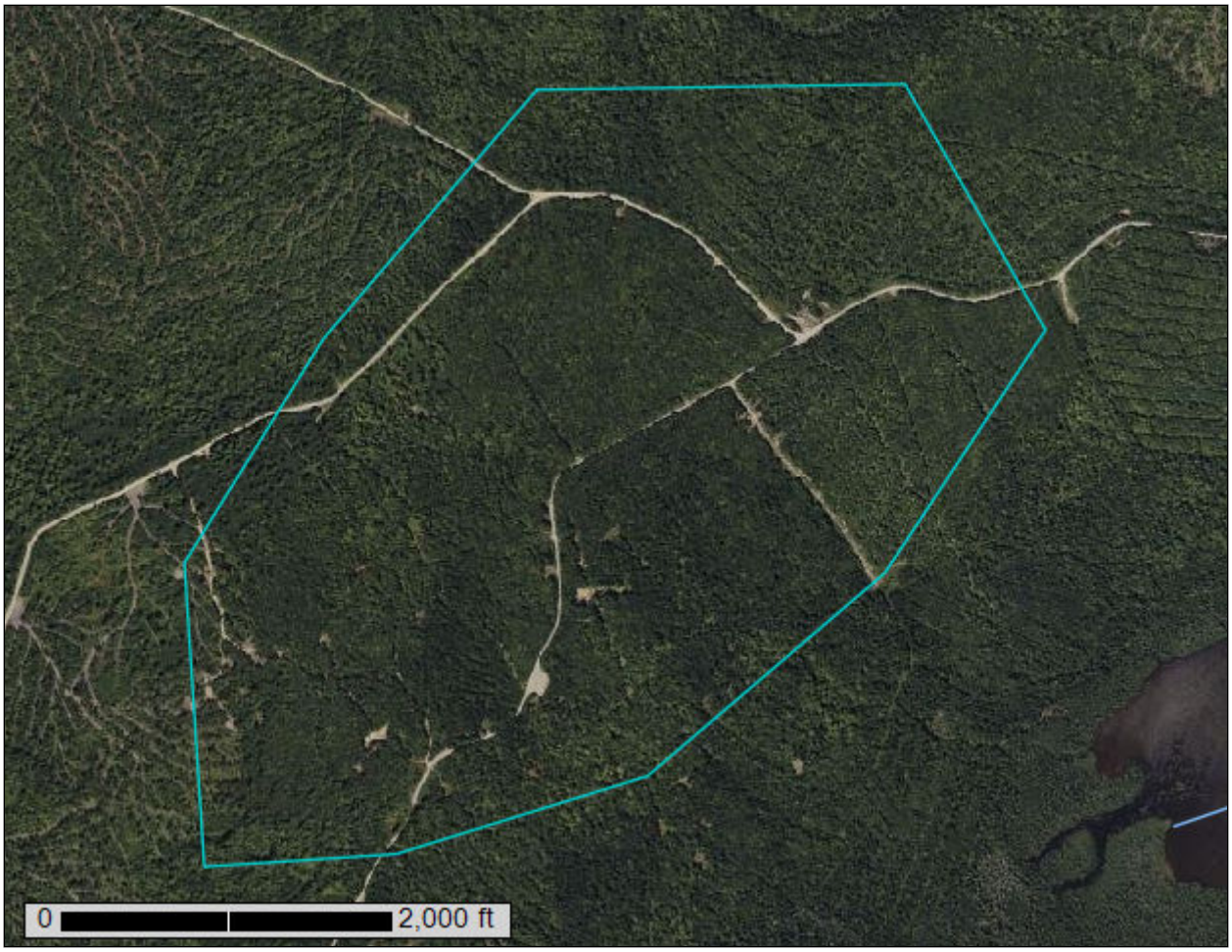
United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Penobscot County, Maine

## Wolfden Pickett MT Mine




September 29, 2022

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

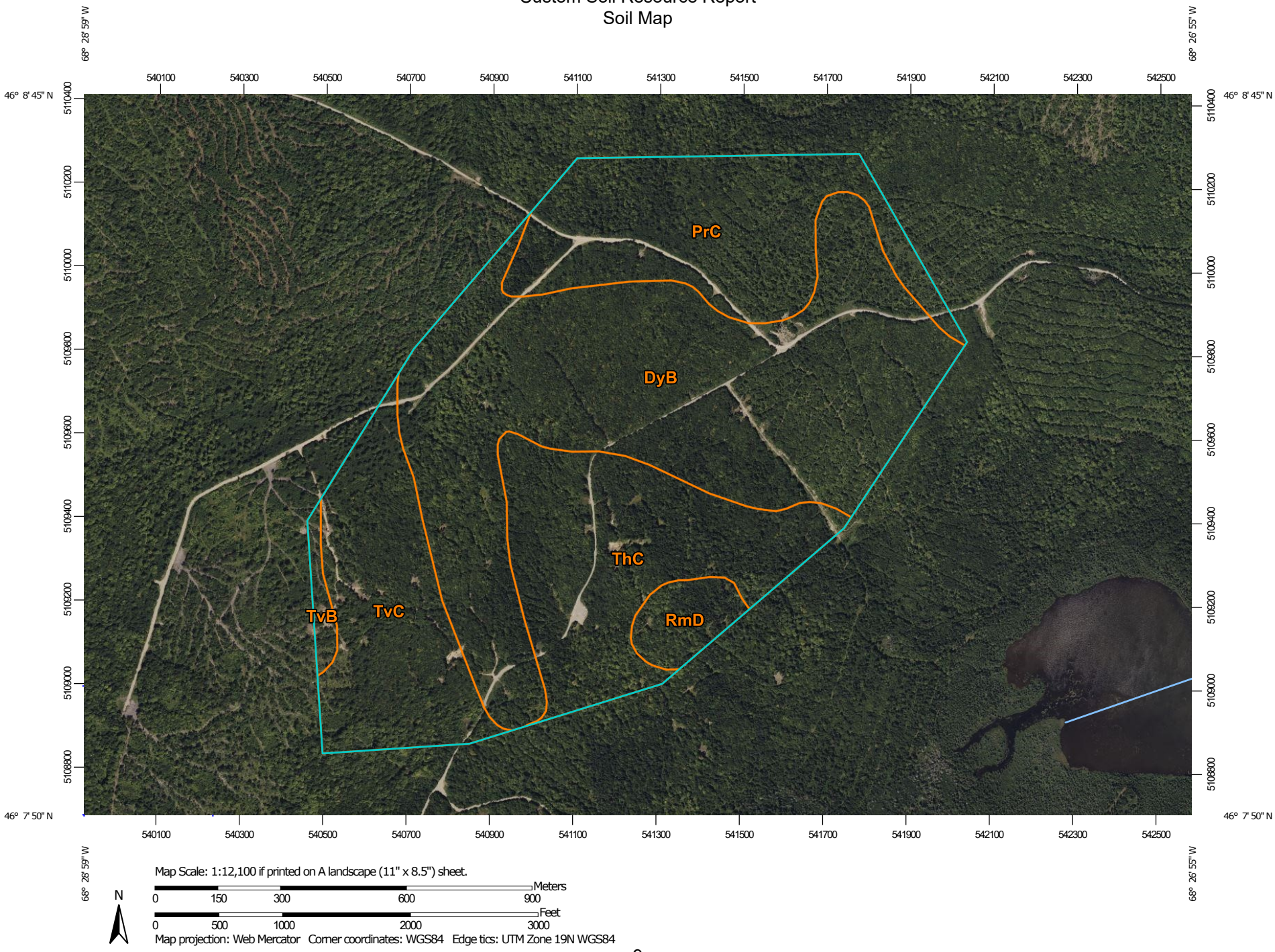
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report
## Soil Map




Map Scale: 1:12,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine
Survey Area Data: Version 20, Aug 30, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2021—Oct 5, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | 171.0 | 45.7% |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony | 66.1 | 17.7% |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony | 10.4 | 2.8% |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky | 69.2 | 18.5% |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky | 3.7 | 1.0% |
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky | 53.7 | 14.4% |
| **Totals for Area of Interest** | | **374.1** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Penobscot County, Maine

## DyB—Dixmont very stony silt loam, 2 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 9ks9
*Elevation:* 10 to 1,000 feet
*Mean annual precipitation:* 34 to 46 inches
*Mean annual air temperature:* 41 to 46 degrees F
*Frost-free period:* 100 to 150 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Dixmont and similar soils:* 91 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Dixmont

#### Setting

*Landform:* Drumlins, ridges, till plains
*Landform position (three-dimensional):* Talf
*Down-slope shape:* Linear
*Across-slope shape:* Concave
*Parent material:* Coarse-loamy supraglacial meltout till derived from phyllite and/or coarse-loamy supraglacial meltout till derived from slate

#### Typical profile

*H1 - 0 to 7 inches:* silt loam
*H2 - 7 to 23 inches:* silt loam
*H3 - 23 to 65 inches:* silt loam

#### Properties and qualities

*Slope:* 2 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.6 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.60 in/hr)
*Depth to water table:* About 12 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* High (about 10.1 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* C/D
*Ecological site:* F143XY502ME - Loamy Till Toeslope
*Hydric soil rating:* No

## PrC—Plaisted loam, 8 to 15 percent slopes, very stony

### Map Unit Setting

*National map unit symbol:* 2w3yk
*Elevation:* 120 to 2,500 feet
*Mean annual precipitation:* 35 to 52 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 80 to 140 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Plaisted and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Plaisted

#### Setting

*Landform:* Drumlinoid ridges, drumlins
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Coarse-loamy lodgment till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* loam
*Bs - 5 to 19 inches:* gravelly silt loam
*BC - 19 to 28 inches:* gravelly silt loam
*Cd - 28 to 65 inches:* gravelly silt loam

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 22 to 34 inches to densic material
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low (0.01 to 0.14 in/hr)
*Depth to water table:* About 26 to 41 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Low (about 5.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* C
*Ecological site:* F143XY501ME - Loamy Slope
*Hydric soil rating:* No

## RmD—Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony

### Map Unit Setting

*National map unit symbol:* 2w3zq
*Elevation:* 300 to 2,500 feet
*Mean annual precipitation:* 35 to 46 inches
*Mean annual air temperature:* 37 to 43 degrees F
*Frost-free period:* 90 to 130 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Rock outcrop:* 50 percent
*Thorndike and similar soils:* 35 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Rock Outcrop

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Crest, free face
*Down-slope shape:* Convex
*Across-slope shape:* Convex

#### Typical profile

*R - 0 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 15 to 25 percent
*Depth to restrictive feature:* 0 inches to lithic bedrock
*Drainage class:* Excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8s
*Hydric soil rating:* No

### Description of Thorndike

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material

*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 15 to 25 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F143XY701ME - Shallow Till
*Hydric soil rating:* No

## ThC—Thorndike channery silt loam, 8 to 15 percent slopes, rocky

**Map Unit Setting**

*National map unit symbol:* 2t0k6
*Elevation:* 300 to 2,500 feet
*Mean annual precipitation:* 35 to 52 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 130 days
*Farmland classification:* Farmland of statewide importance

**Map Unit Composition**

*Thorndike and similar soils:* 80 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Thorndike**

**Setting**

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* channery silt loam

*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F146XY061ME - Shallow Loamy Till
*Hydric soil rating:* No

## TvB—Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky

**Map Unit Setting**

*National map unit symbol:* 2wqn4
*Elevation:* 200 to 2,500 feet
*Mean annual precipitation:* 35 to 48 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 160 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Thorndike and similar soils:* 50 percent
*Winnecook and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Thorndike**

**Setting**

*Landform:* Ground moraines
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam

*R - 18 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 3 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F143XY701ME - Shallow Till
*Hydric soil rating:* No

## Description of Winnecook

**Setting**

*Landform:* Ground moraines
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

**Typical profile**

*Oe - 0 to 3 inches:* moderately decomposed plant material
*E - 3 to 8 inches:* channery loam
*Bs1 - 8 to 12 inches:* very channery loam
*Bs2 - 12 to 27 inches:* very channery loam
*R - 27 to 79 inches:* bedrock

**Properties and qualities**

*Slope:* 3 to 8 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 21 to 43 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* B
*Ecological site:* F143XY701ME - Shallow Till

*Hydric soil rating:* No

## TvC—Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky

### Map Unit Setting

*National map unit symbol:* 2wqn5
*Elevation:* 200 to 2,500 feet
*Mean annual precipitation:* 35 to 48 inches
*Mean annual air temperature:* 37 to 44 degrees F
*Frost-free period:* 90 to 160 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Thorndike and similar soils:* 55 percent
*Winnecook and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Thorndike

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Nose slope, crest
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oa - 0 to 3 inches:* highly decomposed plant material
*E - 3 to 5 inches:* silt loam
*Bs - 5 to 18 inches:* very channery silt loam
*R - 18 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 11 to 23 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Very low (about 2.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* D
*Ecological site:* F144BY701ME - Shallow Till

*Hydric soil rating:* No

### Description of Winnecook

#### Setting

*Landform:* Hills
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Nose slope, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Loamy-skeletal subglacial till

#### Typical profile

*Oe - 0 to 3 inches:* moderately decomposed plant material
*E - 3 to 8 inches:* channery loam
*Bs1 - 8 to 12 inches:* very channery loam
*Bs2 - 12 to 27 inches:* very channery loam
*R - 27 to 79 inches:* bedrock

#### Properties and qualities

*Slope:* 8 to 15 percent
*Surface area covered with cobbles, stones or boulders:* 1.5 percent
*Depth to restrictive feature:* 21 to 43 inches to lithic bedrock
*Drainage class:* Well drained
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.14 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline (0.0 to 1.9 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 4.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6s
*Hydrologic Soil Group:* B
*Ecological site:* F144BY701ME - Shallow Till
*Hydric soil rating:* No

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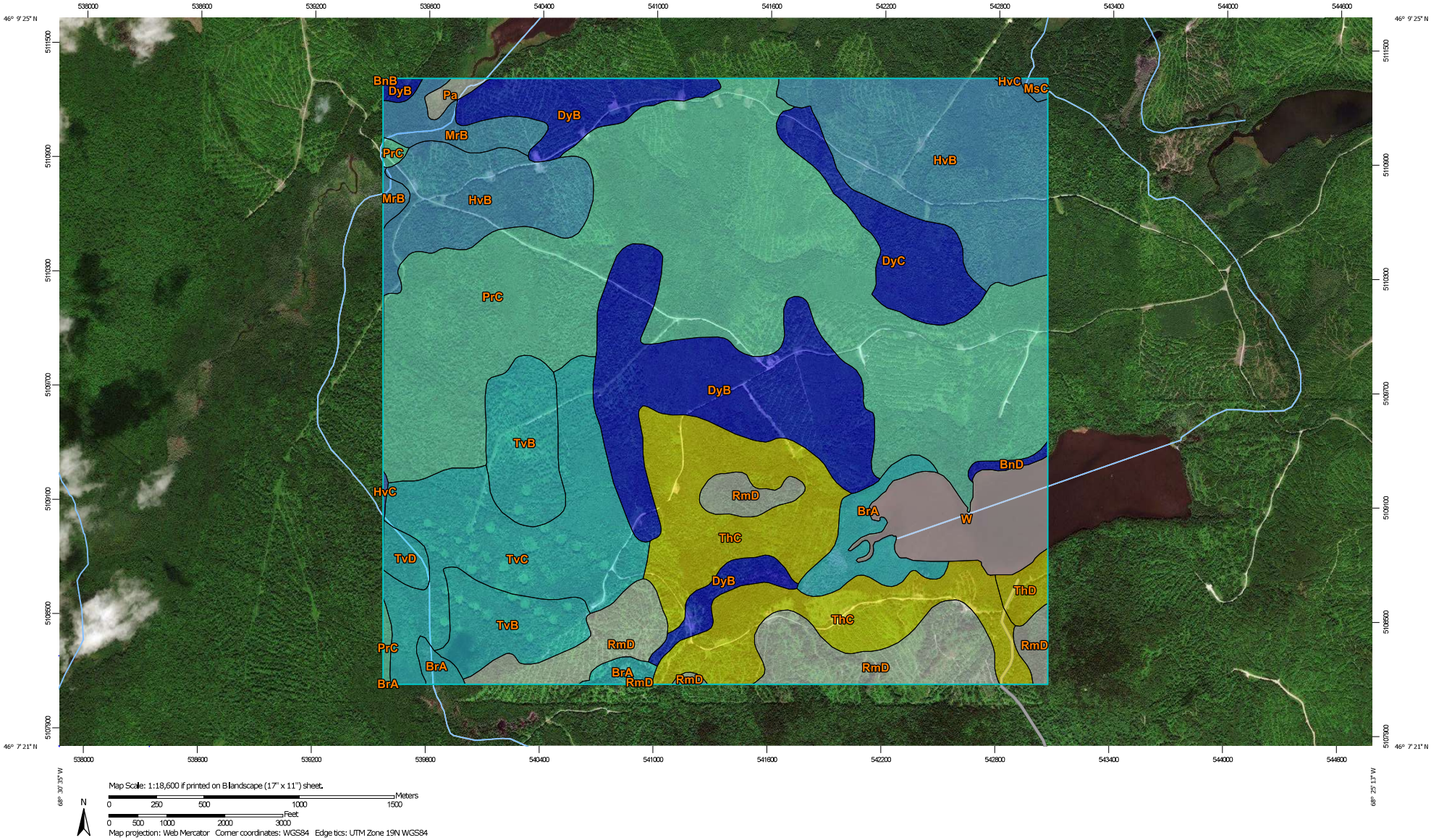
K Factor, Whole Soil—Penobscot County, Maine
(Wolfden K-Factor)




Map Scale: 1:18,600 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

**Soil Rating Lines**

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

**Soil Rating Points**

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine
Survey Area Data: Version 19, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 29, 2013—Sep 29, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# K Factor, Whole Soil

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| BnB | Bangor very stony silt loam, 0 to 8 percent slopes | .64 | 0.1 | 0.0% |
| BnD | Bangor very stony silt loam, 15 to 25 percent slopes | .64 | 5.1 | 0.2% |
| BrA | Burnham silt loam, frequently ponded, 0 to 3 percent slopes | .37 | 67.3 | 2.4% |
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | .64 | 346.1 | 12.5% |
| DyC | Dixmont very stony silt loam, 8 to 15 percent slopes | .64 | 87.5 | 3.2% |
| HvB | Howland loam, 0 to 8 percent slopes, very stony | .43 | 366.5 | 13.3% |
| HvC | Howland silt loam, 8 to 15 percent slopes, very stony | .49 | 1.9 | 0.1% |
| MrB | Monarda-Burnham complex, 0 to 3 percent slopes, very stony | .43 | 46.2 | 1.7% |
| MsC | Monarda-Burnham complex, 0 to 15 percent slopes, extremely stony | .43 | 3.4 | 0.1% |
| Pa | Peat and Muck | | 8.0 | 0.3% |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony | .32 | 842.1 | 30.5% |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony | | 182.7 | 6.6% |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky | .17 | 300.6 | 10.9% |
| ThD | Thorndike channery silt loam, 15 to 25 percent slopes, very rocky | .17 | 16.7 | 0.6% |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky | .37 | 143.4 | 5.2% |

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky | .37 | 226.3 | 8.2% |
| TvD | Thorndike-Winnecook complex, 15 to 35 percent slopes, very rocky | .37 | 15.2 | 0.6% |
| W | Water bodies | | 101.1 | 3.7% |
| **Totals for Area of Interest** | | | **2,760.2** | **100.0%** |

## Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

## Rating Options

*Aggregation Method:* Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

*Component Percent Cutoff: None Specified*

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

*Tie-break Rule:* Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

*Layer Options (Horizon Aggregation Method):* All Layers (Weighted Average)

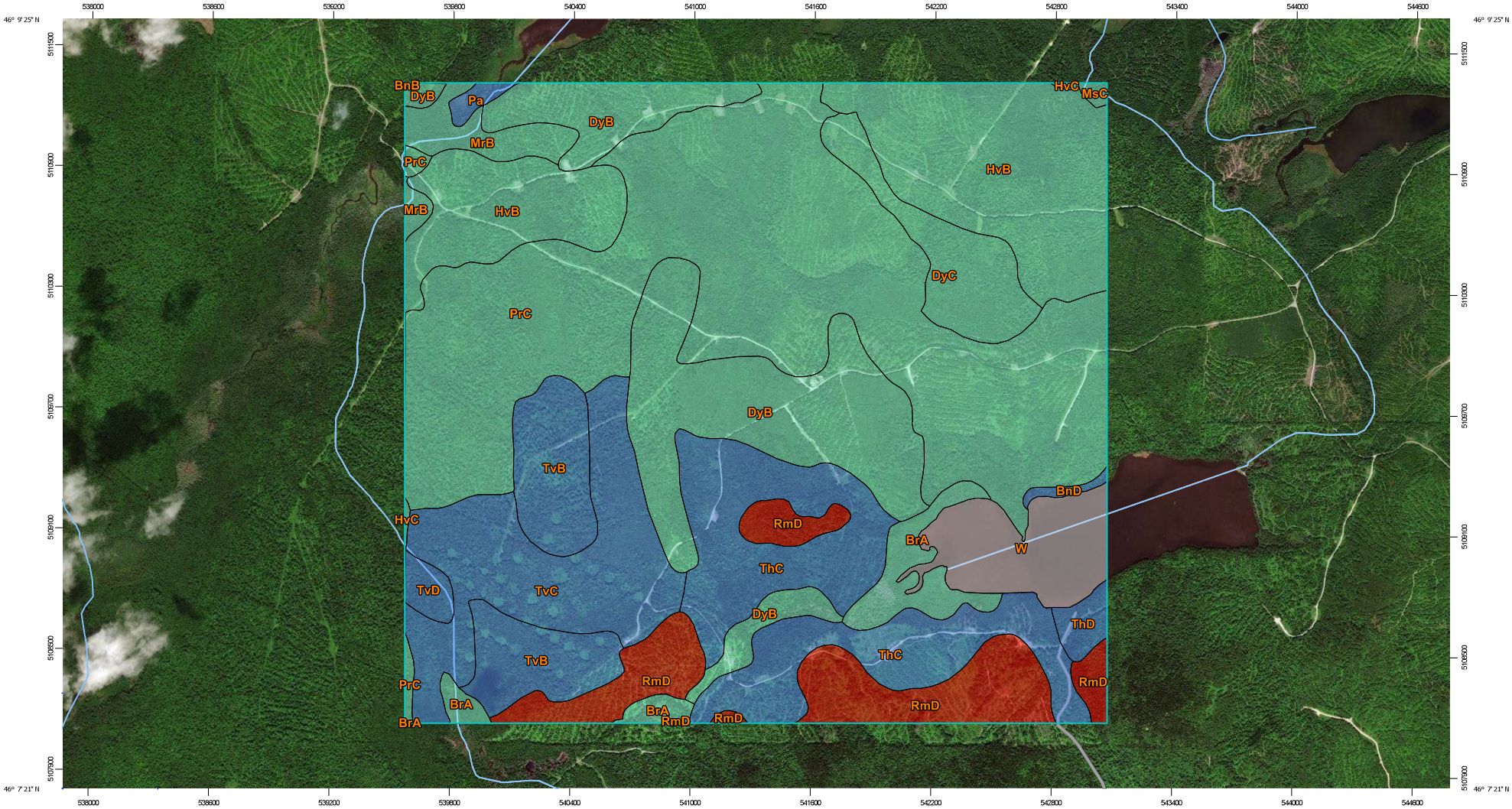
For an attribute of a soil horizon, a depth qualification must be specified. In most cases it is probably most appropriate to specify a fixed depth range, either in centimeters or inches. The Bottom Depth must be greater than the Top Depth, and the Top Depth can be greater than zero. The choice of "inches" or "centimeters" only applies to the depth of soil to be evaluated. It has no influence on the units of measure the data are presented in.

When "Surface Layer" is specified as the depth qualifier, only the surface layer or horizon is considered when deriving a value for a component, but keep in mind that the thickness of the surface layer varies from component to component.

When "All Layers" is specified as the depth qualifier, all layers recorded for a component are considered when deriving the value for that component.

Whenever more than one layer or horizon is considered when deriving a value for a component, and the attribute being aggregated is a numeric attribute, a weighted average value is returned, where the weighting factor is the layer or horizon thickness.

Saturated Hydraulic Conductivity (Ksat), Standard Classes—Penobscot County, Maine
(Wolfden K-Factor)




Map Scale: 1:18,600 if printed on B landscape (17" x 11") sheet.

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Soil Rating Lines**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Soil Rating Points**

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine
Survey Area Data: Version 19, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 29, 2013—Sep 29, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Saturated Hydraulic Conductivity (Ksat), Standard Classes

| Map unit symbol | Map unit name | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| BnB | Bangor very stony silt loam, 0 to 8 percent slopes | 10.1346 | 0.1 | 0.0% |
| BnD | Bangor very stony silt loam, 15 to 25 percent slopes | 10.1346 | 5.1 | 0.2% |
| BrA | Burnham silt loam, frequently ponded, 0 to 3 percent slopes | 5.2072 | 67.3 | 2.4% |
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | 4.3925 | 346.1 | 12.5% |
| DyC | Dixmont very stony silt loam, 8 to 15 percent slopes | 4.3925 | 87.5 | 3.2% |
| HvB | Howland loam, 0 to 8 percent slopes, very stony | 3.6803 | 366.5 | 13.3% |
| HvC | Howland silt loam, 8 to 15 percent slopes, very stony | 3.6652 | 1.9 | 0.1% |
| MrB | Monarda-Burnham complex, 0 to 3 percent slopes, very stony | 3.3148 | 46.2 | 1.7% |
| MsC | Monarda-Burnham complex, 0 to 15 percent slopes, extremely stony | 3.3148 | 3.4 | 0.1% |
| Pa | Peat and Muck | 35.0000 | 8.0 | 0.3% |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony | 4.3833 | 842.1 | 30.5% |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony | 0.0090 | 182.7 | 6.6% |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky | 15.1540 | 300.6 | 10.9% |
| ThD | Thorndike channery silt loam, 15 to 25 percent slopes, very rocky | 15.1540 | 16.7 | 0.6% |

| Map unit symbol | Map unit name | Rating (micrometers per second) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky | 15.1540 | 143.4 | 5.2% |
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky | 15.1540 | 226.3 | 8.2% |
| TvD | Thorndike-Winnecook complex, 15 to 35 percent slopes, very rocky | 15.1540 | 15.2 | 0.6% |
| W | Water bodies | | 101.1 | 3.7% |
| **Totals for Area of Interest** | | | **2,760.2** | **100.0%** |

## Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

## Rating Options

*Units of Measure:* micrometers per second

*Aggregation Method:* Dominant Component

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Component" returns the attribute value associated with the component with the highest percent composition in the map unit. If more than one component shares the highest percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher attribute value should be returned in the case of a percent composition tie. The result returned by this aggregation method may or may not represent the dominant condition throughout the map unit.

*Component Percent Cutoff: None Specified*

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

*Tie-break Rule:* Fastest

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

*Interpret Nulls as Zero:* No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

*Layer Options (Horizon Aggregation Method):* All Layers (Weighted Average)

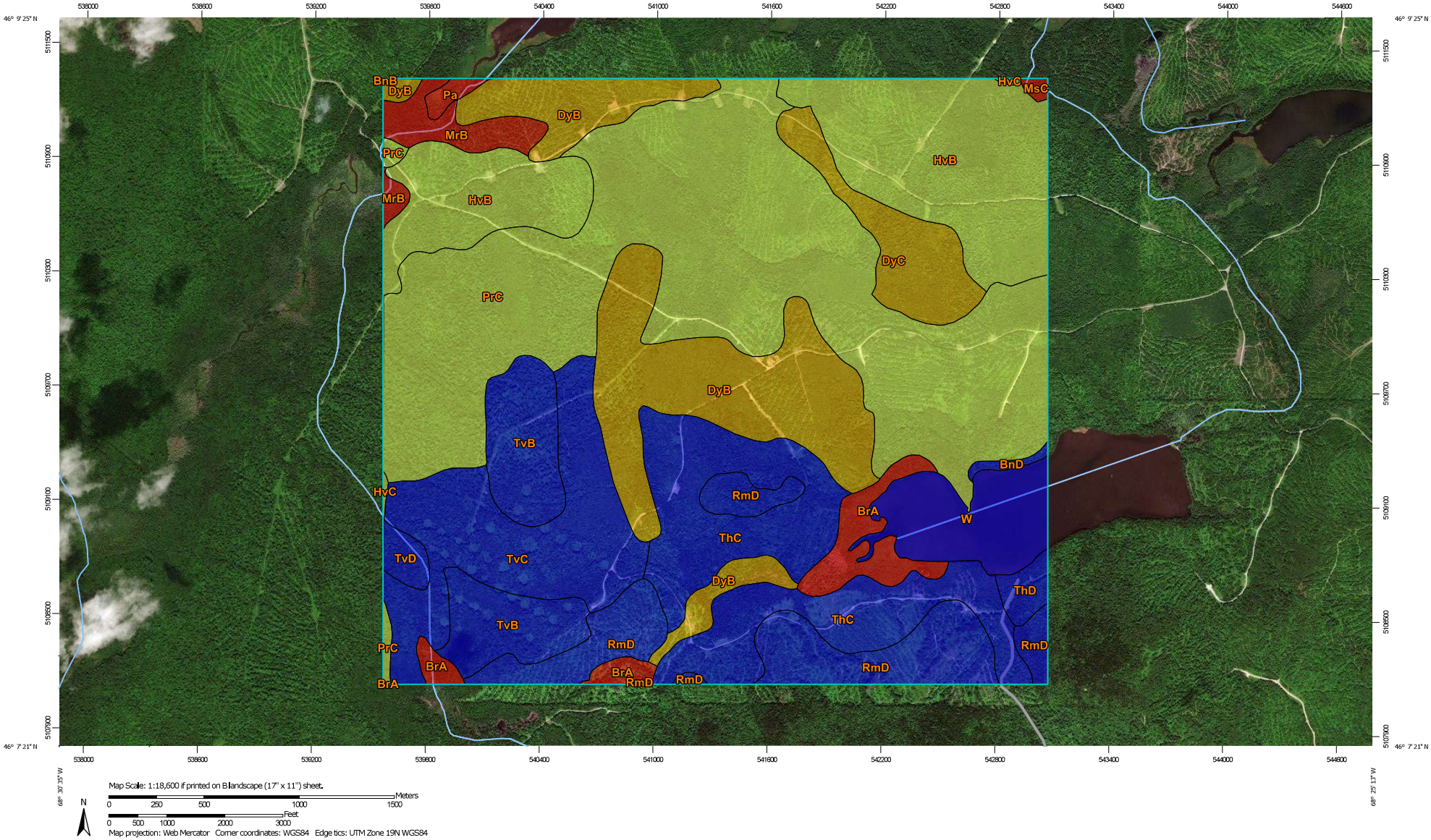
For an attribute of a soil horizon, a depth qualification must be specified. In most cases it is probably most appropriate to specify a fixed depth range, either in centimeters or inches. The Bottom Depth must be greater than the Top Depth, and the Top Depth can be greater than zero. The choice of "inches" or "centimeters" only applies to the depth of soil to be evaluated. It has no influence on the units of measure the data are presented in.

When "Surface Layer" is specified as the depth qualifier, only the surface layer or horizon is considered when deriving a value for a component, but keep in mind that the thickness of the surface layer varies from component to component.

When "All Layers" is specified as the depth qualifier, all layers recorded for a component are considered when deriving the value for that component.

Whenever more than one layer or horizon is considered when deriving a value for a component, and the attribute being aggregated is a numeric attribute, a weighted average value is returned, where the weighting factor is the layer or horizon thickness.

Depth to Water Table—Penobscot County, Maine
(Wolfden SHWT)




Map Scale: 1:18,600 if printed on B landscape (17" x 11") sheet.

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

**Soil Rating Lines**

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

**Soil Rating Points**

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Penobscot County, Maine
Survey Area Data: Version 19, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 29, 2013—Sep 29, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Depth to Water Table

| Map unit symbol | Map unit name | Rating (centimeters) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| BnB | Bangor very stony silt loam, 0 to 8 percent slopes | >200 | 0.1 | 0.0% |
| BnD | Bangor very stony silt loam, 15 to 25 percent slopes | >200 | 5.1 | 0.2% |
| BrA | Burnham silt loam, frequently ponded, 0 to 3 percent slopes | 8 | 67.3 | 2.4% |
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes | 40 | 346.1 | 12.5% |
| DyC | Dixmont very stony silt loam, 8 to 15 percent slopes | 40 | 87.5 | 3.2% |
| HvB | Howland loam, 0 to 8 percent slopes, very stony | 51 | 366.5 | 13.3% |
| HvC | Howland silt loam, 8 to 15 percent slopes, very stony | 51 | 1.9 | 0.1% |
| MrB | Monarda-Burnham complex, 0 to 3 percent slopes, very stony | 15 | 46.2 | 1.7% |
| MsC | Monarda-Burnham complex, 0 to 15 percent slopes, extremely stony | 15 | 3.4 | 0.1% |
| Pa | Peat and Muck | 0 | 8.0 | 0.3% |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony | 85 | 842.1 | 30.5% |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony | >200 | 182.7 | 6.6% |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky | >200 | 300.6 | 10.9% |
| ThD | Thorndike channery silt loam, 15 to 25 percent slopes, very rocky | >200 | 16.7 | 0.6% |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky | >200 | 143.4 | 5.2% |

| Map unit symbol | Map unit name | Rating (centimeters) | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky | >200 | 226.3 | 8.2% |
| TvD | Thorndike-Winnecook complex, 15 to 35 percent slopes, very rocky | >200 | 15.2 | 0.6% |
| W | Water bodies | >200 | 101.1 | 3.7% |
| **Totals for Area of Interest** | | | **2,760.2** | **100.0%** |

## Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

## Rating Options

*Units of Measure:* centimeters

*Aggregation Method:* Dominant Component

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Lower

*Interpret Nulls as Zero:* No

*Beginning Month:* January

*Ending Month:* December

# APPENDIX D
# SITE PHOTOGRAPHS

Atlantic Resource Co, LLC

# WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS

## TWP T6-R6 WELS, ME OCTOBER 2020

*Figure 1: Test Pit RTP-1 in forested area*

*Figure 2: Rock outcrop/disturbed area by access road near RTP-1 in Area 1*

Atlantic Resource Co, LLC

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 3: Area 1 exposed bedrock shield along access road in Dixmont soil map unit. Soils are moderately deep to bedrock and present minor limitation for construction*

*Figure 4: Delineated wetland in Area 2. Unsuitable hydric soil of Monarda series in a mapped Plaisted area.*

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 5: Area 2- RTP-4 Poorly drained soils and site conditions. Typical Monarda soils near wetland.*

*Figure 6: RTP-4 Test pit showing redoximorphic features and high water table. Example of unsuitable soil conditions.*

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 7: Area 6 Test pit RTP-6 with bedrock outcrop in Abrams (Thorndike) soils. Example of generally unsuitable soils.*

*Figure 8: Test Pit RTP-7 Moderately well drained Chesuncook soils along access road in Area 1. Example of generally suitable soils.*

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 9: Test Pit RTP-14 with oxyy-aquic conditions in Area 2 with limited suitability soils*

*Figure 10: Area 2 disturbed skidtrail upslope of RTP-14 in oxy-aquic soils condition. Wetland vegetation and ponded areas in disturbed soil with upland forest in background.*

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 11: Area 1 Test Pit RTP-15 Somewhat poorly drained Telos soils (Dixmont). Example of suitable soils with a water table at 15"*

*Figure 12: Test Pit RTP-24 Somewhat excessively drained Monson (Thorndike) soils in Area 3. Bedrock at 17". Example of limited suitability soil conditions*

Atlantic Resource Co, LLC

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 13: Test Pit RTP 25 Telos-Chesuncook soils in typical forested site in Area 1 (Dixmont) showing suitable soil conditions.*

*Figure 14: Test Pit RTP-25 with seasonal high water table at 13-14" Telos soils with limited suitability due to water table.*

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 15: Area 4- Typical site conditions with disturbed hydric soils near skid road and RTP-28*

*Figure 16: Area 4 Test Pit RTP-28- poorly drained Monarda soil with redoximorphic features at 3”-4”. Typical unsuitable soil conditions*

Atlantic Resource Co, LLC

**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 17: Area 4 Test Pit RTP-28- poorly drained Monarda soil in mapped Dixmont area*

*Figure 18: Area 4 Bedrock outcrops with somewhat poorly drained soils surrounding it. Typical limited soil conditions*

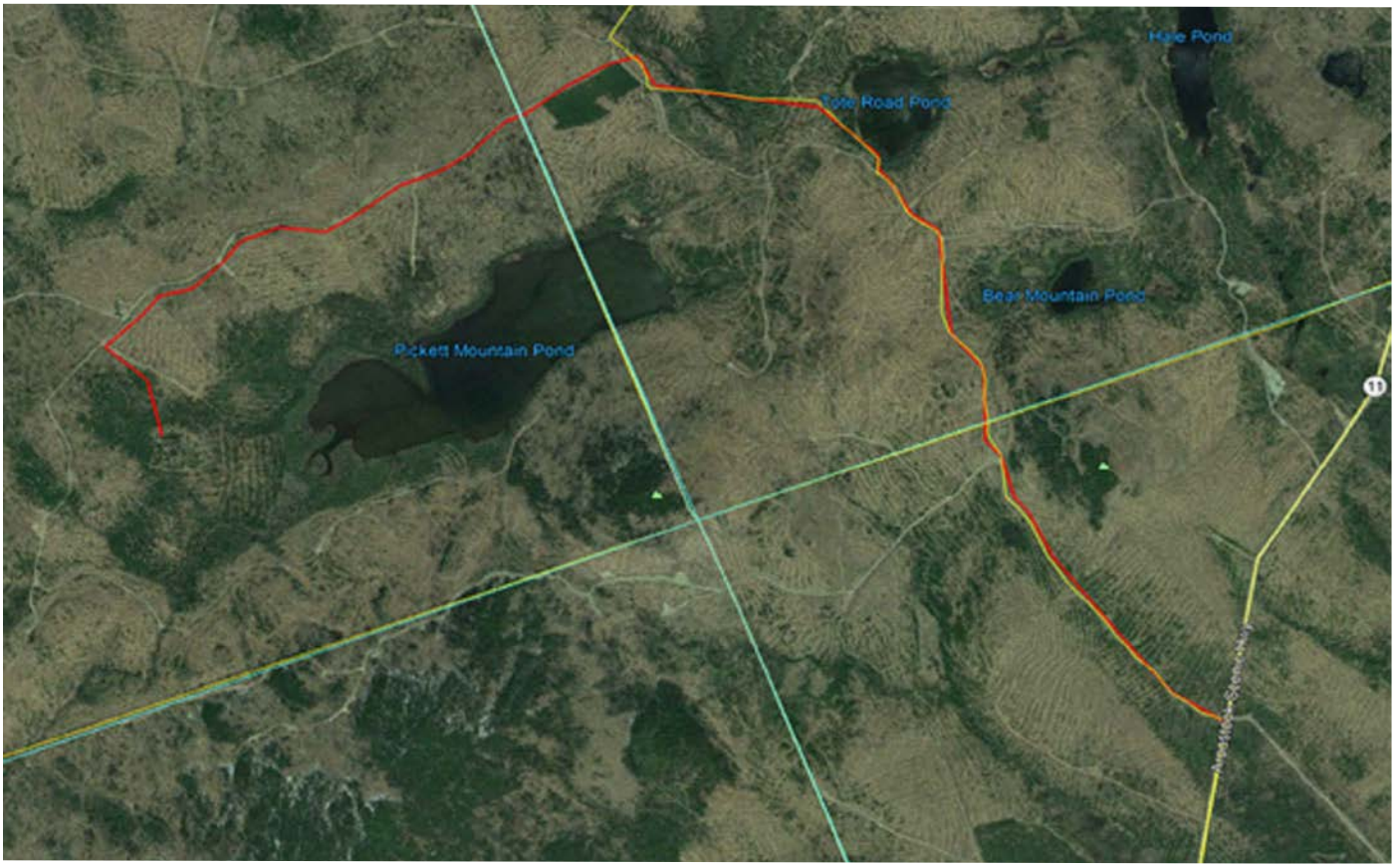
**WOLFDEN PICKETT MT. REZONING PROJECT SITE PHOTOS**

**TWP T6-R6 WELS, ME OCTOBER 2020**

*Figure 19: Area 4 old skid road at RTP-29 Telos soils (Dixmont)*

*Figure 20: Area 4 Test Pit RTP-29 somewhat poorly drained- Telos- Ragmuff (Dixmont) soil series waste table at 15" limited suitability bordering on suitable soil conditions*

# APPENDIX E
# ENGINEERING DETAILS




N

0 1000 2000 4000
SCALE IN FEET

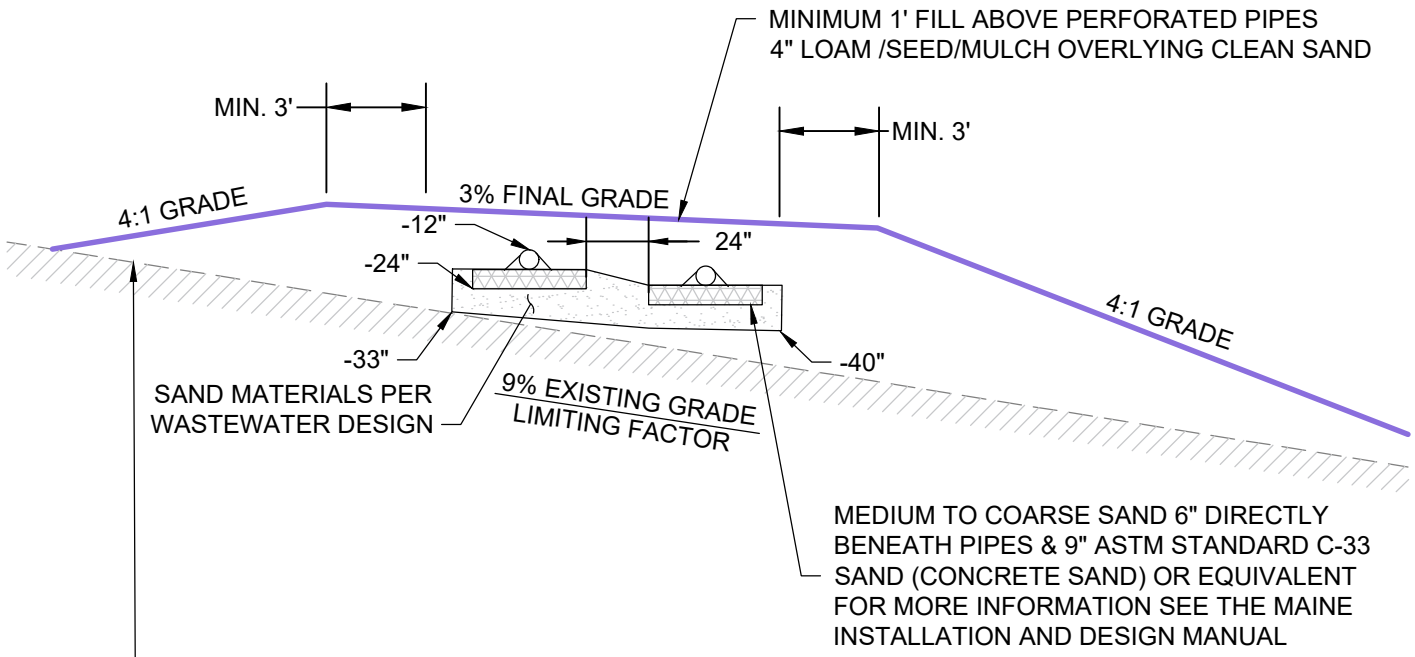
Prepared/Date: BRT 4/25/22
Checked/Date: MAP 9/26/22

Soil Suitability Evaluation
Wolfden Pickett Mt. Mine
Wolfden Mt. Chase, LLC

WSP USA

PROJECT ROADWAY ACCESS
Project 3617-22-7547
Figure 1

\\PLD2-FS1\Project\Projects\Wolfden Resources\8.0 Drawings\Figures\Figures\2022\Figure-1 Project Roadway Access.dwg Thu, 29 Sep 2022 - 8:39am mark.peters




MEDIUM TO COARSE SAND 6" DIRECTLY BENEATH PIPES & 9" ASTM STANDARD C-33 SAND (CONCRETE SAND) OR EQUIVALENT FOR MORE INFORMATION SEE THE MAINE INSTALLATION AND DESIGN MANUAL

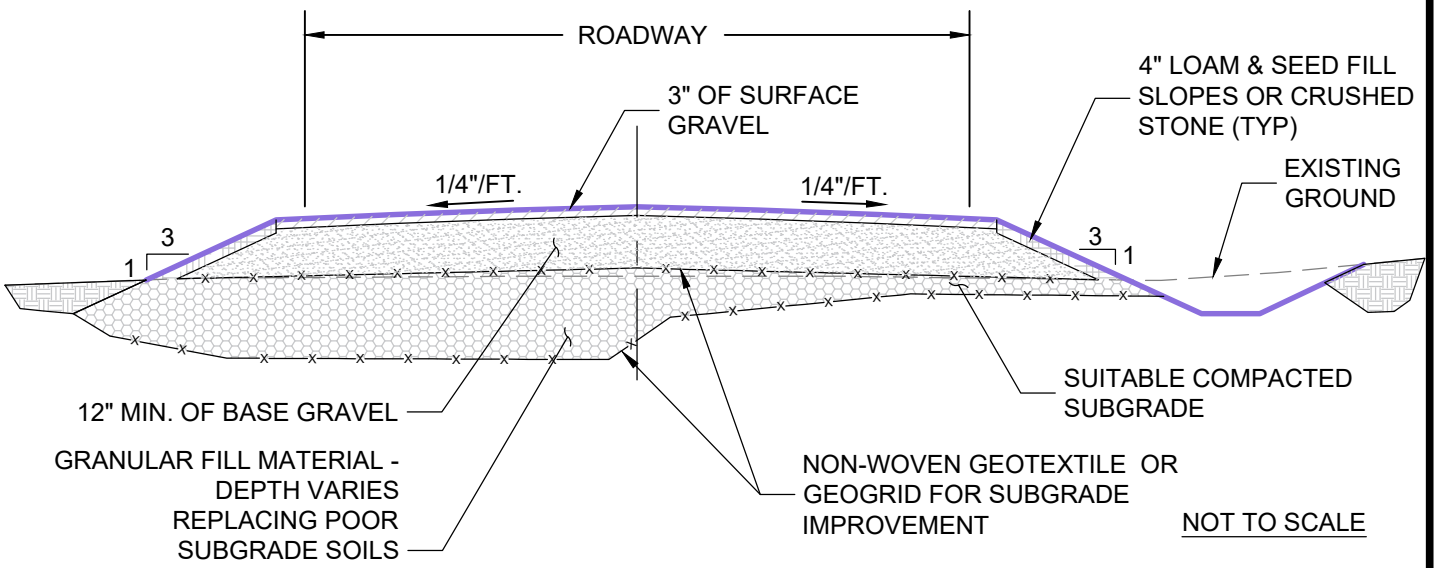
SCARIFY ALL GROUND TO BE FILLED. REMOVE VEGETATION AND ORGANIC MATTER. SCARIFY SOIL TO A DEPTH OF 6 INCHES BY MIXING GRAVELLY COARSE SAND WITH NATIVE SOIL USING A ROTOTILLER OR BACKHOE BUCKET WITH TEETH.

NOT TO SCALE

Prepared/Date: BRT 4/25/22
Checked/Date: MAP 9/26/22

| | | |
|---|---|---|
| Soil Suitability Evaluation<br>Wolfden Pickett Mt. Mine<br>Wolfden Mt. Chase, LLC | WSP USA | TYPICAL MOUNTED WASTEWATER DISPOSAL SYSTEM DESIGN FOR SOILS WITH HIGH WATER TABLE<br>Project 3617-22-7547<br>Figure 4 |

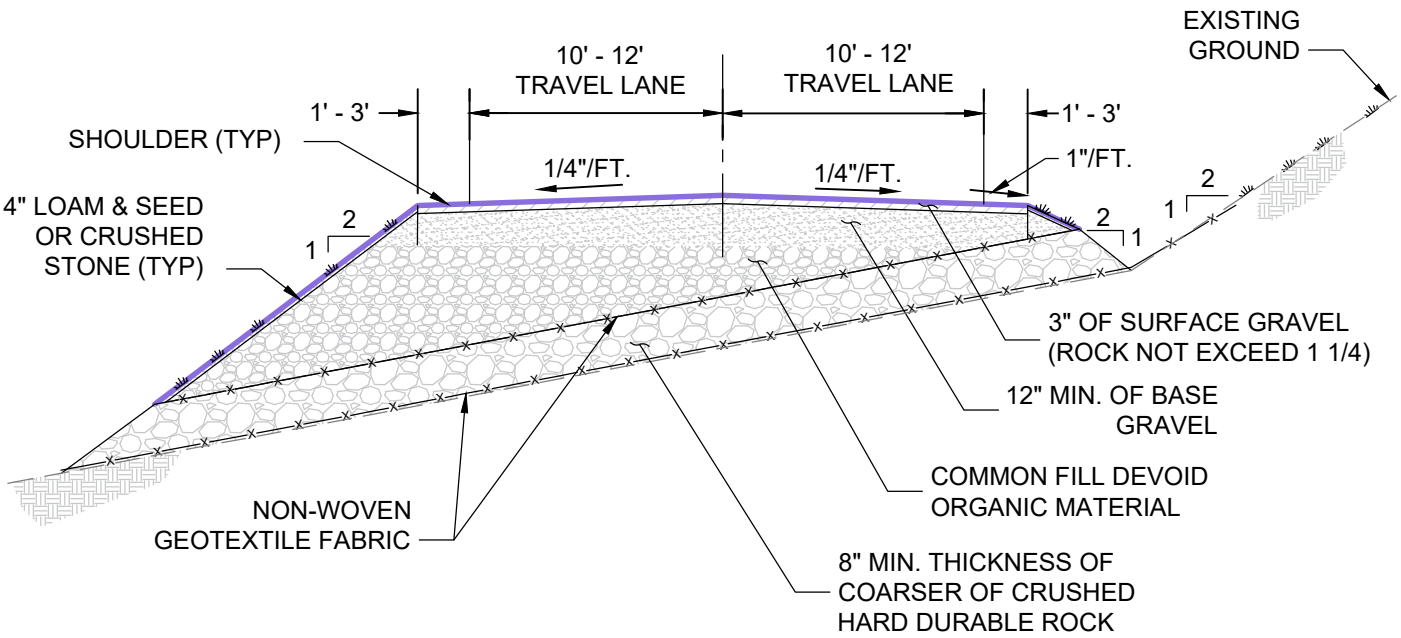
\\PLD2-FS1\Project\Projects\Wolfden Resources\8.0 Drawings\Figures\Figures\Figure-4 Typ Mounded Wastewater Disposal System.dwg Thu, 29 Sep 2022 - 9:21am mark.peters




Prepared/Date: BRT 4/25/22
Checked/Date: MAP 9/26/22

| | | |
|---|---|---|
| Soil Suitability Evaluation<br>Wolfden Pickett Mt. Mine<br>Wolfden Mt. Chase, LLC | WSP USA | TYPICAL ROAD CROSS-SEC.<br>FOR POOR SOILS CONDITIONS<br>Project 3617-22-7547<br>Figure 2 |

\\PLD2-FS1\Project\Projects\Wolfden Resources\8.0 Drawings\Figures\Figures\2022\Figure-2 Typ Road Cross (Poor Soil Cond).dwg Thu, 29 Sep 2022 - 8:41am mark.peters




NOT TO SCALE

Prepared/Date: BRT 4/25/22
Checked/Date: MAP 9/26/22

| | | |
|---|---|---|
| Soil Suitability Evaluation<br>Wolfden Pickett Mt. Mine<br>Wolfden Mt. Chase, LLC | WSP USA | TYPICAL ROAD CROSS-SEC.<br>W/SANDWICH MATERIAL AND DITCH<br>Project 3617-22-7547<br>Figure 3 |

\\PLD2-FS1\Project\Projects\Wolfden Resources\8.0 Drawings\Figures\Figures\2022\Figure-3 Typ Road Cross-Sec W-Sandwich Material and Ditch.dwg Thu, 29 Sep 2022 - 8:54am mark.peters

# EXHIBIT 24.0 SEWAGE WATER/WASTEWATER DISPOSAL

Human sewage from the underground mine operations will be collected in portable toilets and serviced by a licensed septage contractor. Human sewage generated from the surface operations will drain to a typical septic system located on the site down gradient of the infrastructure and site potable water supply. The septic system will be designed according to Maine Department of Health and Human Services Subsurface Wastewater Disposal System Rules to meet anticipated employment numbers. Based on initial surveys, soils in the conceptual area where the septic system is located (Map ID 11 in **Exhibit 2, Exhibit 2, Figure 2-1**) are suitable for management of sewage (see **Exhibit 23, Attachment 23-A**). In summary, the Project would generate typical domestic wastewater flows typical of a medium sized manufacturing or commercial building with estimated flows of 1,840 gallons per day. There are suitable areas onsite to treat the expected wastewater and **Attachment 24-A** provides one conceptual design of how this system could be constructed. However, the final location of any septic system will be subject to further soil testing and design considerations as part of the Chapter 200 permitting process. If further studies and site conditions warrant (e.g., insufficient depth to a restrictive layer), a subsurface domestic wastewater disposal system could be constructed to handle sewage requirements for the Project. **Exhibit 2, Figure 2-7** contains a typical detail for a mounded subsurface domestic wastewater disposal system.

# EXHIBIT 24 FIGURES

Not Applicable

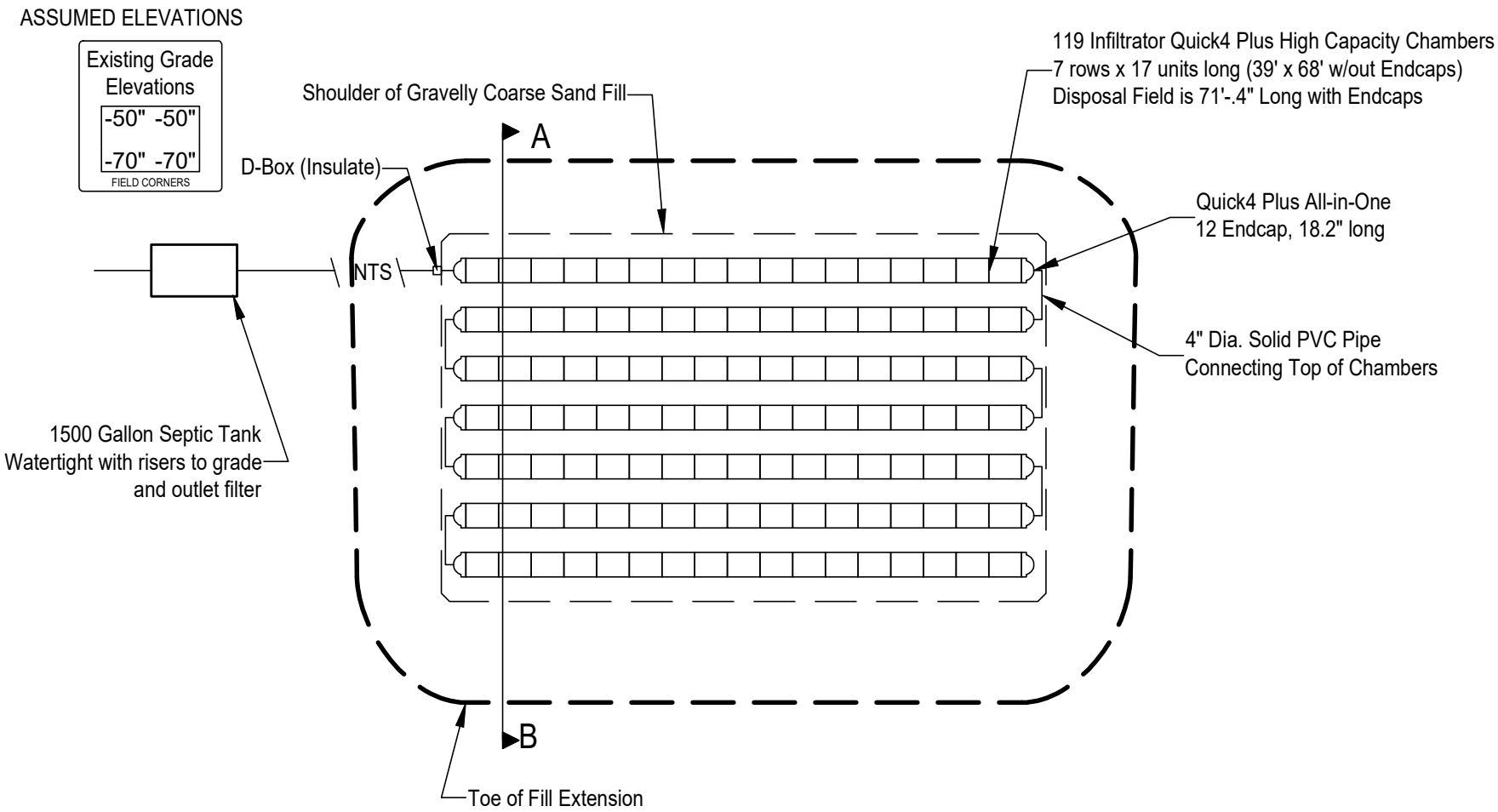
# EXHIBIT 24 ATTACHMENTS

Attachment 24-A: Conceptual Wastewater System Design

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 24-A: Conceptual Wastewater System Design

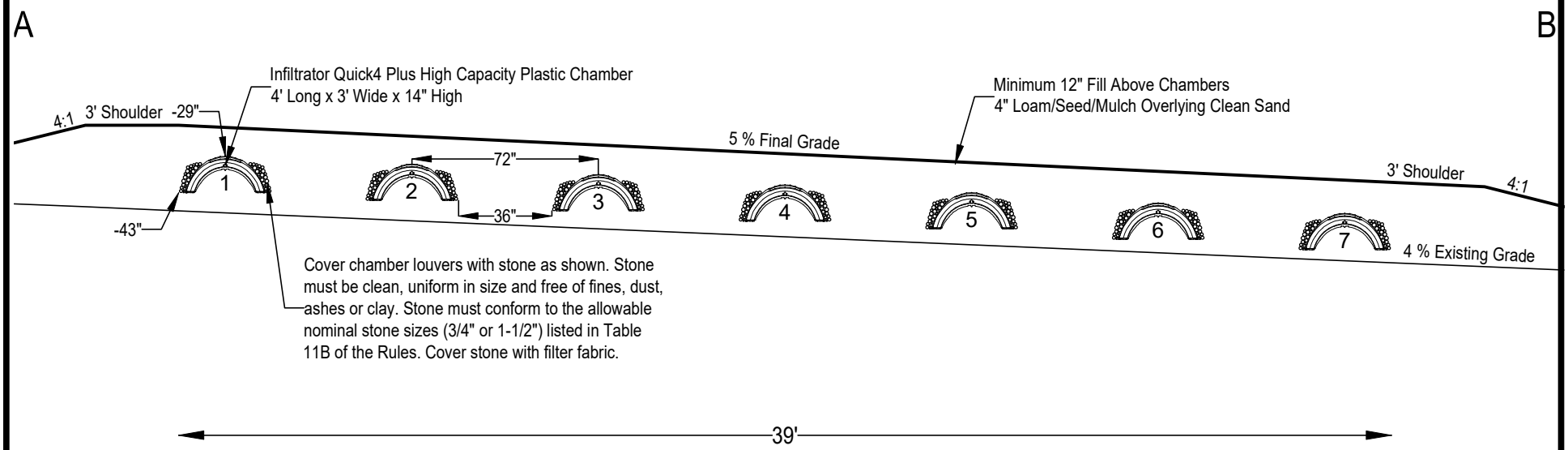



| | | | |
|---|---|---|---|
| **SAMPLE INFILTRATOR WW SYSTEM**<br>**HHE200 PAGE 3A DISPOSAL SYSTEM PLAN** | **4** | BY: RST<br>DATE: 4.6.2021 | ARC Atlantic Resource Co. LLC<br>WWW.ARC-ENV.COM<br>207-944-7288 |
| **920 GPD CAPACITY** | SCALE: 1"= 20' | PROJECT: | |

NOTE: BACKFILL MATERIAL PLACED BELOW OR WITHIN 3' OF THE CHAMBERS MUST BE GRAVELLY COARSE SAND MEETING SECTION 11(E)(2) OF THE RULES. REMAINING FILL LOAMY SAND (NO CLAY).

| ROW # | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| TOP | -29" | -32" | -36" | -40" | -43" | -47" | -51" |
| BOTTOM | -43" | -46" | -50" | -54" | -57" | -61" | -65" |

TOP OF ROW #1 INLET AT -31"




| | | | |
|---|---|---|---|
| **WOLFDEN EXAMPLE DESIGN 920 GPD HHE200 PAGE 3B CROSSSECTION** | **5** | BY: RST | |
| | | DATE: 8/2021 | |
| **HHE200 SUPPLEMENT** | SCALE: 1"=5' | PROJECT: 20034 | ARC Atlantic Resource Co. LLC — WWW.ARC-ENV.COM 207-944-7288 |

# EXHIBIT 25.0 ARCHAEOLOGICAL AND HISTORIC RESOURCES

## 25.1 HISTORICAL SITES

On July 1, 2022, the Northeast Archaeology Research Center, Inc, (NEARC) completed an Archaeological Phase 0 Assessment of the Proposed Pickett Mountain Mine Project T6R6 WELS, Penobscot County, Maine (Phase 0 Assessment) on behalf of Wolfden Resources to identify all archaeologically sensitive areas (ASA) within the rezoning area (**Attachment 25-A**). The Phase 0 Assessment identified five ASAs that fall within or overlap portions of the Project area. Four of these ASAs were classified as sensitive due to the presence of knappable lithic material of a type known to have been used by Native Americans to make stone tools. One area with a small overlap of the rezone buffer area was identified as sensitive as a Native American archaeological habitation site (ASA 5). None of the ASAs are impacted by the Project design.

All areas outside of these ASAs are considered to possess low sensitivity for the presence of Native American archaeological sites. The area is not considered sensitive for the presence of Euroamerican archaeological resources. NEARC recommended an archaeological Phase 1 survey of the ASAs that fall within the Project area if detailed baseline study test work proceeds. The MHPC concurred and the project will conduct Phase 1 surveys during Chapter 200 permitting (**Attachment 25-B**).

## 25.2 ADDITIONAL ARCHAEOLOGICAL STUDY

The applicant will conduct a Phase 1 survey of ASAs within the rezone area that were identified during the Phase 0 Assessment as part of the MDEP Chapter 200 permitting process.

## 25.3 MAINE INDIAN TRIBES CONSULTATION

Letters requesting information on any significant cultural or historical resources were sent to the Aroostook Band of Micmacs, Houlton Band of Maliseet Indians, Passamaquoddy Tribes, and Penobscot Nation on September 28, 2022 (**Attachment 25-C**). The applicant also requested their consultation in development of a Phase 1 survey. Responses from the tribes have not been received prior to submitting this application.

# EXHIBIT 25 FIGURES

Not Applicable

# EXHIBIT 25 ATTACHMENTS

Attachment 25-A: Northeast Archaeology Research Center, Inc., Phase 0 Assessment Report

Attachment 25-B: MHPC Communications on Phase 0 Assessment Report

Attachment 25-C: Tribal Notification Letters

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 25-A: Northeast Archaeology Research Center, Inc., Phase 0 Assessment

# Archaeological Phase 0 Assessment
# for the Proposed Pickett Mountain Mine Project
# T6R6 WELS, Penobscot County, Maine

prepared for:

Wolfden Resources Corporation
1100 Russell Street
Thunder Bay, ON P7B 5N2

prepared by:

Gemma-Jayne Hudgell, Ph.D.
Christopher Brouillette
and
Robert N. Bartone, M.A.

Northeast Archaeology Research Center, Inc.
382 Fairbanks Road
Farmington, Maine 04938

July 1, 2022

**Archaeological Phase 0 Assessment**
**for the Proposed Pickett Mountain Mine Project**
**T6R6 WELS, Penobscot County, Maine**

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**Archaeological Phase 0 Assessment**
**for the Proposed Pickett Mountain Mine Project**
**T6R6 WELS, Penobscot County, Maine**

## List of Figures


Figure 1. Topographic map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 2. Aerial photograph showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 3. Aerial photograph showing the location of defined archaeologically sensitive areas (ASAs) within the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note also the location of previously identified Native American site 147.001.

Figure 4. Map of the Maine biophysical regions showing location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 5. Regional watershed map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 6. Section of the Ekren and Frischkneck 1967 bedrock geologic map of the Island Falls quadrangle, showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 7. Wolfden map of the Pickett Mountain area of exploration, 2019, showing the generalized geology of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine, and surrounding area.

Figure 8. Wolfden geological plan of the Pickett Mountain area of exploration, 2019, showing the geology of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The lines/dots mark boring locations.

Figure 9. USDA Soils map of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 10. Timeline showing the major time periods of Native American history for Maine and the broader region.

Figure 11. Map of tailing pond area showing location of previously identified site 147.001 (the Pickett Pond Site). From Bonnichsen et al. 1984:7, Figure 3.

Figure 12. Profile sketch map of Pickett Pond basin surficial geology showing postglacial landforms. From Bonnichsen et al. 1984:6 Figure 2.

Figure 13. Section of the Walling 1859 map of Penobscot County showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 14. Section of the Colby 1885 map of Penobscot County showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 15. Section of the Stuart 1894 map of the Timber Lands of Maine showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 16. 1940 topographic map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note tote road passing to the north of project area and structure on tote road near Pleasant Lake.

Figure 17. View southeast of skidder trail within the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Pickett Mountain is visible in the background. The photographer is standing on the hill in the northwest portion of the project area in the vicinity of ASA 3.

Figure 18. View north towards the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The photographer is standing in the approximate location of previously identified site 147.001 looking towards ASA 5. The thick undergrowth in the southern portion of the project area is clearly visible. This thick vegetation also denotes the location of wetland areas at the head of Pickett Mountain Pond.

Figure 19. View south of Wolfden geologists Don Dudek and John Breedlove at lithic outcrop ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 20. Lithic outcrop at ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 21. Sample from lithic outcrop at ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 22. View northwest of lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 23. Lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 24. Samples from lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 25. View west of part of lithic outcrop ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 26. View east of part of lithic outcrop ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 27. Samples from lithic outcrop at ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note how well this material flakes using a geological hammer.

Figure 28. View northwest of lithic outcrop ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 29. Lithic outcrop ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 30. Sample of lithic outcrop in ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 31. Lithic outcrop at ASA 6 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note that the lower rock seam appears to be an intact outcrop while the top appears to have been flipped or moved by heavy machinery.

Figure 32. Sample of lithic outcrop in ASA 6, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 33. Poor quality, reddish colored chert seam in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. This chert was identified approximately 100 m south of ASA 1 (location marked on GPS with yellow dot).

Figure 34. Sample of poor quality, reddish colored chert seam in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. This chert was identified approximately 100 m south of ASA 1.

Figure 35. Chert cobble, likely Munsungan material, recovered from glacial till in the vicinity of ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine (location marked on GPS with yellow dot).

Figure 36. Chert cobbles, likely Munsungan material, recovered from glacial till in the southwestern corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine (location marked on GPS with yellow dot).

Figure 37. View northwest of gravel track in southwestern corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The Pickett Mountain Pond stream is within the bushes at the right side of the photograph.

Figure 38. View east of level till bench landform in southeast corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note Wolfden coring location at left of photograph (orange marker).

Figure 39. View south of level landform in southeast corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note wetland beyond.

**Archaeological Phase 0 Assessment**
**for the Proposed Pickett Mountain Mine Project**
**T6R6 WELS, Penobscot County, Maine**

## I: Introduction

The Northeast Archaeology Research Center, Inc. (NE ARC) has completed an archaeological phase 0 assessment of the proposed Pickett Mountain Mine Project on behalf of Wolfden Resources Corporation. The Pickett Mountain Property consists of 6,781 hectares of private land located in Township 6, Range 6, Penobscot County, Maine that was acquired in 2017 by Wolfden Mt. Chase LLC (a wholly-owned subsidiary of Wolfden Resources Corporation). In January 2020 Wolfden submitted a Petition to the Maine Land Use Planning Commission (LUPC) to rezone approximately 295 acres of the Property in support of a developing an underground metallic mineral mine. This area was subject to an archaeological phase 0 assessment. Subsequently, the project was redesigned and the parcel shifted to extend farther to the north and east. This new 415-acre rezoning area, inclusive of a 400-foot buffer, overlaps with the previous 295-acre parcel (an overlap of ~211 acres) (Figures 1 and 2). This new parcel was also subjected to a phase 0 study. The combined results of phase 0 studies of both parcels are presented herein.

The phase 0 work was designed to identify all areas that are sensitive for the presence of Native American or historic Euroamerican archaeological sites both within the mine project area and also at selected locations along the access roads that may be subject to improvement as needed, or to show that archaeological sites of potential significance are not likely to be present. Significant archaeological sites are those that meet eligibility criteria for listing on the National Register of Historic Places (NRHP). The assessment was conducted as part of the Maine LUPC permit application process, and meets guidelines and requirements determined by the Maine Historic Preservation Commission (MHPC).

The original 295-acre parcel was reviewed by the MHPC and was determined to exhibit moderate archaeological sensitivity for Native American archaeological sites based on the project location within the area of possible Ordovician or Silurian chert toolstone outcrops, as well as proximity to previously identified Native American site 147.001, which is located approximately 250 m (0.16 mile) south of the original project area on the edge of the Pickett Mountain Pond valley. Based on information from the MHPC, there is a low probability of post-contact Euroamerican archaeological sites being present, mostly being lumbering camps. In general, this description of sensitivity still applies to the new rezoning area given that there is considerable overlap.

The phase 0 assessment included background research, archaeological sensitivity modeling, and field inspection, including consultation with Wolfden geologists and walkover survey to locate bedrock

outcrops and assess their suitability for use as toolstone. Overall, six archaeologically sensitive areas (ASAs) were defined. Of these, four fall within the original project area and five fall within, or partially within, the new rezoning area. ASAs 1-4 and ASA 6 are areas of outcropping "cherty rhyolite", which is a knappable lithic material of a type known to have been used by Native Americans to make stone tools. Of note, one outcrop, ASA 4, falls outside of both iterations of the project area (Figure 3). The project also possesses archaeological sensitivity for Native American archaeological habitation sites based on the presence of a fairly level till bench terrace located above Pickett Mountain Pond in the southeastern portion of the project and given the identification of site 147.001 within 250 m of the original project area and within 400 m of the southern boundary of the new rezoning area on a similar landform near the head of the same pond. Portions of this till bench located within the boundaries of the previous project area have been designated as ASA 5, and a small portion overlaps with the new rezoning area (see Figure 3). The project area is not considered sensitive for the presence of post-contact Euroamerican archaeological resources.

If detailed baseline study test work proceeds, archaeological phase I survey is recommended within ASAs 1, 2, and 6 as well as small portions of ASAs 3 and 5 in order to determine if archaeological site(s) of potential significance are present within the new rezoning area. A final plan for phase I survey, if required, will be developed in consultation with the MHPC.

## II: Environmental Setting

The Pickett Mountain Mine Project is located in elevated terrain in the southern portion of the Aroostook Hills Region of Maine (Figure 4). This region, as characterized by McMahon (1990: Appendix 7), extends from the Saint John River near Madawaska southwards to the Patten area. The Aroostook Hills are a region of gently rolling terrain that forms part of the eastern foothills of the northern extent of the Appalachian Mountain chain, and as such, more elevated and mountainous terrain is located to the west. The 1000' contour line forms the western boundary of the region, and elevations average between 800' and 1000'. Scattered mountains are present in the Winterville area and on a small pluton north of Shin Pond, and include those in the vicinity of the project: Mount Chase (2440'), located approximately 1.5 km (0.9 mi) south of the project; Hay Brook, Roberts, and Green mountains, 6.7 km (4.2 mi) northwest of the project; and Sugarloaf Mountain (1860'), 11.1 km (6.9 mi) west of the project.

The project is located within Penobscot River Drainage basin, specifically within the Mattawamkeag River sub-basin (Figure 5). High ground in the center of the project area creates a micro-

watershed, with the northern portion of the project area having northerly facing slopes and draining northward to Pleasant Lake/Mud Lake and the West Branch of the Mattawamkeag River, and the southern portion of the project facing south or southeast and draining southwards to Pickett Mountain Pond, which itself drains east then northwards, also into Mud Lake and the West Branch. The Mattawaumkeag River proper forms from the confluence of its East and West branches in Haynesville, 50 km (31 mi) southeast of the Project, then flows just over 80 km (50 mi) southwest to join the Penobscot River in Mattawaumkeag. In turn, the Penobscot River is also formed from its East and West branches, which meet about 17 km (11 mi) upstream of Mattawaumkeag, then flows for a further 175 km (109 mi) south into the Atlantic Ocean at Penobscot Bay, passing through the city of Bangor (which lies approximately 145 km [89 mi] south of the project). Including the East and West Branches, the Penobscot is the second longest river system in Maine, and the longest located entirely within the state. Its drainage basin measures approximately 22,300 square kilometers (8,610 square miles) (U.S. Geological Survey 2012).

Bedrock of the Aroostook Hills region is almost entirely composed of weakly metamorphosed pelites, sandstones, and some limestones. Intrusives include a belt of metavolcanic rock that cuts across the central portion of the region and the quartz diorite pluton that underlies Mount Chase. The major structural feature, the Weeksboro-Lunksoos anticline, passes through the project area roughly west-east. Within the project area north of the anticline, the northern quarter (approximate) contains Rockabema quartz diorite, and the remaining central and southern portions south of the anticline are mainly Mount Chase volcanics (felsic and mafic), including quartz diabase. The Grand Pitch formation, consisting of slate and quartzite, extends slightly into the northwestern portion of the project (Figures 6 and 7) (Ekren and Frischkneck 1967; McMahon 1990: Appendix 7; Osberg et al. 1985). A slightly more detailed map of the project area produced by Wolfden geologists illustrating their target, the massive sulphide deposit, also shows the presence of mudstone and siltstone, and mafic breccia (Figure 8).

The climate of the region varies considerably from north to south and is intermediate between the Saint John Uplands to the west, and the Aroostook Lowlands to the east. Winter temperatures and annual precipitation and snowfall are higher in southern parts of the region, including the project area, due to higher elevations. Near Patten, average precipitation is 43”, and snowfall averages 120”. The average minimum temperatures range from 4° F near Patten to -5° F near Squa Pan (Maine Forest Service 2000).

As a result of climate, thin soils, and high elevations, vegetation is of limited variety compared to other regions of the state. The project area generally falls within the spruce-fir northern hardwoods zone, and principal arboreal species include red spruce, balsam fir, white pine, hemlock, white cedar, red maple, sugar maple, paper birch, yellow birch, aspen, tamarack, and black ash (McMahon 1990; Westveld et al.

1956). The 1000' contour also roughly defines the northern and western limit of eccentric bog distribution in Maine. Modern biotic communities of the region reflect historic and modern land use practices, particularly as a result of land clearing and forestry.

The rolling terrain of this portion of Maine is covered by thin glacial drift, and some portions of the Aroostook Hills (especially in the eastern portion) have extensive but scattered deposits of glaciolacustrine sediments on which cedar swamps and peatlands have developed. Immediately around Pickett Mountain Pond are surficial deposits derived from swamplands, including Burnham silt loam 0-3% slopes, which is frequently ponded, however these soils do not extend into the project area. The project is elevated above the pond and includes soils derived from glacial till, including ablation till – which tends to be loose, stony, and sandy with fair to good drainage – and basal till, which is commonly fine grained and compact, with low permeability and poor drainage (Newman 1981). Much of the northern portion of the project area contains Plaisted loam soils (8 to 15% slopes), very stony, formed from coarse-loamy lodgment till. The central portion of the project area possesses Dixmont very stony silt loam soils, 2 to 8% slopes, formed from coarse-loamy supraglacial meltout (ablation) till derived from slate and/or phyllite, while southwestern portions contain Thorndike-Winnecook complex (3 to 8 % and 8 to 15% slopes), rocky, which is a shallow loam to silt loam formed from loamy-skeletal subglacial (basal) till. Most of the southeastern portion contains Thorndike channery silt loam, 8 to 15% slopes, also formed from loamy-skeletal subglacial till. A small portion of the southeastern part of the project area is mapped as Rock outcrop-Thorndike association, 15 to 25% slopes, very stony, essentially consisting of very thin Thorndike soils over rock outcrops (Figure 9) (USDA 2020).

## III: Pre-Contact Native American Context and Archaeological Sensitivity

### General Archaeological Sensitivity

The Native American history of the region is divisible into four major periods (Bourque 2001; Petersen 1995) (Figure 10). These include the following:

- Paleoindian period, ca. 9000-7000 B.C
    - Early Paleoindian period, ca. 9000-8300 B.C.
    - Middle Paleoindian period, ca. 8300-8100 B.C.
    - Late Paleoindian period, ca. 8100-7000 B.C
- Archaic period, ca. 7000-1000 B.C
    - Early Archaic period, ca. 7000-5500 B.C.
    - Middle Archaic period, ca. 5500-4000 B.C.
    - Late Archaic period, ca. 4000-1000 B.C.
- Ceramic period, ca. 1000 B.C.-A.D. 1550

    - Early Ceramic period, ca. 1000-100 B.C.
    - Middle Ceramic period, ca. 100 B.C.-A.D. 1000
    - Late Ceramic period, ca., A.D. 1000-1550
- Contact period, ca. A.D. 1550-1750

Native occupation dating to all of these time periods has been identified throughout Maine, including the forested and mountainous interior of the state. According to the MHPC site files, there is one known Native American site located in close proximity to the project: site 147.001, located less than 1 km from the southern edge of the project area. Given its relevance to the current project, this site is described in greater detail below. The next closest documented sites are located about 14 km (8.7 mi) west-southwest of the project along the Seboeis River, and are also detailed further below. While there is not a high density of known Native American sites in the vicinity of the project, the general paucity of recorded Native American sites in this part of Maine reflects a lack of archaeological research rather than actual Native American presence and settlement within the region. For example, the Penobscot River and its associated watersheds are central to the culture of the Wabanaki people and in particular the Penobscot Indian Nation. When permit related or avocational archaeology has been performed in this region, the investigations frequently result in the identification of Native American archaeological sites across the landscape.

Much identification and documentation of sites has followed recent cultural resource management (CRM) investigations in the local area following the development of the Katahdin Woods and Waters National Monument (KWWNM). NE ARC has recently completed three projects in the local area, including one directly for the KWWNM at Lunksoos Camps, plus two nearby trail developments. Archaeological sites were newly defined at all three projects, including a series of six sites located along the Seboeis River in T5R6 and T5R7 dating from the Late Archaic period through to the Late Ceramic period (Beale at al. 2019). At 14 km distant, are some of the closest documented sites to the project. Additional sites are located farther downstream at the confluence of the Seboeis, Wassataquoik and Penobscot Rivers, beginning about 25 km (15.5 mi) southwest of the project area (Loftus et al. 2020), as well as along the East and West branches of the Penobscot and the Penobscot River proper (Beale et al. 2018; Cowie 2017), and around Grand Lake Matagamon, the headwaters of the East Branch of the Penobscot (about 25 km west of the project), to name a few. All of these sites yielded an assortment of flakes and stone tool fragments of a variety of lithic raw materials gathered from various locales within Maine, including Kineo and Traveler rhyolite, Munsungan and Wassataquoik chert, and quartz (C. Sockalexis [Penobscot Nation Tribal Historic Preservation Office], personal communication, May 2020).

Likewise, intensive archaeological research in the area around the Munsungan Lake area, primarily related to Native American use of high-quality chert material from the Munsungan geological formation, has led to the identification of well over 100 archaeological sites, including quarries, workshops, and habitation sites (MHPC site files). Clusters of sites are particularly well known on Norway Bluff Mountain; at Munsungan and Chase Lakes; at Mooseleuk Lake; and at Round Mountain Pond (Bonnichsen 1984; Bouras and Evans 2006; Hudgell et al. 2016). Although the Munsungan area is located about 45 km (28 mi) northwest of the project area, the network of rivers and streams in the local area ensures that there are multiple transportation routes for the movement of Munsungan chert material. Local waterways, including the Mattawaumkeag River, the East Branch and the Seboeis are known to have been used for millennia as canoe routes, for example to various lakes in the area, onwards to the Allagash and Aroostook watersheds, and also to the Munsungan area (Cook 2007). Campsites in use today by canoeists and fishermen were therefore likely used by prehistoric travelers as well. To the southwest of the project, the aforementioned valley of Wassataquoik Stream and the surrounding hills are also known as good sources for chert lithic material, with associated Native American quarry sites (Georgiady and Brockmann 2002). As well as chert material, a highly regarded source of rhyolite comes from Traveler Mountain, which is located about 30 km (18.6 mi) west of the project area.

**Previously Identified Site 147.001**

There is one recorded Native American archaeological site in the vicinity of the project: site 147.001, which is located approximately 250 m (0.16 mile) south of the original project area and about 400 m south of the new rezoning area, on the edge of the Pickett Mountain Pond valley (see Figure 3). The site was identified in 1984 during initial survey for the Chase Mountain mine tailing pond project, which was conducted by the University of Maine at Orono on behalf of the E.C. Jordan Company (Bonnichsen et al. 1984). The site was found at the location of a proposed dam within a small southwest-northeast trending basin, where a small stream flows through the basin to Pickett Mountain Pond (Figure 11). The lateral margins of the basin are characterized by what appear to be glacial kame terraces, and site 147.001 is located on the first till bench immediately below one of these terraces on the southwest side of the basin at about the 1100 ft contour (Figure 12). Given the location and formation of terraces around the basin, Bonnichsen et al. concluded that Pickett Mountain Pond and its basin formed from the melting of a large stagnant ice block (i.e., is a kettle pond), and was thus larger during late glacial times than today. It appears that the occupants of the site camped at the head of a bay where a freshwater stream entered the pond, rather than adjacent to a small perennial stream as is the case today (Bonnichsen et al. 1984:13).

The site measures about 200 sq m in extent (about 2,150 sq ft) and recovered artifacts include a biface fragment and 69 pieces of lithic debitage (flakes), produced during the manufacture or refurbishment of bifacial tools with distinctive scalloped edges. The flaked stone from the site is documented as a "volcanic tuff", and has been degraded/naturally chemically weathered to a tan or white color. The source of the material was not located by the original excavators, but was not believed to have been obtained from stream bed cobbles, as no cobble cortex was identified on any of the flakes.

Tools (or evidence for their manufacture) similar to those from site 147.001 have been recovered from the Vail Paleoindian site in western Maine, as well as from the Round Maintain Pond site near Munsungan Lake, north of the project area. Interestingly, although undated, the Round Mountain Pond site is similarly situated on the first till bench below a kame terrace (Bonnichsen et al. 1984:27). Given the location of the site just below a kame terrace, as well as the technological grammar of artifact manufacture and patterning of artifact recovery, site 147.001 is believed to represent a single occupation dating to the early postglacial period, i.e., the beginning of the Holocene, i.e., the later portion of the Paleoindian period or Early Archaic period (Bonnichsen et al. 1984:iv).

The site is thought to represent an occupation dating to the Late Paleoindian or Early Archaic periods of Native American history for the region, ca. 10,000-7,500 years ago.

**Native American Toolstone Use**

As noted above in the general environmental section, geologic maps indicate that Mount Chase volcanics, Rockabema quartz diorite, quartz diabase, and potentially some quartzite and slate underly the project area. Quartzites and fine-grained volcanics such as rhyolite or felsite have certainly been utilized by precontact peoples to manufacture stone tools, although regionally, cryptocrystalline silicates such as cherts were generally preferred, as they give a particularly good result for knapping: i.e., they break relatively easily and predictably, and produce a fine, sharp edge. The nearest defined chert outcrops are mapped at approximately 8 km (5 mi) east of the project area (Ekren and Frischknecht 1967), while an exposure of Wassataquoik chert is located approximately 10 km (6.2 mi) southwest of the project area (Neuman 1967), and the Munsungan formation begins approximately 45 km (28 mi) northwest of the project (Osberg et al. 1985). Red, gray, and black cherts were also noted by Bonnichsen et al. as being locally available in stream bed and glacial till deposits (Bonnichsen et al. 1984:3). Additionally, while not categorized on the overview geological maps of the area (i.e., Ekren and Frisschknecht 1967, Osberg et al. 1985), Wolfden geologists have identified chert within the project area, as listed in the "*Geology and Mineralization*" section of the Pickett Mountain Property page:

> "The Pickett Mountain [massive sulphide] deposit is located on the southeast limb of the northeast-trending Weeksboro-Lunksoos anticlinorium. The anticlinorium is cored by black shales and sandstones of the Grand Pitch formation of Cambrian age; these comprise the deepest footwall rocks at Pickett Mountain. The sediments are overlain by intermediate to rhyolitic volcanic and volcaniclastic rocks (middle Ordovician) which host the deposit. The immediate footwall to the deposit comprises a sheared footwall breccia that is characterized by intense, pyritic, sericitic and choritic alteration proximal to mineralization. The massive sulphide deposit is in turn overlain by hanging-wall tuffs, an **iron-rich chert**, mafic volcanic rocks and an upper-most sequence of shales, some of which are carbonaceous."
>
> (*wolfdenresources.com/projects/pickett-mountain-maine/;* emphasis added.)

As well as chert, rhyolites including Kineo and Traveler varieties (from Moosehead Lake, 120 km southwest of the project, and from just north of Katahdin 45 km west of the project, respectively) have been identified in regional artifact assemblages. To reiterate, the artifacts from the nearby Pickett Pond archaeological site, 147.001, are defined by the excavators as "volcanic tuff" and are described as weathered to tan or white.

**Predictive Modelling and Summary**

Finally, predictive modeling for Maine prehistoric sites, as developed by the MHPC, indicate that the project area is generally archaeologically sensitive (Spiess and Smith 2016). Two models are pertinent. One model account for most of the Paleoindian sites in Maine and indicates that sites of this period most commonly occur on well drained sandy soils adjacent to small water bodies that are usually not accessible by canoe. Adjacent water bodies can include first or second order streams, marshes, or kettle hole ponds, such as Pickett Mountain Pond. The second pertinent model accounts for 90% of prehistoric habitation sites, which occur on level landforms adjacent to canoe navigable water. Pleasant Lake/Mud Lake, to the north of the project area, links to canoe navigable waterways. Proximity of the project to Pickett Mountain Pond and Pleasant Lake/Mud Lake, along with their associated waterways and wetlands, therefore, indicates moderate sensitivity for the presence of Native American archaeological sites of all time periods. Most specifically, given the proximity of known early Holocene site 147.001 (Paleoindian or Early Archaic) at the edge of a former kettle pond, the project area is particularly sensitive for the presence of sites of a similar date.

In sum, background review and predictive modeling indicates that the project area in general is sensitive for the presence of Native American habitation sites, potentially dating to all recognized time periods, but particularly dating to the early portion of the Holocene, i.e., the Paleoindian or Early Archaic periods of Native American history for the region. Sensitivity is indicated by the geological potential for

toolstone resources and thus potential for quarry or workshop sites within the project area; proximity to Pickett Mountain Pond and its wetlands and drainages tributary to the Mattawaumkeag River; and the presence of a known Native American archaeological site within 400 m of the southern boundary of the new rezoning area.

## IV: Post-Contact Historic Context and General Archaeological Sensitivity

The township of T6 R6 WELS within which the project area lies is situated along the eastern edge of Penobscot County, and is bordered to the north by the township of T7 R6, to the west by T6 R7, and to the south by the town of Mount Chase. To the east is Moro Plantation, within Aroostook County. Townships are minor civil divisions that have no organized local government, as opposed to plantations, towns, or cities, which do; as such, townships are administered directly by the state. Townships occasionally have names but are commonly designated by a township and range identification, i.e., Township 6 Range 6. WELS is an abbreviation for "West of the Easterly Line of the State," referring to the north-south line extending from Hamlin in the north to Amity in the south in Aroostook County. Maine currently has 421 townships making up its Unorganized Territory of 9,284,166 acres of land, of which 7,550,783 acres are in the Tree Growth current use program, and 1,167,795 acres are exempt from property tax, such as State and Federal land. There are approximately 379 miles of summer roads and 570 miles of winter roads in the Unorganized Territory, and a total full-time resident population of 7,900 (Office of the State Auditor 2015). Given that townships are not organized and most often have a minimal resident population, the history of nearby towns or the more general area is more telling than is a specific history of township T6R6.

The first substantial exploration of the area by non-native Americans was an 1825 survey conducted on behalf of the Maine Boundary Commission, which sought to resolve issues stemming from timber cutting, initially on the Aroostook and Madawaska rivers, from a "mistaken view of the boundary line." The survey certainly followed the Seboeis and Aroostook rivers to the west and north of the project area, respectively, although how close the surveyors came to the project area itself is not clear (Williams 1882:624).

Penobscot County was formed on April 1, 1816 from the northern part of what was then Hancock County, and later gave up territory to form Piscataquis and Aroostook counties. As with many counties, towns and borders changed throughout the early 19$^{th}$ century. For example, Moro Plantation, which contains the eastern portion of Pickett Mountain Pond, is the remaining fragment of the former

Rockabema "mega" plantation, which was formed from T6 R5 WELS (Moro), T7 R5 WELS, and the northwest quarter of T6 R4 WELS (Merrill) in 1846. In 1859 Maine abolished mega-plantations and Rockabema was split, with Moro eventually formed from one of the sections in 1870, and formally organized in 1891 (Historical Records Survey [Maine] 1940).

Moro, along with Mount Chase – the next town south of the project area – and Patten, one town south again, were some of the first permanently settled townships in proximity to the project area. The first permanent residents arrived ca. 1837-1838, and by 1860 the population of Moro was 171 and of Mount Chase was 250, although that of Mount Chase had only slightly increased to around 300 by the early 20th century, dropping to around 200 in recent times (U.S. Census Bureau). Early workers were attracted to the area for opportunities working for lumber companies, and in 1881, the area was well wooded, with a saw mill on Crystal Brook at the eastern side of Mount Chase (Varney 1881), while another contemporary work pointed out that farming was another major occupation (Williams 1882).

Following the Civil War, the European and North American Railroad (one of many companies in the Bangor area) extended its lines along the Penobscot River from Bangor to Mattawamkeag, ca. 1869 (Cook 2020), and Mount Chase was "on the stage line from the European & North American Railroad at Mattawamkeag to Fort Kent in the extreme north of the State, on the St John" (Williams 1882:193). Residents and tourists could take advantage of the 50-mile stage route from Mattawamkeag to Mount Chase, and supplies could be shipped in and goods or wild game out more readily.

Throughout the Maine woods, the infrastructure that developed to support the logging industry also drew hunters, anglers, hikers, and other recreationists, as recreational hunting became more popular with increased ownership of civilian firearms following the Civil War (The White House Office of the Press Secretary 2016). Following his travels in the 1840s and 50s, Henry David Thoreau described every log hut in the woods as a public house (Thoreau 1864). Thoreau spent time along the West Branch of the Penobscot and on the slopes of Katahdin, but his well-described travels probably brought him no closer than 40 or 50 miles south of the project area. In general, hunting and fishing opportunities of the Maine north woods encouraged development of interior sporting camps as an alternative to resort facilities along the Maine coast (Starkey 1947:166-167). The Shin Pond House in Shin Pond village, Mount Chase was established in the 1870s, later becoming the Crommett House and Farm (Williams 1882). Shin Pond village, situated between Upper and Lower Shin Pond, is approximately 7.5 km (4.6 mi) southwest of the project area. Sporting camps have continued as a means of support to the present time, and the numerous ponds and brooks in the area were thus likely popular destinations throughout the 19th and 20th centuries.

Despite the possibility of logging and some recreational activity in the general area of the project in the 19th century, 19th century maps including Walling's 1859 map, Colby's 1885 atlas and Stuart's 1894

map (Colby 1885; Stuart 1894) do not show any roads or structures within, or in close proximity to the project (Figures 13-15). These show the path of what is now Route 11 to the east of the project area, as well as a road passing in a northwesterly direction through Mount Chase, between the Shin Ponds/ through Shin Pond village, west and south of the project area. These road alignments are still in use today. A 1940 topographic map shows a number of tote roads extending from what is now Route 11 northwestwards, including what is today named the Pleasant Lake Road and which skirts the northern edge of the project area (Figure 16). The closest structure to the project area marked on any of the reviewed maps first appears on this 1940 map, and is an unmarked structure, possibly a logging camp, located approximately 1 mile north of the project area and a short distance from the south shore of Pleasant Lake (Mud Lake). No structures or historic tote roads are marked within the project area itself.

In sum, background research indicates low sensitivity for archaeological resources associated with 19th century logging and lumbering activities, as most activity appeared to have occurred along roads and rivers outside of the project area. Likewise, there is low sensitivity for archaeological resources associated with secondary activities including recreational hunting, fishing, and camping, as such activities were more likely to have occurred much closer to the shores of Pickett Mountain Pond and Pleasant Lake.

## V: Field Inspection and Delineation of Archaeologically Sensitive Areas

### General Project Description

As noted, given the changes in project plans, the field inspection was undertaken in two episodes. The first was conducted by NE ARC Assistant Director Dr. Gemma Hudgell on June 24 and 25, 2020 and focused on the original project parcel. A second, focusing on the updated and expanded study area (the new rezoning area) was conducted by NE ARC Project Director Christopher Brouillette between May 10 and 12, 2022. Overall, the project is located primarily on the eastern slopes of an unnamed hill, and also contains a number of lower hills and knolls. The highest elevations are in the southwestern portions of the study area, with the lowest to the east, in proximity to Pickett Mountain Pond, and the north. Much of the project area possesses gradual to medium slopes, with level areas in the central sections of the project; as such, the parcel is gently rolling with the steepest portions towards the western edge, including a hill in the southwest corner and a low, rocky knoll in the approximate center with moderate slopes southeastwards towards Pickett Mountain Pond. A few rocky outcrops and glacial erratics were noted but there are no 'cliff edge' features, talus slopes, or extensive areas of exposed rock.

A system of gravel roads cut across the project area from northeast to southwest as well as northwest to southeast, and follows fairly level portions of the project area before descending down a moderate to steep slope at the southwest edge of the project and then continuing around on level landforms towards the southern side of Pickett Mountain Pond. A perennial stream is located at the southern edge of the original project area, draining eastwards into Pickett Mountain Pond, while a series of swales/head of draws on the eastern side of the hill drain eastwards and southeastwards towards Pickett Mountain Pond. At the time of the field inspection Maine was witnessing a drought, but it is possible that some of these draws might represent the location of seasonal springs.

The project area is forested with a mixture of hard- and softwood growth, but aerial photos indicate that almost the entirety of the project area has been logged since the 1990s. At the time of the 2020 field inspection, the northwestern portion of the project had been very recently logged, and the area was open with piles of brush still present (Figure 17). This area still retained a few large hardwoods as well as some stands of fir and some underbrush of young birch and poplar. Recent skidder tracks were unvegetated and the ground surface was clearly visible. Much of the northeastern and central portion of the project area possessed slightly more mature trees (mainly deciduous varieties including maple, poplar, and birch) with relatively little underbrush, and so visibility was still reasonable, although the ground surface was covered with leaf litter. The southernmost edge of the project in proximity to Pickett Mountain Pond became increasingly heavily vegetated with mature fir and cedar and a thick underbrush, substantially negatively affecting visibility (Figure 18). At the time of the 2022 field inspection, the eastern portion of the new rezoning area had been recently logged and exhibited many of the same characteristics previously described.

The majority of the project area was inspected, given good access from logging roads. As noted, although the entirety of the project area is wooded, most portions have either been recently logged or possess relatively little underbrush, affording reasonable or good visibility to a distance of up to 60 m (200 ft), which allowed for wide transects to be walked yet to still allow inspection of a broad area. The only exception was the thick brush at the southern edge of the project, which possessed low visibility of around 5-10 m (16-32 ft); this area was walked as two closely spaced parallel transects to gain best coverage. Access roads were also walked, including those outside of the project area which are not marked as tote roads on topographic maps (e.g., not marked on Figure 1).

The location of bedrock outcrops and level areas close to water, and thus potentially suitable for habitation, were the focus of the field inspection. All visible bedrock outcrops were inspected and marked with a hand-held GPS, as were potentially habitable landforms. Wolfden geologists Don Dudek and John Breedlove were also in the project area on the dates of the 2020 field inspection and assisted with initial

geological identifications. Given their intimate knowledge of the geology of the project, combined with extensive coverage during the archaeological field inspection, NE ARC are confident that all major geological outcrops within the project area have been identified. Samples were obtained from all lithic outcrops with potential for use as toolstone, and samples were also obtained on cobbles and pebbles present in glacial till.

**Defined Areas of Archaeological Sensitivity**

As detailed below, a total of six areas of archaeological sensitivity (ASAs) were identified throughout both iterations of the project parcel, although note that one of these (ASA 4) falls outside of either of the defined project areas and was located on an initial "walk in" or test of accessibility (see Figure 3). Five of these ASAs (1-4 and 6) are outcrops of potential toolstone. The sixth, ASA 5, is a level landform determined to be sensitive for the presence of Native American habitation sites.

*Lithic Resources*

The majority of rock outcrops within either iteration of the project area are coarse grained or low-grade material and thus unsuitable for tool making. However, a total of five distinct areas, ASAs 1-4 and ASA 6, were found to include outcrops of material suitable for use as toolstone (see Figure 3). All are a "cherty rhyolite", which is a fine-grained volcanic material that grades from dark to light gray and also includes a banded gray and pink variety (Figures 19-31). As can be seen from the photographs, this material is gray or gray and pink when freshly fractured but weathers to white when exposed. While other materials less suitable for toolmaking can also weather to a similar pale color, this weathering nevertheless makes for high visibility of outcropping material for easy location by Native American peoples searching for suitable toolstone. Geological samples were obtained from all potential toolstone outcrops, either from this season's freeze-thaw material or from pieces obtained with a geological hammer, and are illustrated in Figures 21, 24, 27, 30, and 32. All outcrops defined as ASAs produced material suitable for flaking; flake morphology as produced via geological hammer is most clearly seen in Figure 27 (samples from ASA 3). All identified outcrops are located roughly parallel to the Weeksboro-Lunksoos anticline in the central portions of the project.

From the description in the MHPC site files, it is assumed that the "cherty rhyolite" volcanic material recovered from the project area is similar to, if not the same as, the artifactual material recovered from previously identified site 147.001: in particular, the description of white to tan weathering of the site material is reflective of similar weathering effects noted at the outcrops within the project area. Although no signs of Native American use of the material was identified during the field inspection, this

was only a cursory examination, and only the visible (above current ground surface/unvegetated) portions of outcrops have been considered.

No good quality/knappable chert outcrops were identified, although a poor-quality and highly fragmented chert seam of very limited extent is present in the southern portion of the project area (Figures 33 and 34). This material did not fracture conchoidally when sampled but instead had a platy breakage pattern. Assorted chert cobbles are also present in glacially deposited till that overlies much of the project (Figures 35 and 36), thus corroborating Bonnichsen's description of materials present in the local area (Bonnichsen et al. 1984:3).

*Potential Native American Habitation Sites*

Following the predictive model, the field inspection focused on drainages, wetland margins, and distinct topographic features that may have been a focal point for Native American activity, although as mentioned virtually the entirety of the project area was walked.

As noted, a few swales are present along the eastern slopes of the high ground within the project area, that would feasibly be the location of springs or ephemeral drainages in wetter conditions. However, these areas were also generally sloped, and would not have been suitable for encampments. The northeastern extent of the overall project area to the north of the access road (above the 1,200 ft contour) is level ground, but is not near any mapped water resource, and no potential spring holes, stream beds, swales, or heads of draw were identified in this area.

The Pickett Mountain Pond stream cuts through the southwestern corner of the original iteration of the project area. This area is particularly steeply sloped and runs alongside a gravel road (Figure 37). Where the stream meets the original project boundary, it enters a wetland area. The wetland margin was walked and was found to correspond approximately with the 1,100 ft contour. The only level landforms in proximity to the stream are located in wetland areas (see also Figure 18).

Immediately above (north of) the wetland, between the 1,090 to 1,140 ft contours, lies a set of relatively level to gently sloping terrace landforms. Eastern portions of this level area have been partially disturbed by Wolfden coring activity, however the presence of skidder trails and clearing in this area allow a clear view of the level landform and also of the till-derived soils (Figure 38). Immediately to the south is a slightly lower, level landform that borders the wetland area (Figure 39). Vegetation in this area is relatively thick, and it was not possible to tell if two distinct terraces are present, or if one slopes into the other; however, following the topographic and surficial geology descriptions of the Pickett Mountain Pond basin in Bonnichsen et al. (1984), the overall landform or set of landforms is interpreted as a till bench and/or kame terrace. As detailed above, previously identified Native American site 147.001 is located on

a till bench just below a kame terrace at approximately the 1,100 ft contour, on the south side of a stream/wetlands draining into Pickett Mountain Pond. Following the 1,100 ft contour around the pond, it appears that the landform set within the original project area forms the northern portion of this till bench and kame terrace pair, and is thus an extension of the same till bench as that of site 147.001 (see Figure 3). At minimum, this represents a similar landform that would have been a choice area for habitation at a similar time in the past. The till bench/kame terrace landform has thus been designated as archaeologically sensitive for the presence of Native American sites. A small portion of this landform extends into the new rezoning area.

The location of previously identified site 147.001 was also briefly inspected in order to gain an understanding of the similarity of the landforms. The site location has been estimated from the schematic maps provided in Bonnichsen et al. (1984; see Figure 11 of this report), and appears to lie on, or close to, the gravel track that passes to the west and south of the project area (see Figure 3). The apparent site landform does appear to be level and immediately overlying thickly vegetated landforms, as shown in Figure 18.

*Historic Euroamerican Archaeological Sensitivity*

Regarding post-contact, Euroamerican archaeological resources, no evidence of logging camps or activity other than very recent material (oil cans and pallets placed within gravel pull-offs) were noted within the project or along access roads. Nineteenth and twentieth century historic and USGS maps of the area record the presence of a potential logging camp a short distance from the south shore of Pleasant Lake, approximately 1 mile north of the project area, but no structures or historic tote roads are marked within the project area itself. Thus, the project area is considered to possess low sensitivity for the presence of Euroamerican archaeological sites.

*Non-Sensitive Areas*

Archaeological sites are considered unlikely to be present within all other portions of the proposed project area outside of the defined ASAs. All other portions of the project area were deemed to have low sensitivity due to slope, uneven terrain, disturbance, poor drainage/the presence of wetland areas, the lack of lithic materials or presence of only poor quality materials, or lacked other sensitivity factors.

## VI: Conclusion and Recommendations

An archaeological phase 0 assessment of the proposed Pickett Mountain Mine Project indicates that five areas of the proposed project are archaeologically sensitive for the presence of Native American archaeological sites (see Figure 3). All five areas extend, at least partially, into the current project area, i.e., the new rezoning area. Four of these ASAs (ASA 1-3 and 6) are locations of outcropping "cherty rhyolite", which is a knappable lithic material of a type known to have been used by Native Americans to make stone tools. The artifacts from the nearby previously identified Native American site, 147.001, may be of this material, or a very similar type. These areas are defined as sensitive for archaeological sites representing Native American quarry or workshop sites. An additional outcrop has been defined as ASA 4 however this is located outside of both the original project area and the new rezoning area.

The wider project also possesses archaeological sensitivity for Native American archaeological habitation sites, within an area defined as ASA 5. ASA 5 is extensive within the former project area and very slightly overlaps into the new rezoning area. Sensitivity is based on the presence of a fairly level till bench terrace located above Pickett Mountain Pond in the southeastern portion of the project, and given the identification of site 147.001 within 400 m of the southern boundary of the new rezoning area on a similar landform near the head of the same pond.

The project area is not considered sensitive for the presence of Euroamerican archaeological resources. All areas outside of the defined ASAs are considered to possess low sensitivity for the presence of Native American archaeological sites.

If detailed baseline study testwork proceeds, archaeological phase I survey is recommended in areas of archaeological sensitivity that fall within the new rezoning area in order to determine if archaeological sites of potential significance are present. This includes the entirety of ASAs 1, 2, and 6 as well as portions of ASAs 3 and 5. As stated in the RFQ, proposed phase I survey approaches include the excavation of up to 50 standard sized 0.5 m x 0.5 m test pits, to be placed in areas of archaeological sensitivity: i.e., on the till bench terrace and also around the potential toolstone outcrops. In lieu of test pit excavation, some removal of surface detritus, including duff and leaves, is also suggested around the potential toolstone outcrops, as flaking debris may be preserved subsurface in these areas. A final plan for phase I survey, if required, will be developed in consultation with the MHPC.

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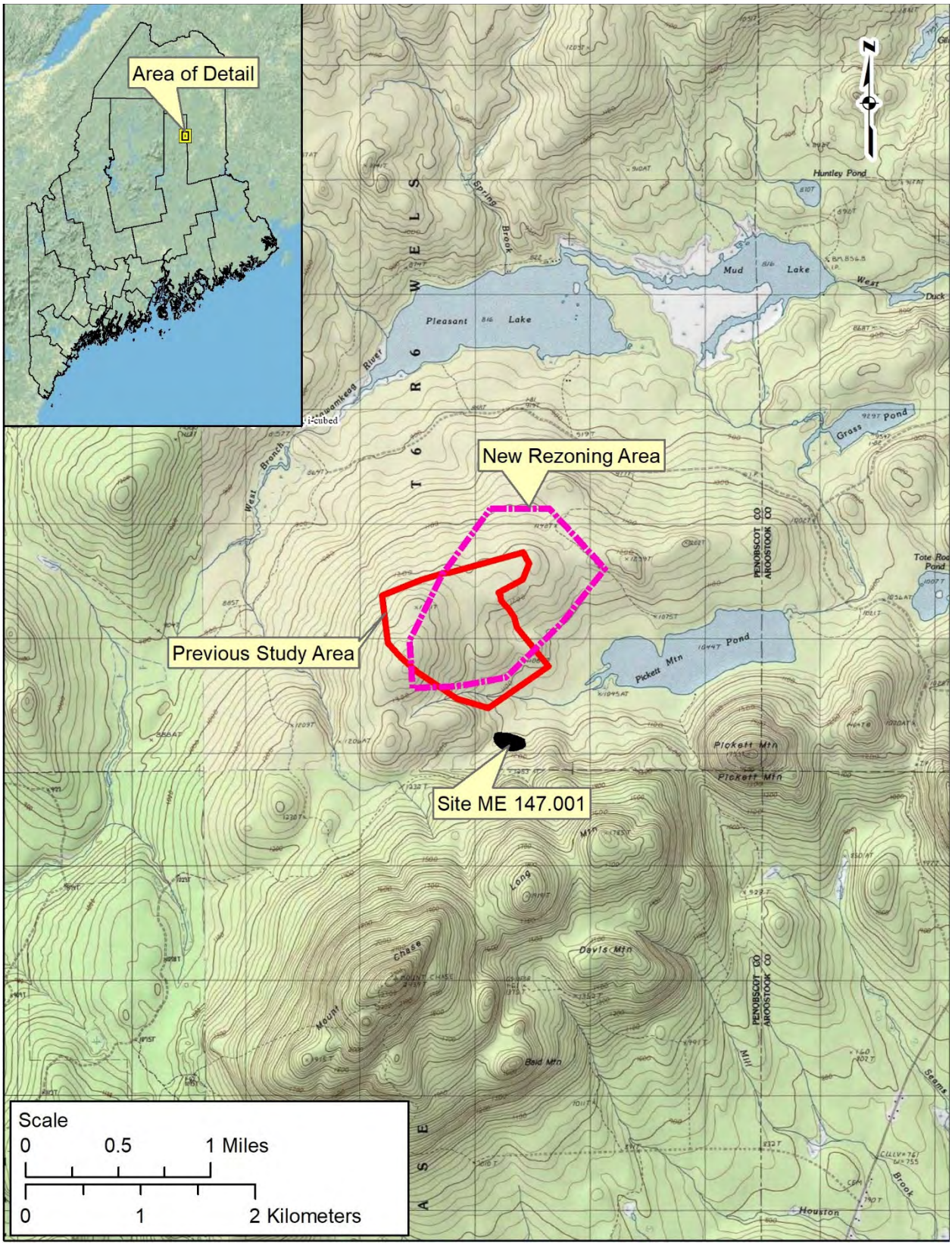



Figure 1. Topographic map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

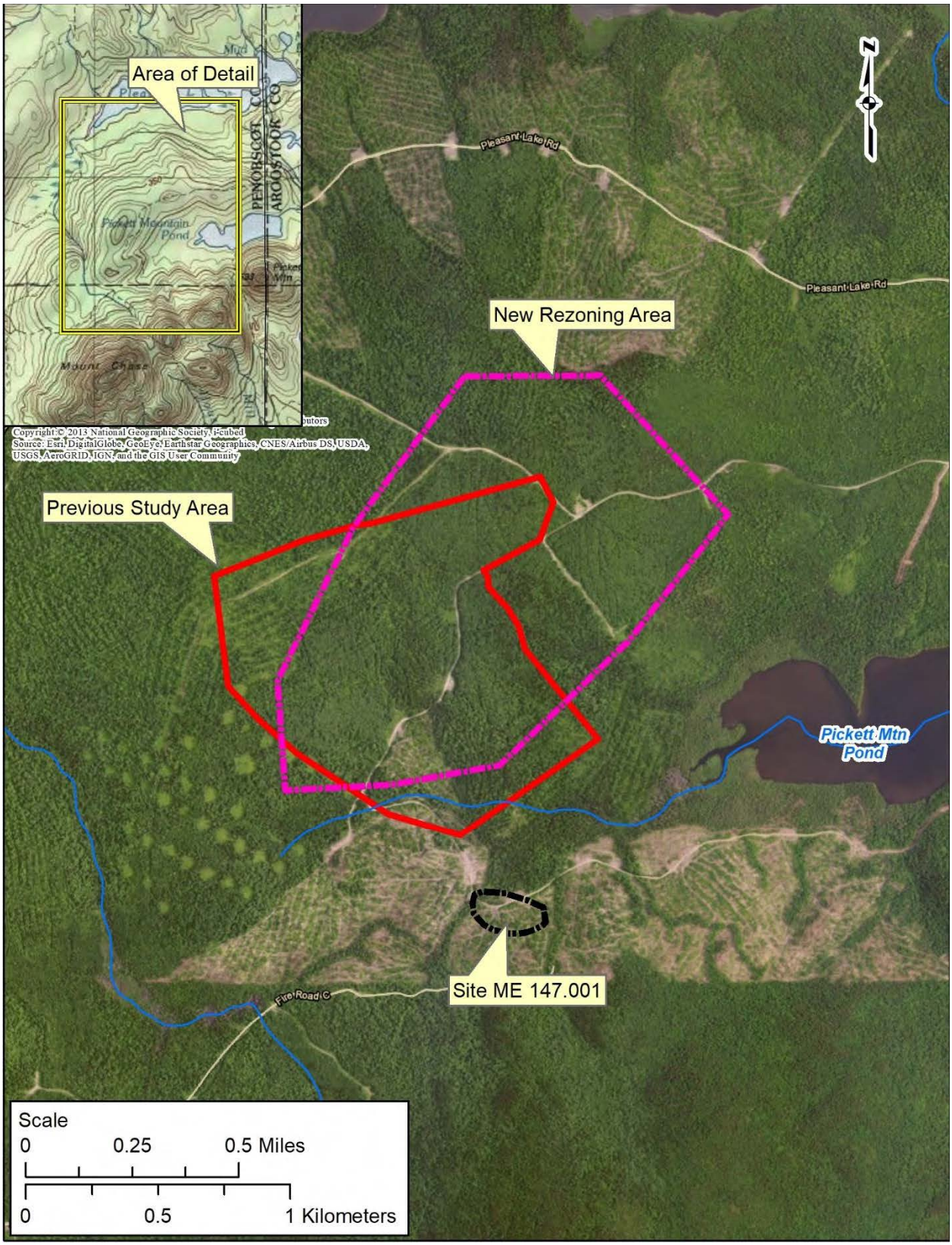



Figure 2. Aerial photograph showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

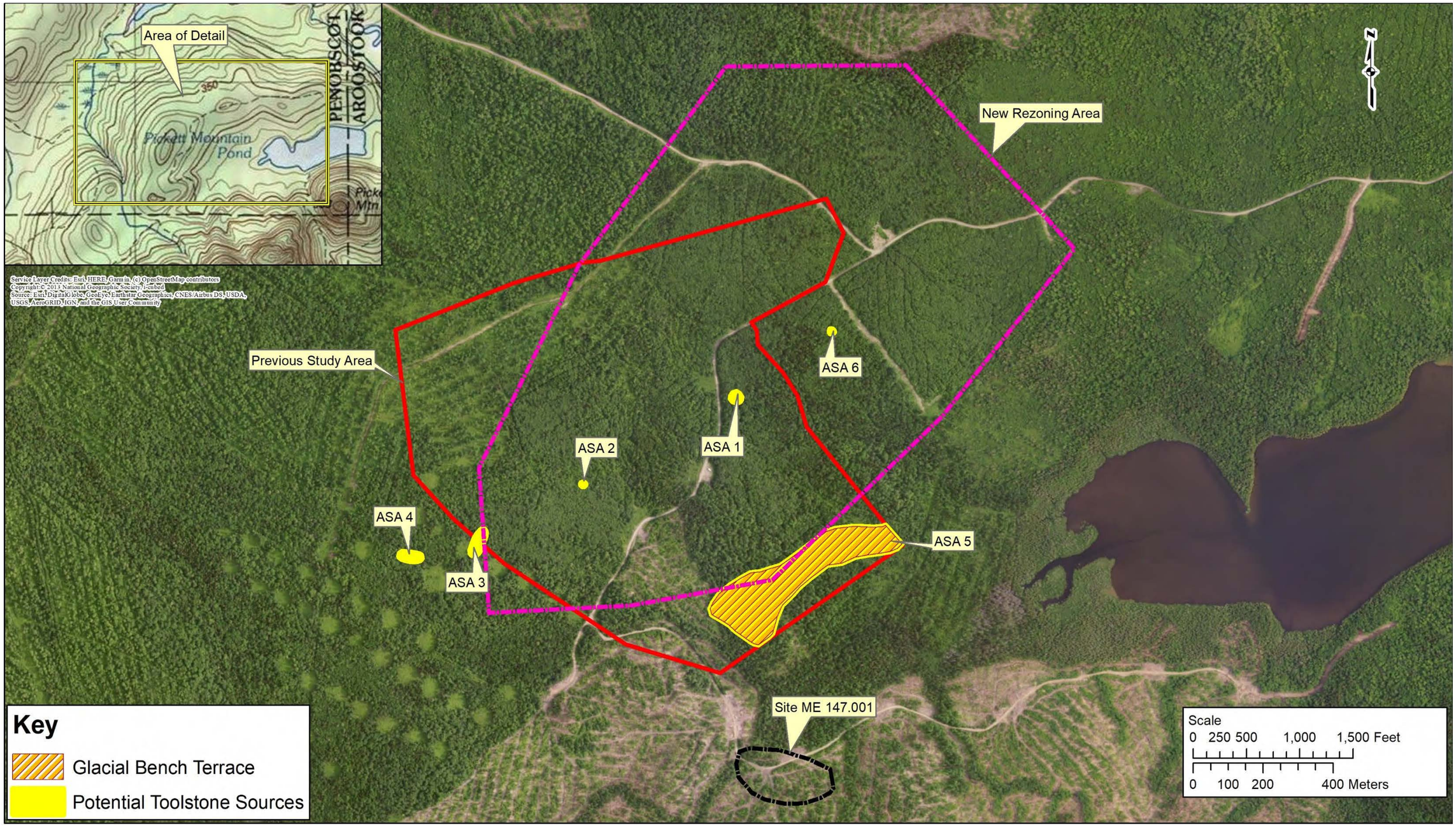



Figure 3. Aerial photograph showing the location of defined archaeologically sensitive areas (ASAs) within the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note also the location of previously identified Native American site 147.001.

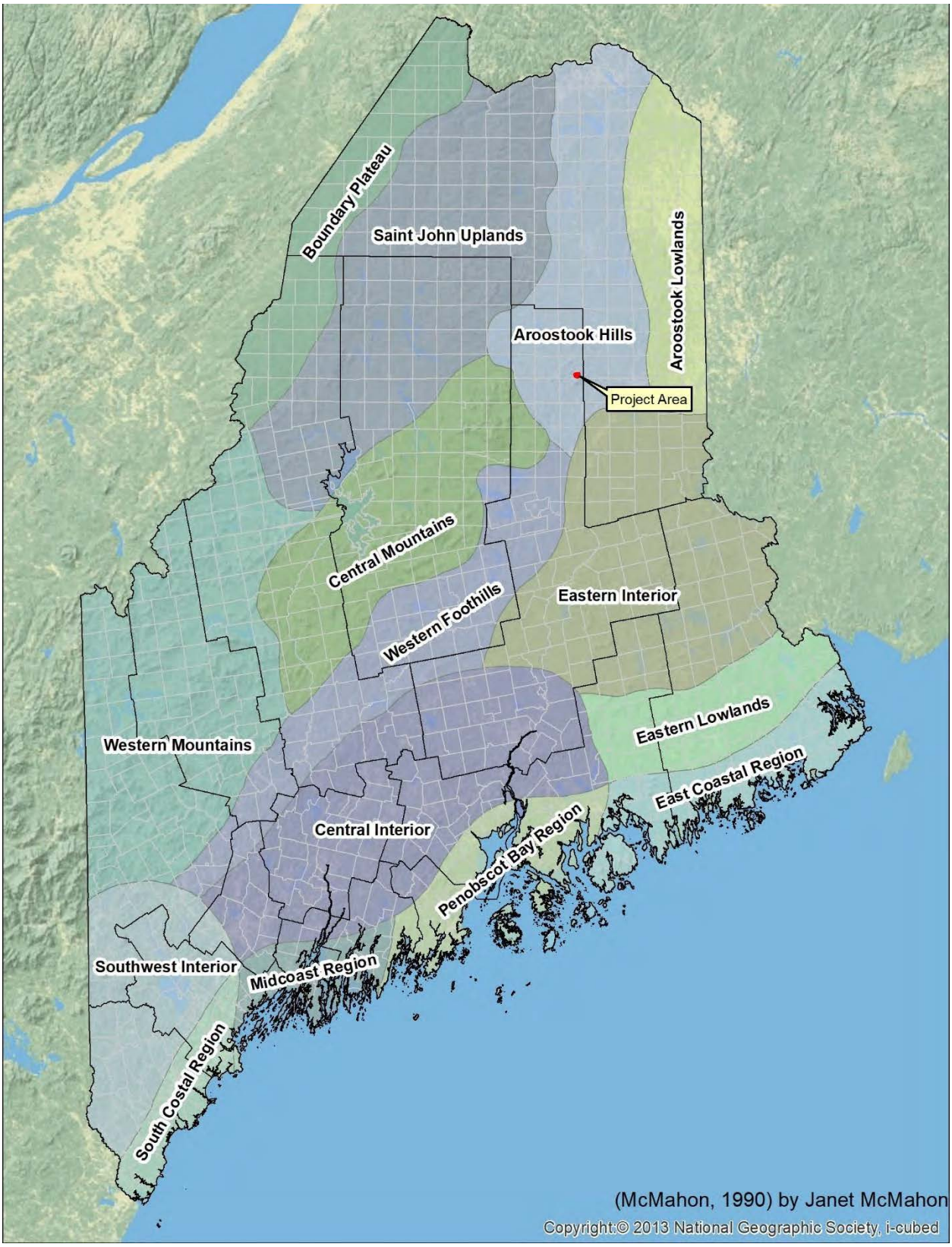



Figure 4. Map of the Maine biophysical regions showing location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

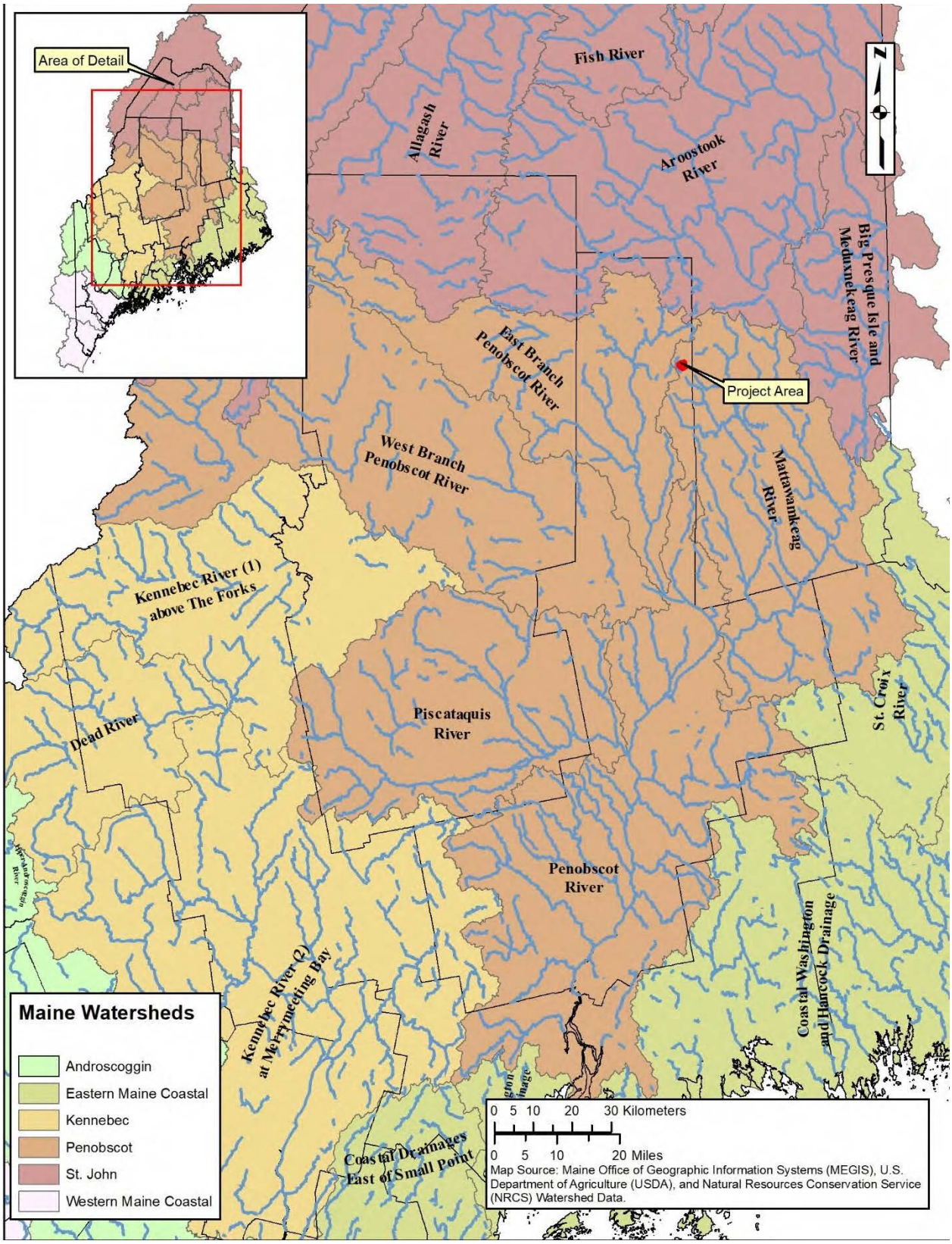



Figure 5. Regional watershed map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

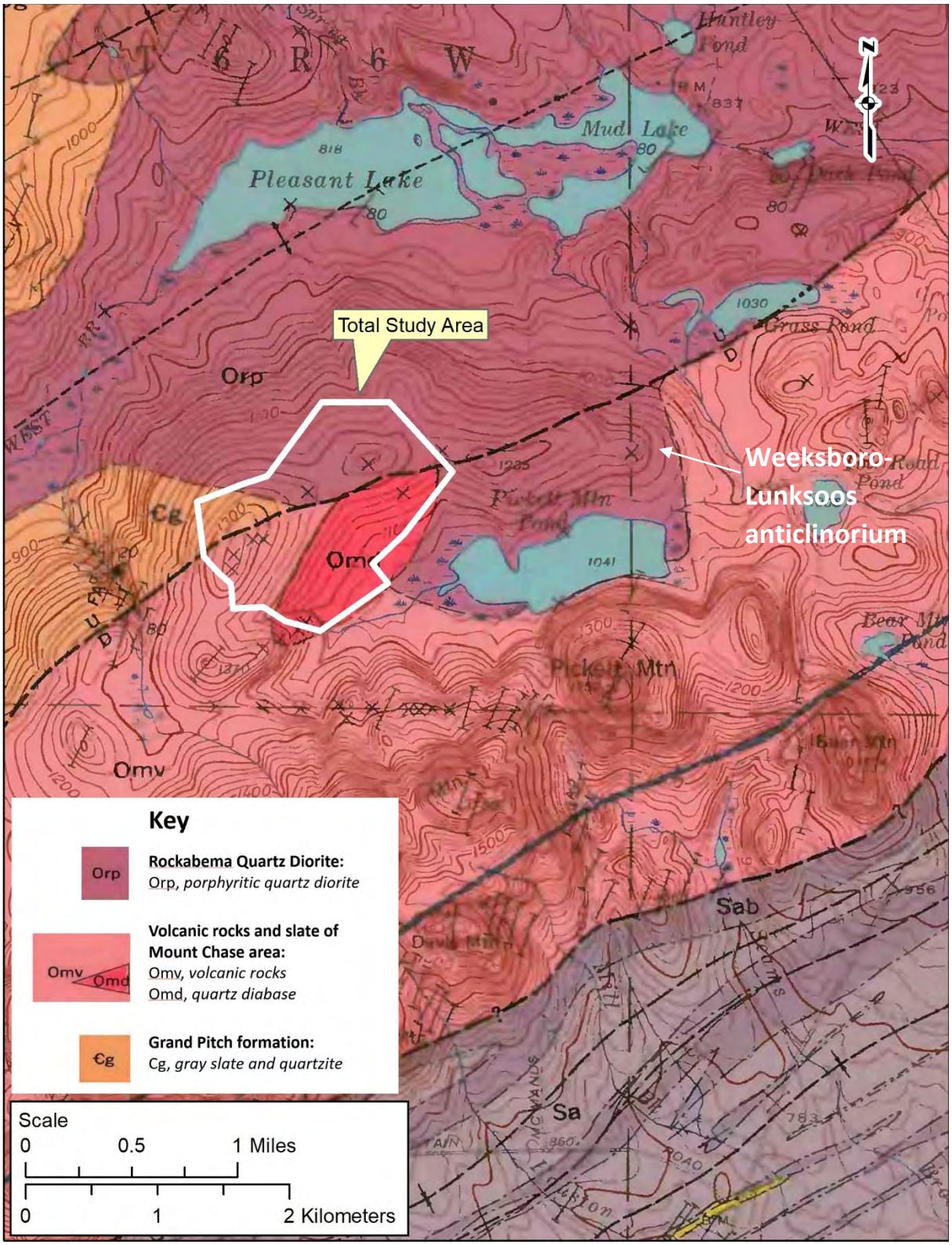



Figure 6. Section of the Ekren and Frischkneck 1967 bedrock geologic map of the Island Falls quadrangle, showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

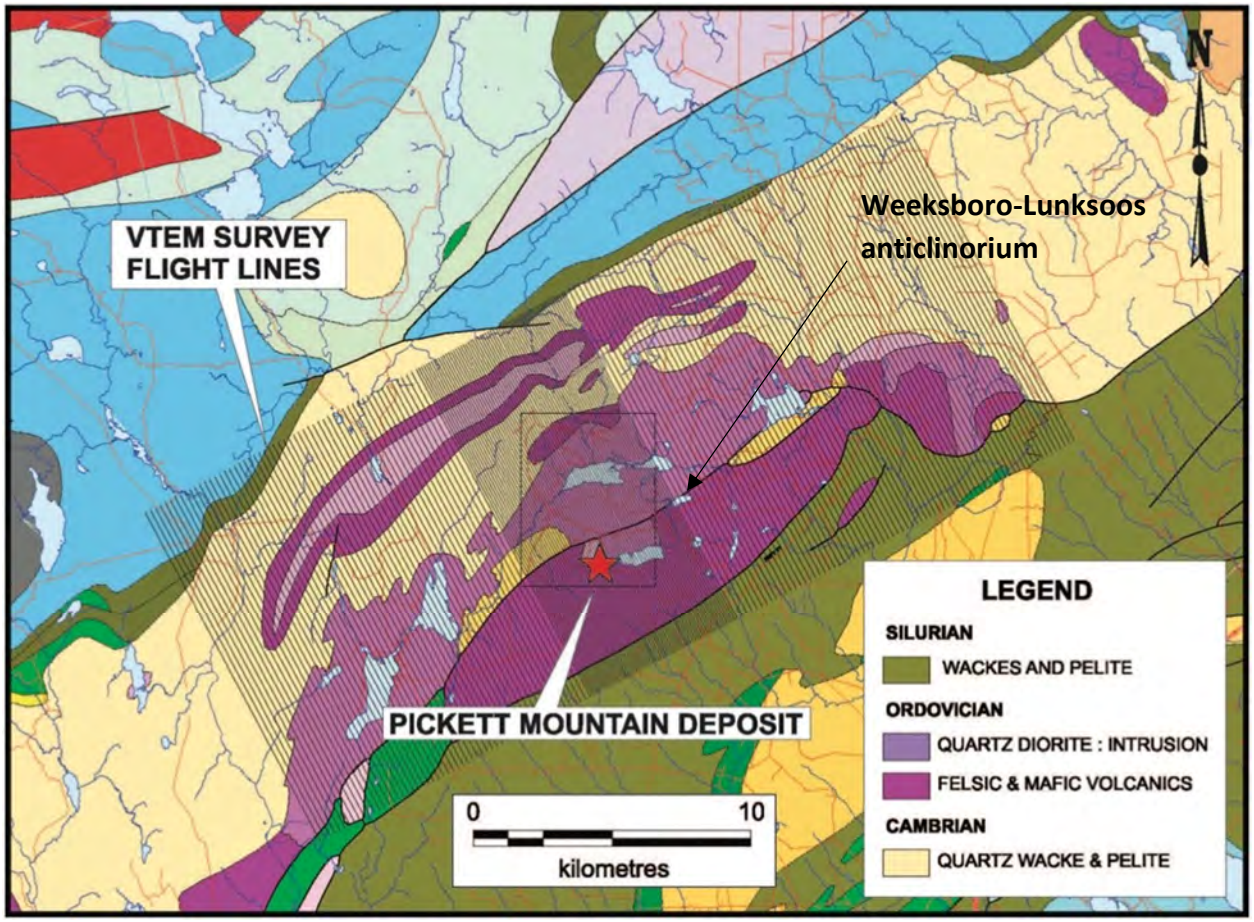



Figure 7. Wolfden map of the Pickett Mountain area of exploration, 2019, showing the generalized geology of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine, and surrounding area.

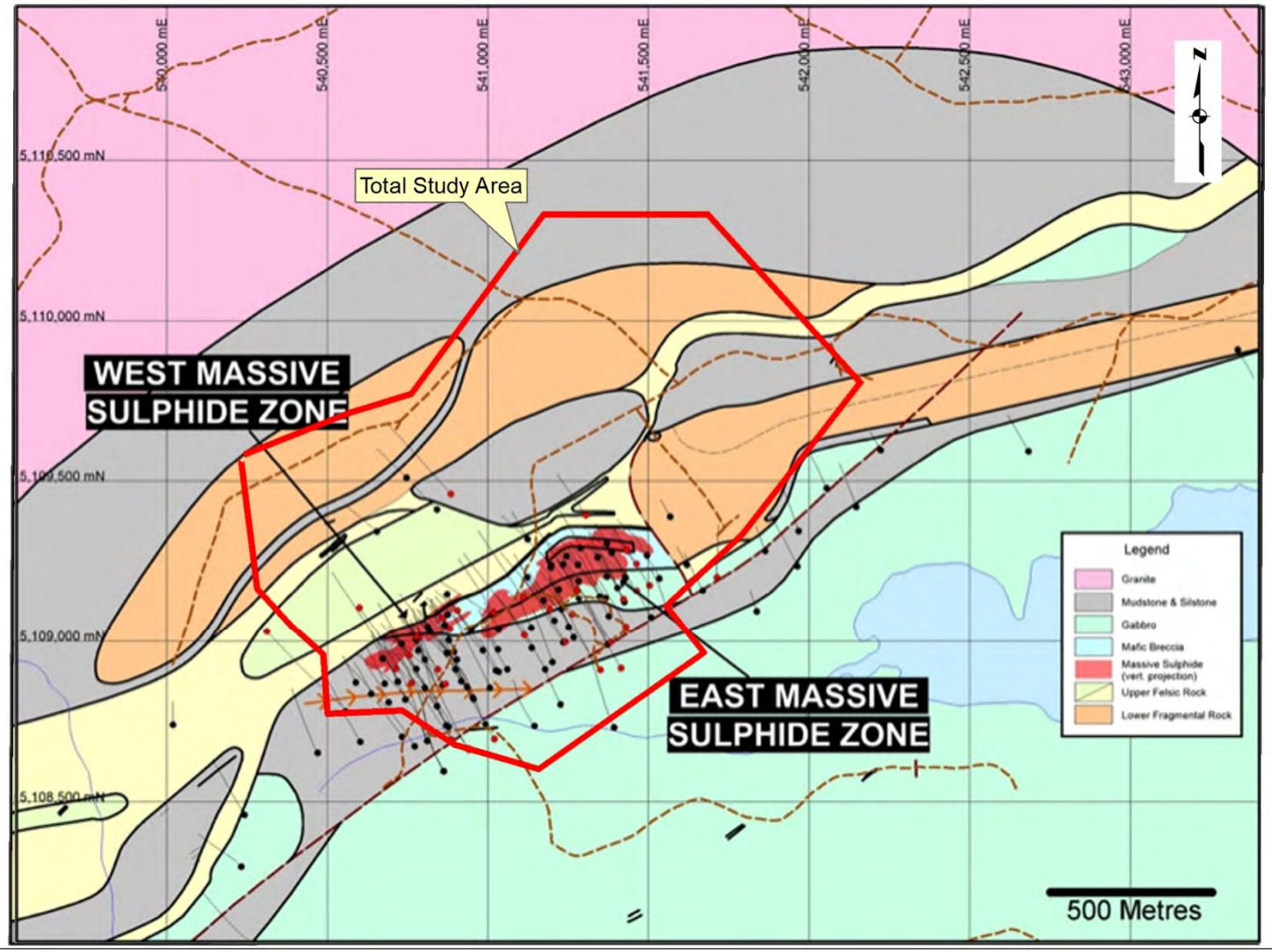
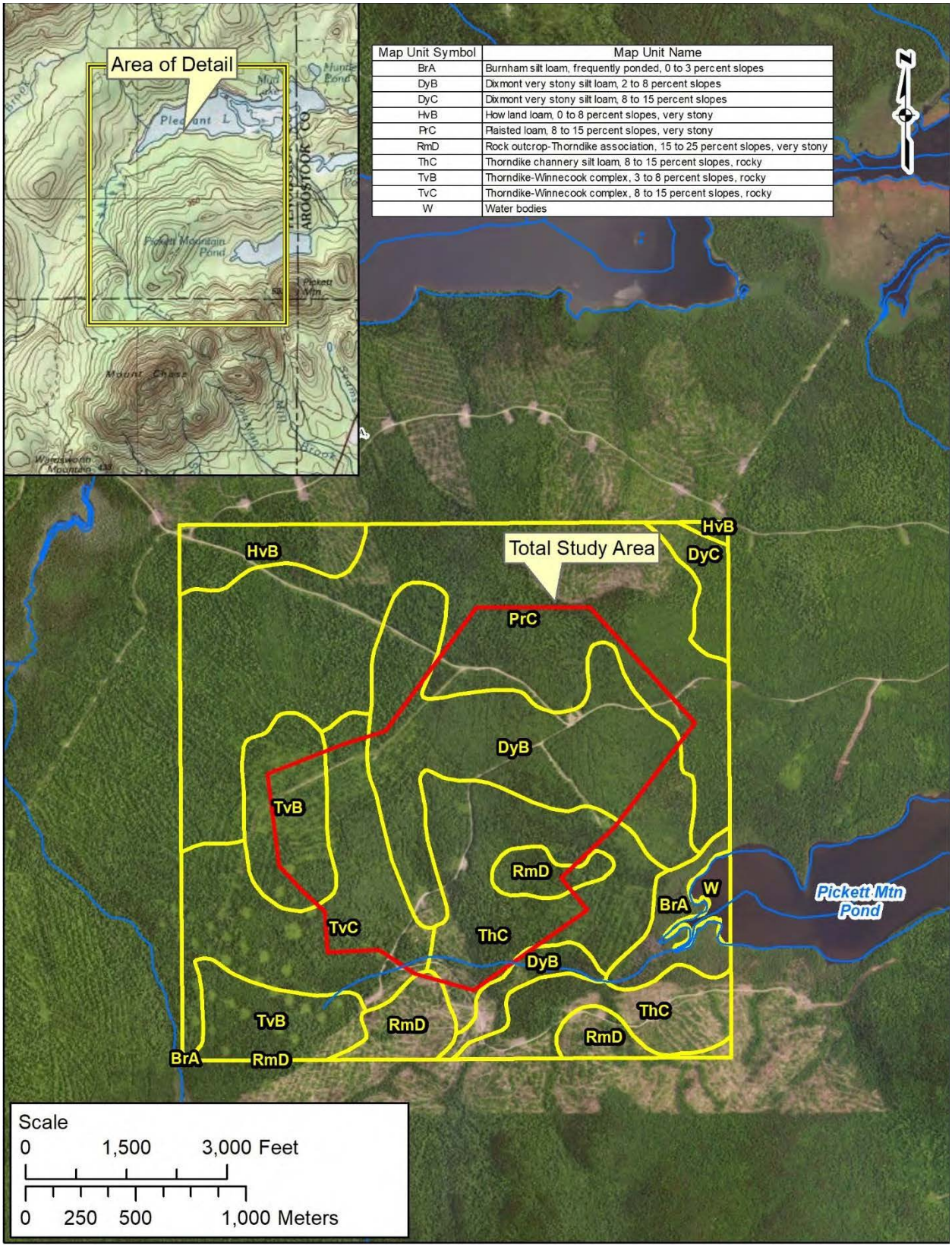



Figure 8. Wolfden geological plan of the Pickett Mountain area of exploration, 2019, showing the geology of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The lines/dots mark boring locations.




| Map Unit Symbol | Map Unit Name |
|---|---|
| BrA | Burnham silt loam, frequently ponded, 0 to 3 percent slopes |
| DyB | Dixmont very stony silt loam, 2 to 8 percent slopes |
| DyC | Dixmont very stony silt loam, 8 to 15 percent slopes |
| HvB | How land loam, 0 to 8 percent slopes, very stony |
| PrC | Plaisted loam, 8 to 15 percent slopes, very stony |
| RmD | Rock outcrop-Thorndike association, 15 to 25 percent slopes, very stony |
| ThC | Thorndike channery silt loam, 8 to 15 percent slopes, rocky |
| TvB | Thorndike-Winnecook complex, 3 to 8 percent slopes, rocky |
| TvC | Thorndike-Winnecook complex, 8 to 15 percent slopes, rocky |
| W | Water bodies |

Figure 9. USDA Soils map of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

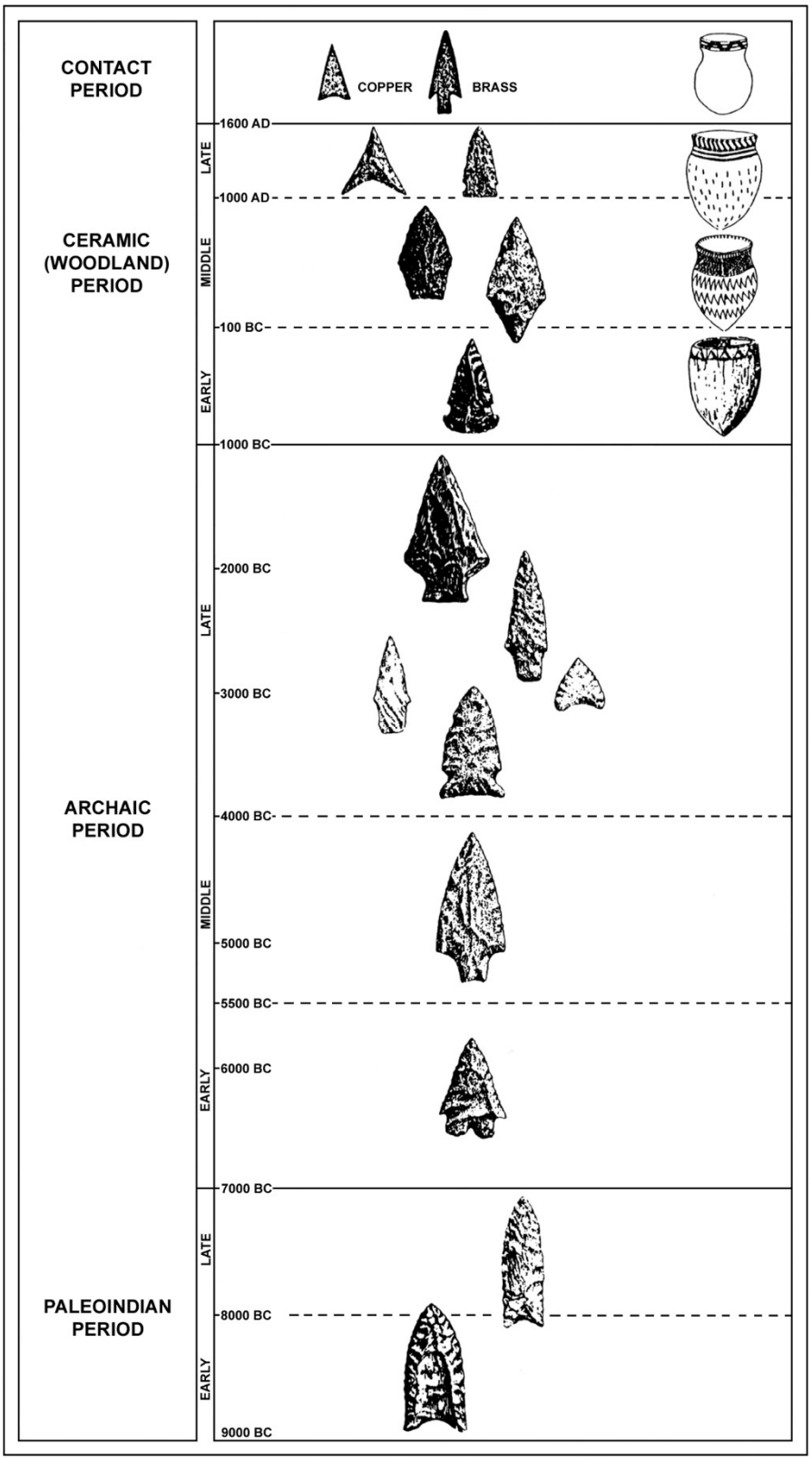



Figure 10. Timeline showing the major time periods of Native American history for Maine and the broader region.

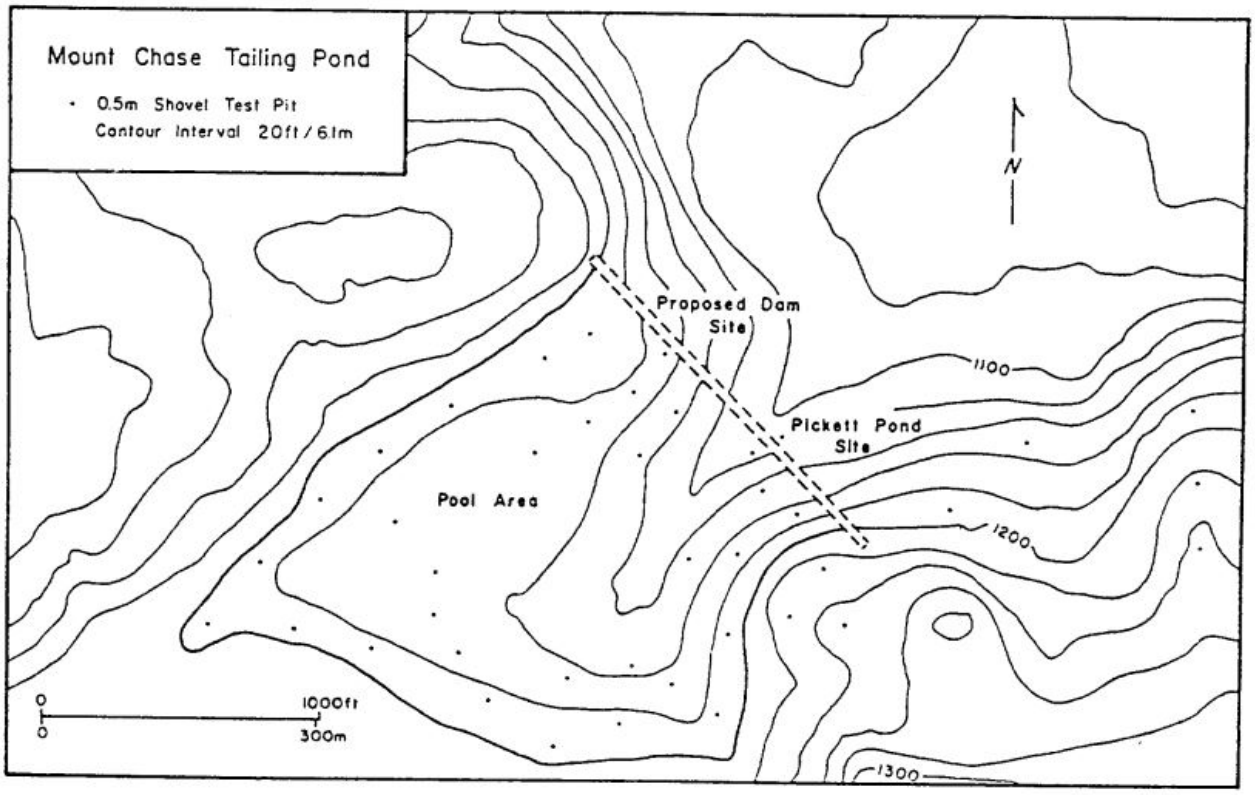



Figure 11. Map of tailing pond area showing location of previously identified site 147.001 (the Pickett Pond Site). From Bonnichsen et al. 1984:7, Figure 3.

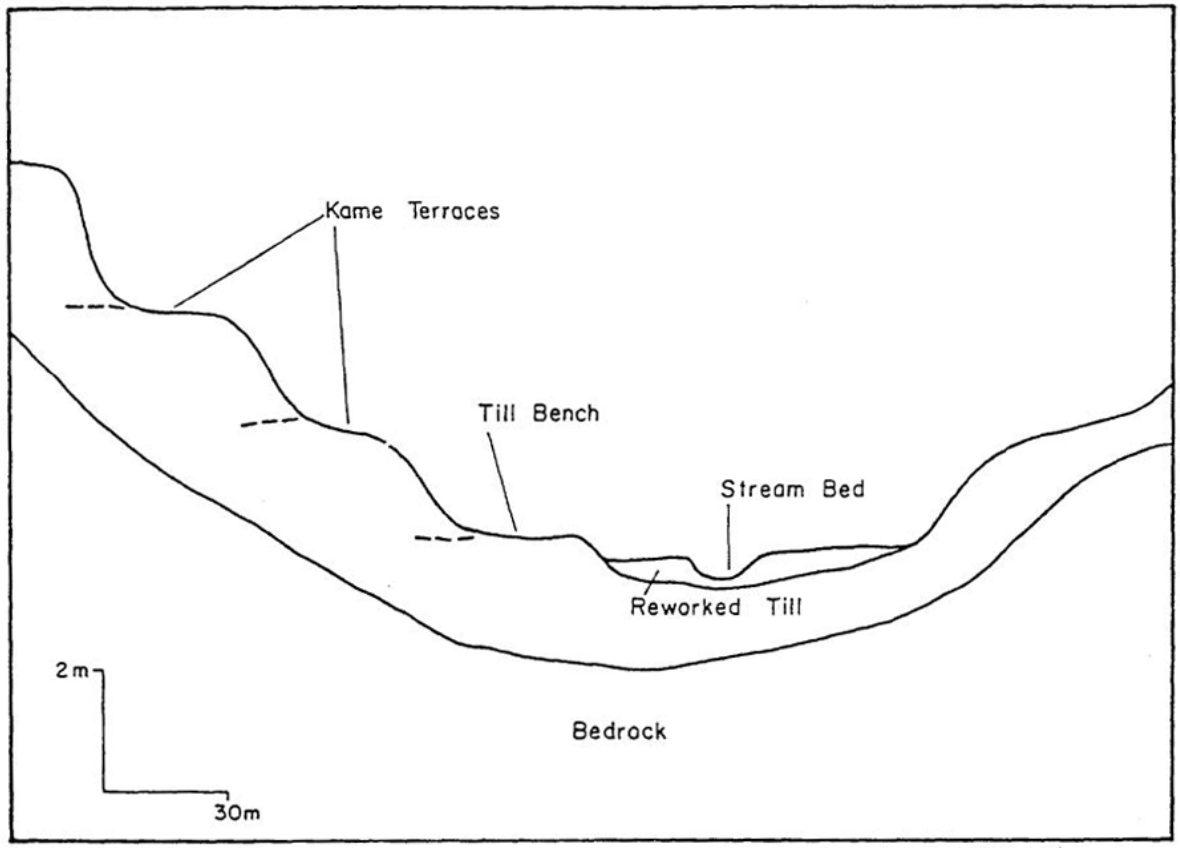



Figure 12. Profile sketch map of Pickett Pond basin surficial geology showing postglacial landforms. From Bonnichsen et al. 1984:6 Figure 2.

Figure 13. Section of the Walling 1859 map of Penobscot County showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

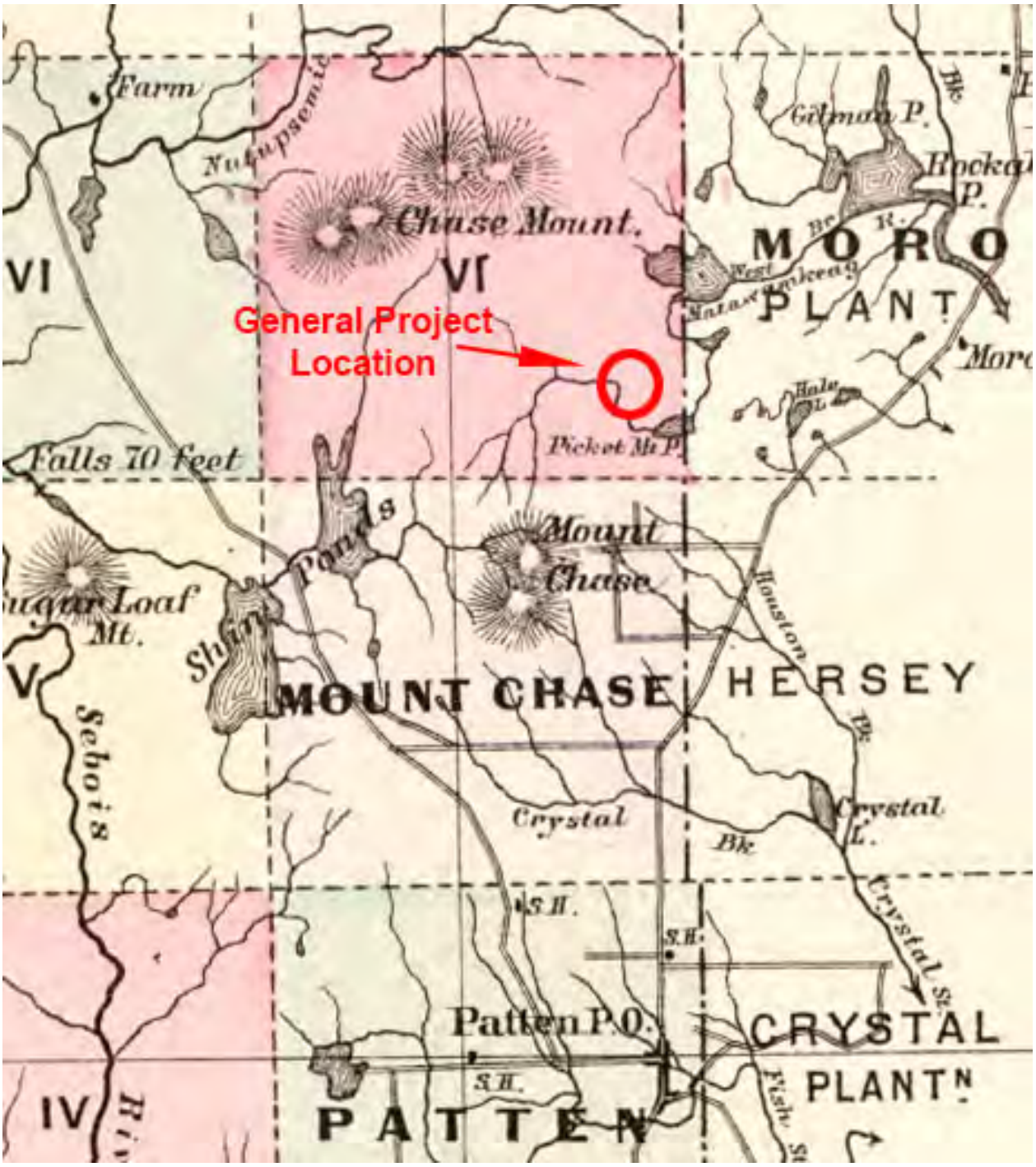



Figure 14. Section of the Colby 1885 map of Penobscot County showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

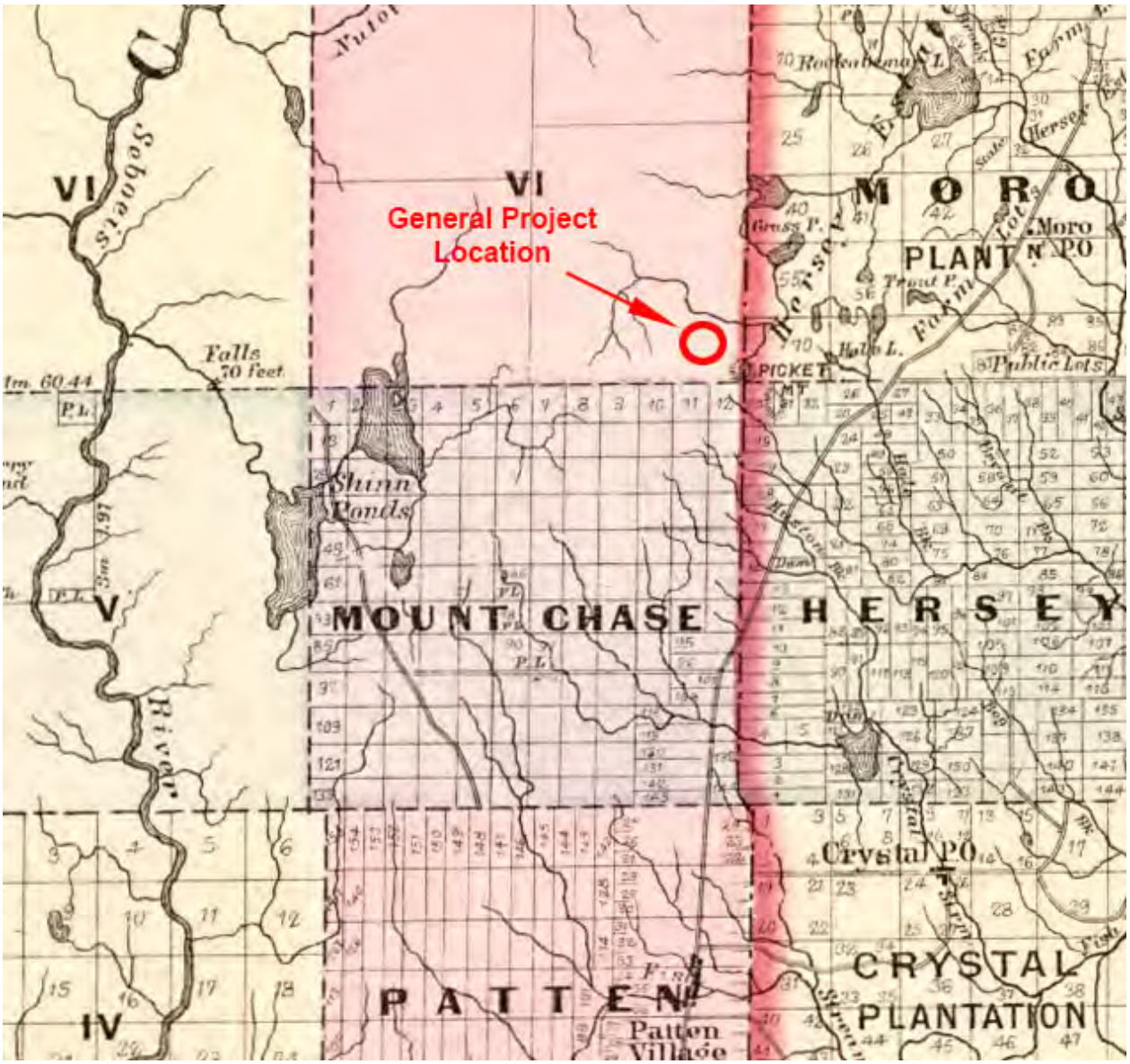



Figure 15. Section of the Stuart 1894 map of the Timber Lands of Maine showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

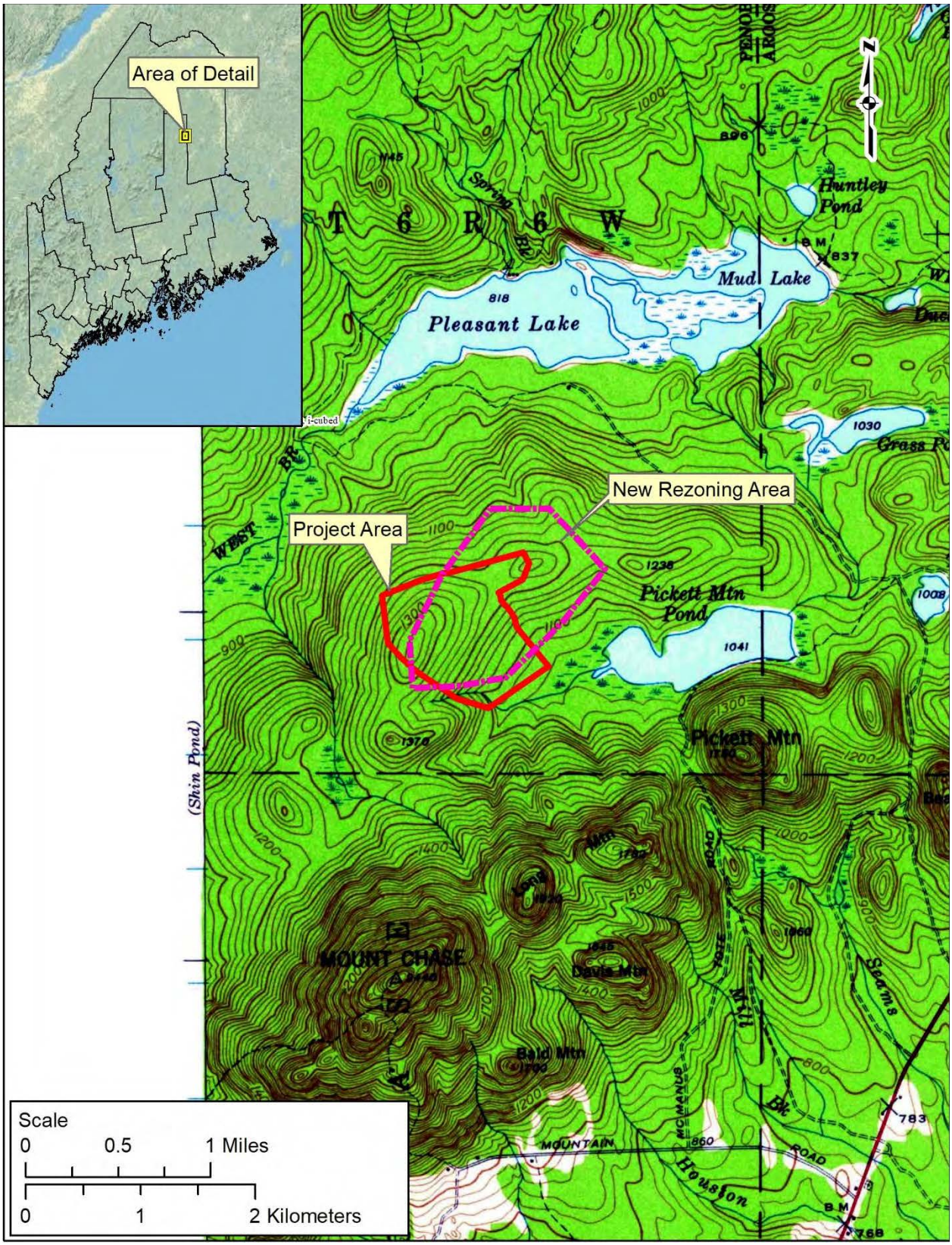



Figure 16. 1940 topographic map showing the location of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note tote road passing to the north of project area and structure on tote road near Pleasant Lake.

Figure 17. View southeast of skidder trail within the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Pickett Mountain is visible in the background. The photographer is standing on the hill in the northwest portion of the project area in the vicinity of ASA 3.

Figure 18. View north towards the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The photographer is standing in the approximate location of previously identified site 147.001 looking towards ASA 5. The thick undergrowth in the southern portion of the project area is clearly visible. This thick vegetation also denotes the location of wetland areas at the head of Pickett Mountain Pond.

Figure 19. View south of Wolfden geologists Don Dudek and John Breedlove at lithic outcrop ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 20. Lithic outcrop at ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 21. Sample from lithic outcrop at ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 22. View northwest of lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 23. Lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 24. Samples from lithic outcrop at ASA 2 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 25. View west of part of lithic outcrop ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 26. View east of part of lithic outcrop ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 27. Samples from lithic outcrop at ASA 3 in the western portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note how well this material flakes using a geological hammer.

Figure 28. View northwest of lithic outcrop ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 29. Lithic outcrop ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 30. Sample of lithic outcrop in ASA 4, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 31. Lithic outcrop at ASA 6 in the central portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note that the lower rock seam appears to be an intact outcrop while the top appears to have been flipped or moved by heavy machinery.

Figure 32. Sample of lithic outcrop in ASA 6, located outside of the western edge of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine.

Figure 33. Poor quality, reddish colored chert seam in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. This chert was identified approximately 100 m south of ASA 1 (location marked on GPS with yellow dot).

Figure 34. Sample of poor quality, reddish colored chert seam in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. This chert was identified approximately 100 m south of ASA 1.

Figure 35. Chert cobble, likely Munsungan material, recovered from glacial till in the vicinity of ASA 1 in the eastern portion of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine (location marked on GPS with yellow dot).

Figure 36. Chert cobbles, likely Munsungan material, recovered from glacial till in the southwestern corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine (location marked on GPS with yellow dot).

Figure 37. View northwest of gravel track in southwestern corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. The Pickett Mountain Pond stream is within the bushes at the right side of the photograph.

Figure 38. View east of level till bench landform in southeast corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note Wolfden coring location at left of photograph (orange marker).

Figure 39. View south of level landform in southeast corner of the proposed Pickett Mountain Mine Project, T6R6 WELS, Penobscot County, Maine. Note wetland beyond.

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 25-B: MHPC Communications on Phase 0 Assessment Report

## Jeremy Ouellette

**From:** Gemma Hudgell <hudgell@nearchaeology.com>
**Sent:** September 19, 2022 11:13 AM
**To:** Jeremy Ouellette
**Cc:** Bob Bartone; Hutch Mcpheters
**Subject:** Fw: Wolfden Pickett Mtn Phase 0 Assessment MHPC 1783_19

Good morning Jeremy,

We've received a response from the MHPC - see email below.

Please let us know if you have any questions of if there's anything else you need.

Many thanks -

Gemma

Gemma-Jayne Hudgell, Ph.D.

Assistant Director

Principal Investigator

Northeast Archaeology Research Center, Inc.

382 Fairbanks Road

Farmington, ME 04938

Office: 207-860-4032

cell: 207-578-8535

www.nearchaeology.com

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**From:** Spiess, Arthur <Arthur.Spiess@maine.gov>
**Sent:** Friday, September 16, 2022 2:09 PM
**To:** Gemma Hudgell <hudgell@nearchaeology.com>; Bob Bartone <bartone@nearchaeology.com>
**Subject:** Wolfden Pickett Mtn Phase 0 Assessment MHPC 1783_19

Hello Gemma and Bob:

I have carefully read your "Archaeological Phase 0 Assessment" for the proposed Pickett Mountain Mine project LUPC rezoning request. It is acceptable in all respects. Interesting to see possible tool stone (chert-like) outcrops, and I

concur with the need for archaeological testing around them and on the relatively level terraces in archaeologically sensitive area (ASA) 5.

Please forward this email to Wolfden, if you wish. We have not, at this time, produced a separate comment for LUPC.

Regards, Art

Arthur Spiess, PhD
Senior Archaeologist, MHPC
Desk phone: 207-287-2789

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 25-C: Tribal Notification Letters

Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

September 28, 2022
File: 195602317

**Attention: Clarissa Sabattis, Tribal Chief**
Houlton Band of Maliseet Indians
88 Bell Road
Littleton, ME 04730

**VIA EMAIL:** csabattis@maliseets.com

**Reference: Pickett Mountain Project Cultural / Historical Resources Information Request**

Dear Chief Sabattis,

The purpose of this letter is to request information on any significant cultural or historic resources associated with the Pickett Mountain Project (Project) depicted on the attached figure (Figure 1). We are assisting Wolfden Mount Chase LLC (Wolfden) with a Land Use Planning Commission (LUPC) Zoning Petition to reclassify the Project area from General Management (M-GN) to Planned Development (D-PD).

The project completed a Phase 0 Archaeological Assessment that identified six potential areas of archaeological significance, five within the area proposed for LUPC rezoning (report attached). These areas are avoided by the project design, but the Project will be conducting a Phase 1 archaeological survey to further investigate these areas. Prior to that Phase 1 survey, the project will contact you to request your review of the survey design and invite your participation.

Please note that significant modifications to the Project area and proposed activities have been made from the original 2020 petition. This Project area is smaller but overlaps with your previous review area. The 2020 Petition proposed on-site tailings processing; the new Petition will be for a mine only. Mined ore will be transported to an offsite concentrating and tailings facility for processing. The Project will request your further review of the offsite facility location once a site is chosen.

Please review the attached map and let me know if there are any known or suspected cultural or historic resources associated with the Project area and its surroundings. Should you have any questions please feel free to contact me.

**Reference:** **Pickett Mountain Project Cultural / Historical Resources Information Request**

Thank you for your assistance in obtaining this information.

Regards,

**Stantec Consulting Services Inc.**

**Douglas B. Stewart, PWS**
Senior Principal
Phone: (207) 406-5471
Fax: (207) 729-2715
doug.stewart@stantec.com

Attachment: Pickett Mountain Project Map

**Reference:** **Pickett Mountain Project Cultural / Historical Resources Information Request**

# Attachment: Pickett Mountain Project Map

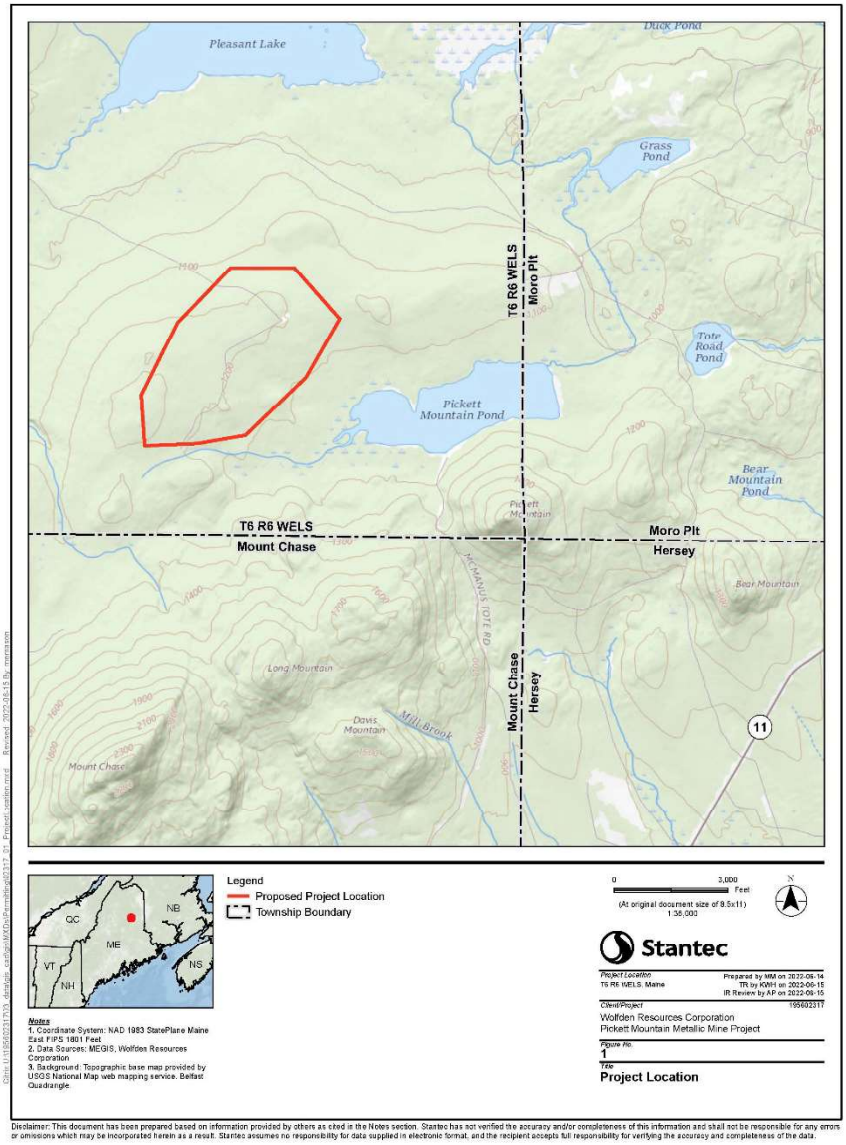


Figure 1 Project area.

Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

September 28, 2022
File: 195602317

Attention: Jennifer Pictou, Tribal Historic Preservation Officer
Aroostook Band of Micmacs
7 Northern Road
Presque Isle, ME 04769

VIA EMAIL: jpictou@micmac-nsn.gov; researchandhistory@gmail.com

**Reference: Pickett Mountain Project Cultural / Historical Resources Information Request**

Dear Ms. Pictou,

The purpose of this letter is to request information on any significant cultural or historic resources associated with the Pickett Mountain Project (Project) depicted on the attached figure (Figure 1). We are assisting Wolfden Mount Chase LLC (Wolfden) with a Land Use Planning Commission (LUPC) Zoning Petition to reclassify the Project area from General Management (M-GN) to Planned Development (D-PD).

The project completed a Phase 0 Archaeological Assessment that identified six potential areas of archaeological significance, five within the area proposed for LUPC rezoning (report attached). These areas are avoided by the project design, but the Project will be conducting a Phase 1 archaeological survey to further investigate these areas. Prior to that Phase 1 survey, the project will contact you to request your review of the survey design and invite your participation.

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Please review the attached map and let me know if there are any known or suspected cultural or historic resources associated with the Project area and its surroundings. Should you have any questions please feel free to contact me.

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

Thank you for your assistance in obtaining this information.

Regards,

**Stantec Consulting Services Inc.**

**Doug B. Steward, PWS**
Senior Principal
Phone: (207) 406-5471
Fax: (207) 729-2715
doug.stewart@stantec.com

Attachment: Pickett Mountain Project Map

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

# Attachment: Pickett Mountain Project Map

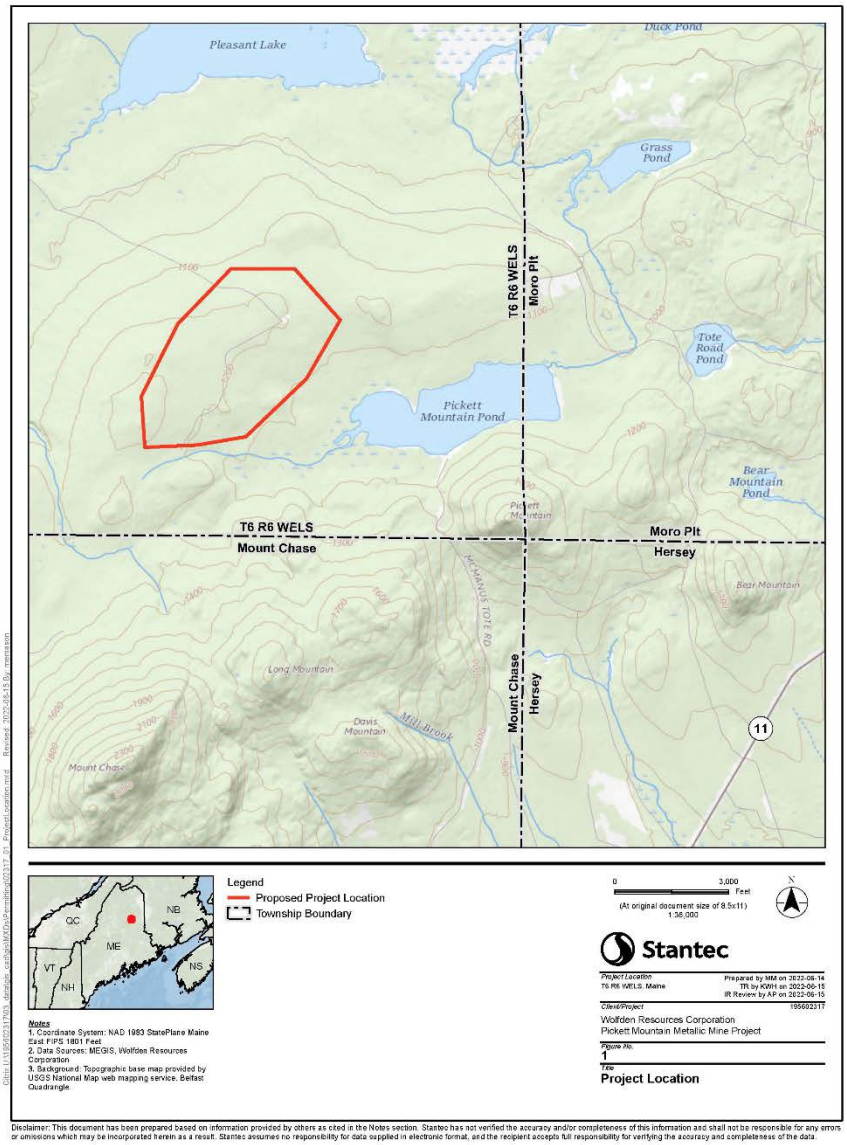


Figure 1 Project area.

Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

September 28, 2022
File: 195602317

Attention: Donald Soctomah, Tribal Preservation Officer
Passamaquoddy Tribe
Indian Township and Pleasant Point Reservations
P.O. Box 301
Princeton, ME 04668

VIA EMAIL: soctomah@gmail.com

**Reference: Pickett Mountain Project Cultural / Historical Resources Information Request**

Dear Mr. Soctomah,

The purpose of this letter is to request information on any significant cultural or historic resources associated with the Pickett Mountain Project (Project) depicted on the attached figure (Figure 1). We are assisting Wolfden Mount Chase LLC (Wolfden) with a Land Use Planning Commission (LUPC) Zoning Petition to reclassify the Project area from General Management (M-GN) to Planned Development (D-PD).

The project completed a Phase 0 Archaeological Assessment that identified six potential areas of archaeological significance, five within the area proposed for LUPC rezoning (report attached). These areas are avoided by the project design, but the Project will be conducting a Phase 1 archaeological survey to further investigate these areas. Prior to that Phase 1 survey, the project will contact you to request your review of the survey design and invite your participation.

Please note that significant modifications to the Project area and proposed activities have been made from the original 2020 petition. This Project area is different but overlaps with your previous review area. The 2020 Petition proposed on-site tailings processing; the new Petition will be for a mine only. Mined ore will be transported to an offsite concentrating and tailings facility for processing. The Project will request your further review of the offsite facility location once a site is chosen.

Please review the attached map and let me know if there are any known or suspected cultural or historic resources associated with the Project area and its surroundings. Should you have any questions please feel free to contact me.

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

Thank you for your assistance in obtaining this information.

Regards,

**Stantec Consulting Services Inc.**

**Doug B. Stewart, PWS**
Project Manager
Phone: (207) 406-5471
Fax: (207) 729-2715
doug.stewart@stantec.com

Attachment: Pickett Mountain Project Map

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

# Attachment: Pickett Mountain Project Map

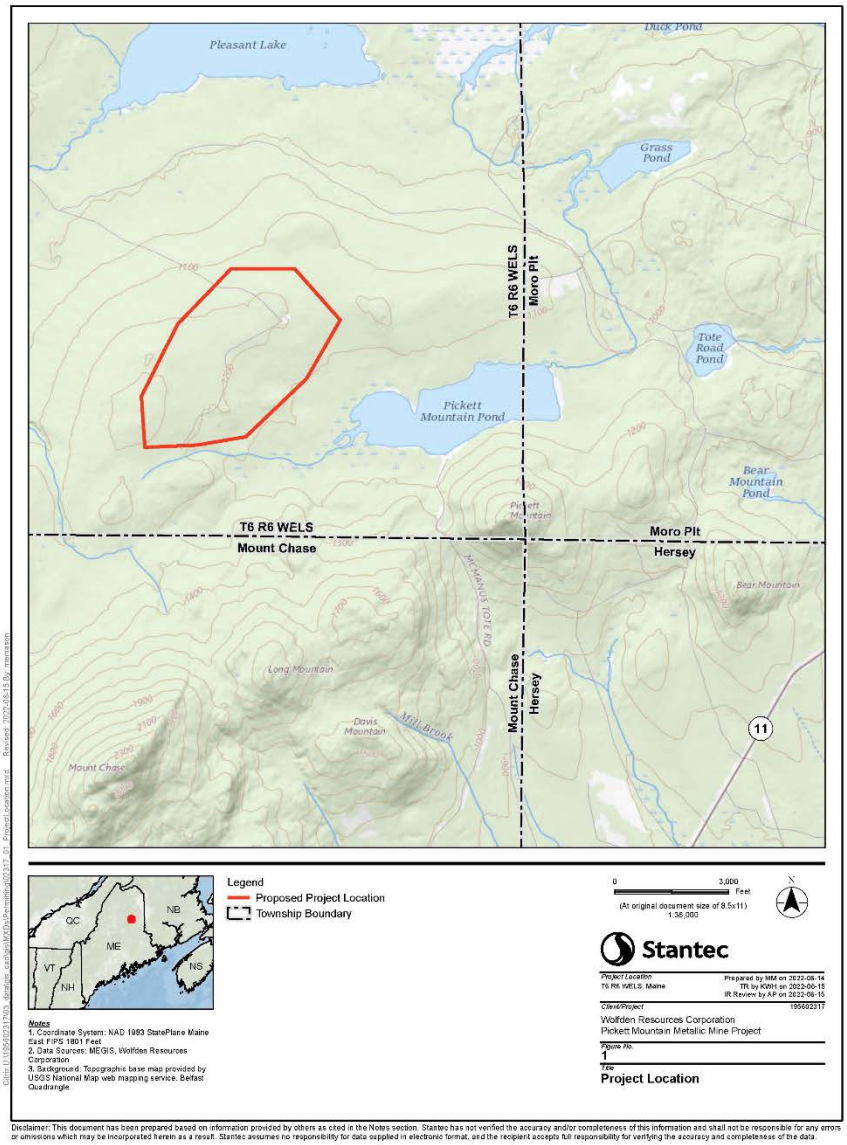


Figure 1 Project area.

Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

September 28, 2022
File: 195602317

Attention: Chris Sockalexis, Tribal Historic Preservation Officer
Penobscot Nation
Cultural and Historic Preservation Department
12 Wabanaki Way
Indian Island, ME 04468

VIA EMAIL: chrissockalexis@penobscotnation.org

**Reference: Pickett Mountain Project Cultural / Historical Resources Information Request**

Dear Mr. Sockalexis,

The purpose of this letter is to request information on any significant cultural or historic resources associated with the Pickett Mountain Project (Project) depicted on the attached figure (Figure 1). We are assisting Wolfden Mount Chase LLC (Wolfden) with a Land Use Planning Commission (LUPC) Zoning Petition to reclassify the Project area from General Management (M-GN) to Planned Development (D-PD).

The project completed a Phase 0 Archaeological Assessment that identified six potential areas of archaeological significance, five within the area proposed for LUPC rezoning (report attached). These areas are avoided by the project design, but the Project will be conducting a Phase 1 archaeological survey to further investigate these areas. Prior to that Phase 1 survey, the project will contact you to request your review of the survey design and invite your participation.

Please note that significant modifications to the Project area and proposed activities have been made from the original 2020 petition. This Project area is smaller but overlaps with your previous review area. The 2020 Petition proposed on-site tailings processing; the new Petition will be for a mine only. Mined ore will be transported to an offsite concentrating and tailings facility for processing. The Project will request your further review of the offsite facility location once a site is chosen.

Please review the attached map and let me know if there are any known or suspected cultural or historic resources associated with the Project area and its surroundings. Should you have any questions please feel free to contact me.

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

Thank you for your assistance in obtaining this information.

Regards,

**Stantec Consulting Services Inc.**

**Doug B. Stewart, PWS**
Senior Principal
Phone: (207) 406-5471
Fax: (207) 729-2715
doug.stewart@stantec.com

Attachment: Pickett Mountain Project Map

Reference: Pickett Mountain Project Cultural / Historical Resources Information Request

# Attachment: Pickett Mountain Project Map

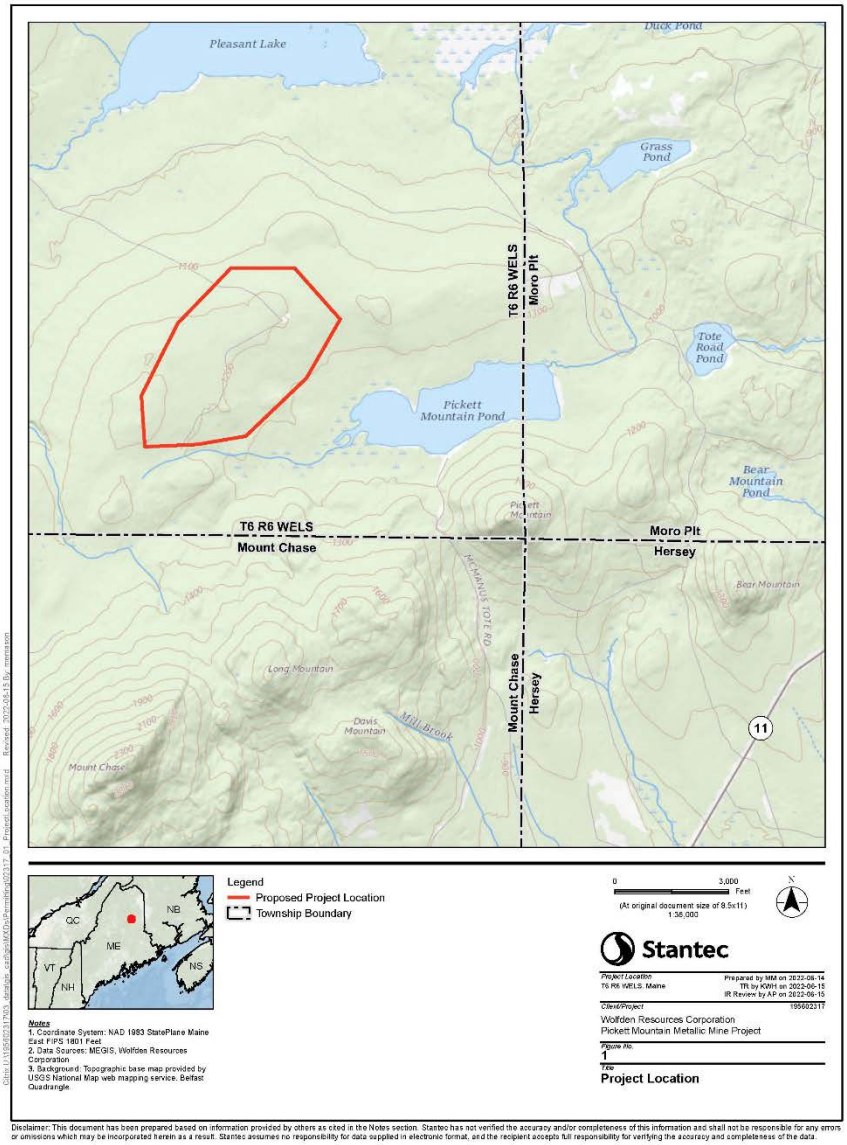


Figure 1 Project area.

# EXHIBIT 26.0 RARE OR SPECIAL PLANT COMMUNITIES AND WILDLIFE HABITAT

Wolfden has consulted with the US Fish and Wildlife Service (USFWS) regarding the possible presence of RTE wildlife species and significant wildlife habitat (**Attachment 26-A**); the Maine Department of Inland Fisheries and Wildlife (MDIFW) for known locations of State Endangered, Threatened, and Special Concern species and habitats, designated Essential and Significant Wildlife Habitats, critical fisheries and aquatic resources, and other Protected Natural Resources concerns (**Attachment 26-B**); the MNAP for information on the presence of rare of unique botanical features (**Attachment 26-C**); and the MDEP for information on any significant natural resources (**Attachment 26-D**) in the area proposed for development.

## 26.1 AGENCY FINDINGS

### 26.1.1 US Fish and Wildlife Service

Through the USFWS Information Planning and Consultation (IPaC) tool, federally threatened Canada lynx (*Lynx canadensis*) and federally endangered Atlantic salmon (*Salmo salar*) designated critical habitat were identified as overlapping with the Project Area. In addition, federally threatened northern long-eared bat (*Myotis septentrionalis*), expected to be uplisted to endangered in 2023, and federal candidate species monarch butterfly (*Danaus plexippus*) habitat potential was identified as potentially overlapping with the Project Area, although critical habitat has not been designated for these species.

During June 2022 wetland delineation surveys of the Project Area, all but one of the delineated streams were intermittent in nature and, therefore, unlikely to provide suitable habitat for Atlantic salmon. One perennial stream reach, located within a large wetland complex, was delineated in the south-central portion of the Project Area. The Project proposes no instream work and adherence to 75-foot buffers around wetlands and surface waters to minimize potential impacts to sensitive habitats. Outside of the Project Area, the headwaters of Pleasant Lake and areas downstream have been modeled as potential Atlantic Salmon habitat; however, there are several dams below Pleasant Lake that restrict upstream migration. The Project's water management approach, detailed in **Exhibit 10 – Surrounding Uses and Anticipated Impacts**, describes the measures that the Project will implement to treat water to existing background condition before being allowed to return to the environment while mirroring natural water balances to each natural resource.

Ideal habitat for Canada lynx in Maine is tied to the abundance of their primary prey, snowshoe hare (*Lepus americanus*). Canada lynx show a strong preference for conifer and mixed conifer sapling forests where high densities of snowshoe hares may be found.[16] Within the Project Area, pockets of coniferous or mixed coniferous communities are generally limited to the margins of wetlands and stream bodies. In these areas, individual trees are generally larger than the sapling classes and provide low value as snowshoe hare habitat. The Project proposes adherence to 75-foot buffers around wetlands and surface waters to minimize potential impacts to sensitive habitats. Other portions of the Project Area likely support

[16] MDIFW. 2012. Canada Lynx Assessment. Research and Assessment Section. Bangor, ME. 107pp.

transitory lynx movements across the regional landscape as home ranges in Maine are between 12 and 24 square miles.[16] The amount of potential habitat impacted by the Project is of poor quality and minimal in size compared to what is available in the regional landscape and is unlikely to adversely alter Lynx movements or the local population.

Surveys for bat hibernacula will be required as part of the MDEP Chapter 200 permitting process and this will include inspections of all areas of talus and rock features per MDIFW recommendations noted below. In addition, the Project will limit required tree clearing to between November 1 and April 14 to avoid periods when trees may be used for reproduction and habitat for young who are unable to fly. There are generally no Endangered Species Act Section 7 requirements for candidate species like the monarch butterfly. The Project Area currently is forested and does not provide suitable habitat. The proposed solar facility may provide potential habitat through the creation of open-field conditions and the establishment of flowering plants and milkweed (*Asclepias* spp), the host plant for monarch butterfly.

### 26.1.2 Maine Department of Inland Fisheries and Wildlife

In their response letter, MDIFW stated there are no known State-listed Endangered, Threatened, or Special Concern or State Essential Wildlife Habitat species occur within the Project Area. MDIFW identified potential for bat species—including State Endangered little brown and northern long-eared; State Threatened eastern small-footed (*Myotis leibii*); and State Species of Special Concern big brown (*Myotis lucifugus*), red (*Lasiurus borealis*), hoary (*Lasiurus borealis*), silver-haired (*Lasionycteris noctivagans*), and tri-colored (*Perimyotis subflavus*)—as potentially occurring during the fall/spring migration, summer breeding season, and/or overwintering periods. MDIFW conducted a GIS analysis that did not indicate presence of exposed rocky features typical of bat overwintering hibernacula. However, because not all talus and rocky features have been mapped statewide, they “advise that all areas of talus and rocky features of approximately 1,000 square feet or greater in size be documented on and within 250 feet of the Project area.” Surveys for bat hibernacula are required as part of the MDEP Chapter 200 process that the applicant must fulfil to receive permission for the Project and rocky feature surveys will be conducted prior to receiving MDEP authorization.

MDIFW also recommended wetland delineations to avoid impacts to freshwater wetlands, intermittent or perennial streams, and significant vernal pools. Wetland delineations were completed and impacts avoided as part of the Project design. Mine construction, operation, and decommissioning will avoid all wetlands including a 75-foot buffer zone. See **Exhibit 6, Attachment 6-A** for details on the wetland delineation study.

MDIFW noted that Inland Waterfowl and Wading Bird Habitat is located on the inlet on the western end of Pickett Mountain Pond, adjacent to the proposed Project site. The nearest project feature to mapped Inland Waterfowl and Wading Bird Habitat on the western end of Pickett Mountain Pond is an Water Recharge Area located 0.32 miles away. MDIFW recommended “that, while conducting further site investigations and resources for project design and review, the applicant survey live trees in upland areas within the proposed project boundary for great blue heron (*Ardea Herodias*) nest colonies and level of use.” During June 2022 wetland delineations of the entire Project Area—when great blue herons are expected to be actively nesting—Stantec biologists did not observe great blue heron individuals, nests, or features representative of nesting habitat within the Project Area.

### 26.1.3 Maine Natural Areas Program

In their response letter, MNAP stated “there are no mapped MNAP rare botanical features located in the project area.” Their response also stated, “You may want to have the site inventoried by a qualified field biologist to ensure that no undocumented rare features are inadvertently harmed.” In response, a Stantec botanist conducted a desktop analysis of the potential for rare botanical features and concluded “the Project site has low to very low potential to support rare or exemplary botanical resources based on a review of the available ecological site data, landscape position, and past disturbances from forestry operations. As such, botanical field surveys are not recommended at this time.” Details of the data sources, methodology, and analysis are in **Attachment 26-E**. In addition, **Attachment 26-F** provides a memo summarizing the results of an October 1, 2020, site visit with Wolfden, LUPC, MDIFW, and MNAP confirming a lack of shrubby cinquefoil (*Potentilla fruticose*), host plant for the state-threatened Clayton’s copper butterfly (*Lycaena Dorcas claytoni*) along the western shore and inlet stream to Pickett Mountain Pond. As a result, MDIFW concluded their concerns regarding potential effects to Clayton’s copper butterfly were no longer relevant.

### 26.1.4 Maine Department of Environmental Protection

MDEP did not provide any additional information and will conduct a comprehensive review under Chapter 200 permitting for the proposal.

# EXHIBIT 26 FIGURES

Not Applicable

# EXHIBIT 26 ATTACHMENTS

Attachment 26-A: USFWS Correspondence

Attachment 26-B: MDIFW Correspondence

Attachment 26-C: MNAP Correspondence

Attachment 26-D: MDEP Correspondence

Attachment 26-E: Botanical Desktop Assessment

Attachment 26-F: MDIFW Memorandum on Clayton’s copper butterfly

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 26-A: USFWS Correspondence

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Maine Ecological Services Field Office
P. O. Box A
East Orland, ME 04431
Phone: (207) 469-7300 Fax: (207) 902-1588


In Reply Refer To: June 16, 2022
Project Code: 2022-0054887
Project Name: Pickett Mountain Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

**Migratory Birds**: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Maine Ecological Services Field Office**
P. O. Box A
East Orland, ME 04431
(207) 469-7300

# Project Summary

Project Code: 2022-0054887
Event Code: None
Project Name: Pickett Mountain Project
Project Type: Commercial Development
Project Description: The Pickett Mountain project (Project) is proposing an underground mine to mine commercial grades of minerals from a known metallic mineral deposit.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@46.137863249999995,-68.46599169733392,14z

Counties: Penobscot County, Maine

# Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Mammals

| NAME | STATUS |
|---|---|
| Canada Lynx *Lynx canadensis*<br>Population: Wherever Found in Contiguous U.S.<br>There is **final** critical habitat for this species. Your location overlaps the critical habitat.<br>Species profile: https://ecos.fws.gov/ecp/species/3652 | Threatened |
| Northern Long-eared Bat *Myotis septentrionalis*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/9045 | Threatened |

## Fishes

| NAME | STATUS |
|---|---|
| Atlantic Salmon *Salmo salar*<br>Population: Gulf of Maine DPS<br>There is **final** critical habitat for this species. Your location overlaps the critical habitat.<br>Species profile: https://ecos.fws.gov/ecp/species/2097 | Endangered |

## Insects

| NAME | STATUS |
|---|---|
| Monarch Butterfly *Danaus plexippus*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/9743 | Candidate |

## Critical habitats

There are 2 critical habitats wholly or partially within your project area under this office's jurisdiction.

| NAME | STATUS |
|---|---|
| Atlantic Salmon *Salmo salar*<br>https://ecos.fws.gov/ecp/species/2097#crithab | Final |
| Canada Lynx *Lynx canadensis*<br>https://ecos.fws.gov/ecp/species/3652#crithab | Final |

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 26-B: MDIFW Correspondence

| | |
|---|---|
| **From:** | Stratton, Robert D |
| **To:** | Pries, Alex |
| **Cc:** | Carr, Tim; Beyer, Stacie R; Clark, Michael S; Stebbins, Mark N; Puryear, Kristen; Mahaney, Wende; Dunham, Kevin; Caron, Mark; IFWEnvironmentalreview |
| **Subject:** | Information Request: T6R6, Wolfden Mount Chase LLC, Pickett Mountain Rezoning Proposal |
| **Date:** | Wednesday, July 27, 2022 3:38:03 PM |
| **Attachments:** | MDIFWResponse_ERid3721_ERVerID7413, Wolfden 27July2022.pdf<br>Topo_2014_ERid3721_ERVerID7413.pdf<br>MDIFW - Wolfden 11Sep2020.pdf<br>Wolfden prelim resource surveys 25Nov2019.pdf<br>Wolfden preliminary stream resources.pdf<br>#BATS--Representative Photographs of Suitable Bat Rock-Roosting Areas.pdf |

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Good afternoon Alex,

I am writing in response to your request of June 27, 2022 for resource information for the T6R6, Wolfden Mount Chase LLC, Pickett Mountain Rezoning Proposal. I apologize for the delay. Please find MDIFW's review and recommendations attached. If you have any questions or concerns, feel free to contact me. Thank you, Bob.

Bob Stratton
Wildlife Biologist
Environmental Program Manager
Maine Department of Inland Fisheries & Wildlife
353 Water Street; 41 State House Station
Augusta, Maine 04333-0041
(207) 287-5659 office; (207) 592-5446 cell
mefishwildlife.com

*Correspondence to and from this office is considered a public record and may be subject to a request under the Maine Freedom of Access Act. Information that you wish to keep confidential should not be included in email correspondence.*

JANET T. MILLS
GOVERNOR

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
353 WATER STREET
41 STATE HOUSE STATION
AUGUSTA ME 04333-0041

JUDITH CAMUSO
COMMISSIONER

July 27, 2022

Alex Pries
Stantec
0 Park Drive
Topsham, ME 04086

**RE: Information Request: T6R6, Wolfden Mount Chase LLC, Pickett Mountain Rezoning Proposal**

Dear Alex,

Per your request received on June 27, 2022, we have reviewed current Maine Department of Inland Fisheries and Wildlife (MDIFW) data and maps for known locations of State Endangered, Threatened, and Special Concern species and habitats; designated Essential and Significant Wildlife Habitats; critical fisheries and aquatic resources; and other Protected Natural Resources concerns within the vicinity of the *T6R6, Wolfden Mount Chase LLC, Pickett Mountain Rezoning Proposal*. Please note that our comments should be considered preliminary based on the limited information provided at this stage.

It should be noted that there is no comprehensive statewide inventory that includes all Rare, Threatened, and Endangered species occurrences and habitats or Significant Wildlife Habitats and that the completeness of resource maps varies by habitat type, location, and previous survey efforts. MDIFW's preliminary record searches identify known resources, but site surveys are necessary to identify other important resources that have not yet been investigated but may be present in an area. Locating a project in or in proximity to certain habitats can result in adverse impacts to those habitats and the species that utilize them and, in those situations, MDIFW will likely recommend increased siting and design considerations, operational measures, monitoring practices, and/or other efforts in attempt to avoid, minimize, and possibly mitigate for such impacts. Resource surveys, project siting, facility design/layout, and operational practices are all very important steps in this process. MDIFW provides recommendations based on known and reported resource information but, it is the applicant's ultimate responsibility to ensure that its activities do not result in substantial detrimental impacts to resources.

As you will observe from the attached preliminary resource map, information from our desktop review indicates no known locations of State-listed Endangered, Threatened, or Special Concern species within the designated project area that would be directly affected by your project. Additionally, our Department has not mapped any Essential Wildlife Habitats that would be affected by your project footprint. Essential Habitats are currently only designated for three Endangered coastal breeding bird species that are not found in the project area.

In your request you noted, *"significant modifications to the Project area and proposed activities have been made from the original 2020 petition. This Project area is different but overlaps with your previous review area."* From your site map, we can see that the review area has been slightly modified. However, as you note, the 2022 project area overlaps with a significant portion of the 2020 version. Thus, as habitat maps have not been further updated since the previous review, known resources and concerns can be anticipated to be substantially the same as included in MDIFW's correspondences of September 11, 2020 and November 25, 2019, attached.

***Endangered, Threatened, and Special Concern Species***

Bat Species – Of the eight species of bats that occur in Maine, the three *Myotis* species are afforded protection under Maine's Endangered Species Act (MESA, 12 M.R.S §12801 et. seq.): little brown bat (State Endangered), northern long-eared bat (State Endangered), and eastern small-footed bat (State Threatened). The five remaining bat species are designated as Species of Special Concern: big brown bat, red bat, hoary bat, silver-haired bat, and tri-colored bat. While a comprehensive statewide inventory for bats has not been completed, based on historical evidence, it is likely that several of these species occur within the project area during the fall/spring migration, the summer breeding season, and/or for overwintering. If the proposed project has a Federal nexus, either via funding or permitting, or if the project is not consistent with the USFWS "4(d) Rule", we recommend that you contact the U.S. Fish and Wildlife Service--Maine Fish and Wildlife Complex (Wende Mahaney, Wende_Mahaney@fws.gov, 207-902-1569) for further guidance on their perspective, as the northern long-eared bat is also listed as a Threatened Species under the Federal Endangered Species Act. The USFWS "4(d) Rule" provides guidance for protection of bat winter hibernacula and maternity roost trees for northern long-eared bats (see https://www.fws.gov/midwest/endangered/mammals/nleb/4drule.html). MDIFW Endangered Species Rules for bats (Chapter 8.06; see link at http://www.maine.gov/sos/cec/rules/09/137/137c008.docx) provide equivalent seasonal protection of maternity roost trees for any of the three state-listed bats, seasonally prohibits entry into subsurface winter hibernacula, and has additional protections for tree removal within ¼ mile of subsurface winter hibernacula. At present, no maternity roost trees have been designated for protection.

In addition to traditional hibernacula like caves and old mines, recent findings indicate that *Myotis* and big brown bats may also overwinter in exposed rocky features. To date, Maine talus and rocky outcrop studies have focused on relatively exposed slopes with minimal canopy cover, although ongoing research has shown that bats use rocky areas under the forest canopy. Occupied talus slopes in Maine have consisted of variable rock sizes, ranging in size from softball-sized to car-sized boulders. Rock piles, rock ledges, and small vertical cracks in rocks (>1/2-inch-wide) create crevices that allow bats to access deeper cavities that provide protection from predators and suitable temperature and humidity conditions. Some species of bat, like the eastern small-footed bat, use rocky features year-round. A desktop GIS analysis does not indicate the presence of these features in your project area; however, not all talus and rocky features have been mapped statewide. Therefore, we advise that all areas of talus and rocky features of approximately 1,000 square feet or greater in size be documented on and within 250 feet of your project area, including smaller areas of rock piles and tailings (i.e., quarry spoils). See attached photographs for representative features—these photographs are not all-inclusive and should be used for guidance purposes only. Detailed photographs and coordinates should be submitted to MDIFW for review, and additional monitoring may be recommended to document occupancy. Alternatively, these features should be appropriately buffered commensurate with the size and layout of the project. If these features are not present in the project area, our Agency does not anticipate significant impacts to any of the bat species as a result of this project based on current best available science.

***Significant Wildlife Habitats; Critical Fisheries and Aquatic Resources; and other Protected Natural Resources***

In the attached MDIFW letters from 2019 and 2020, a number of resources were described as being located and/or of potential concern in the project vicinity. The resources noted should still be considered of concern and should be addressed in subsequent investigations and project designs.

The site map included with your request appears to indicate that the southern perimeter of the designated project site will be located in proximity to a tributary stream to Pickett Mountain Pond and the associated Inland Waterfowl and Wadingbird Habitat (IWWH #UMO-4024). Please refer to the previous MDIFW letters for recommended riparian buffers for all intermittent and perennial streams and contiguous wetlands, and for concerns described for aquatic habitats and fisheries resources in this area.

To update a recommendation in the 2020 MDIFW letter, based on an October 1, 2020 site investigation, the wetland located along the western shore and inlet stream to Pickett Mountain Pond (T6 R6 WELS) was determined to provide unsuitable habitat for shrubby cinquefoil, the host plant for the State Threatened Clayton's copper butterfly. Thus, MDIFW no longer has concerns for either of these two species within this wetland resource.

I hope this information is of assistance to you. MDIFW anticipates being able to provide more resource information and recommendations when provided with greater project details and site plans as part of a formal application review during permitting processes. In your request you noted, *"The 2020 Petition proposed on-site tailings processing; the new Petition will be for a mine only. Mined ore will be transported to an offsite concentrating and tailings facility for processing."* Many of MDIFW's previous concerns related to aquatic and wetland resources, flora and fauna. Full project details will be critical in evaluating the new proposal and how it addresses previously voiced concerns for protecting surface and subsurface hydrologic flow patterns and features that supply wetlands, streams, and the aquatic life, fisheries, and wildlife resources throughout the area.

This consultation review has been conducted specifically for known MDIFW jurisdictional features and should not be interpreted as a comprehensive review for the presence of other regulated features that may occur in this area. Prior to the start of any future site disturbance, we recommend additional consultation with the municipality, and other state resource agencies including the Maine Natural Areas Program and Maine Department of Environmental Protection in order to avoid unintended protected resource disturbance.

If you have any questions or concerns with any of these recommendations, please feel free to contact me at robert.d.stratton@maine.gov or (207) 287-5659.

Sincerely,

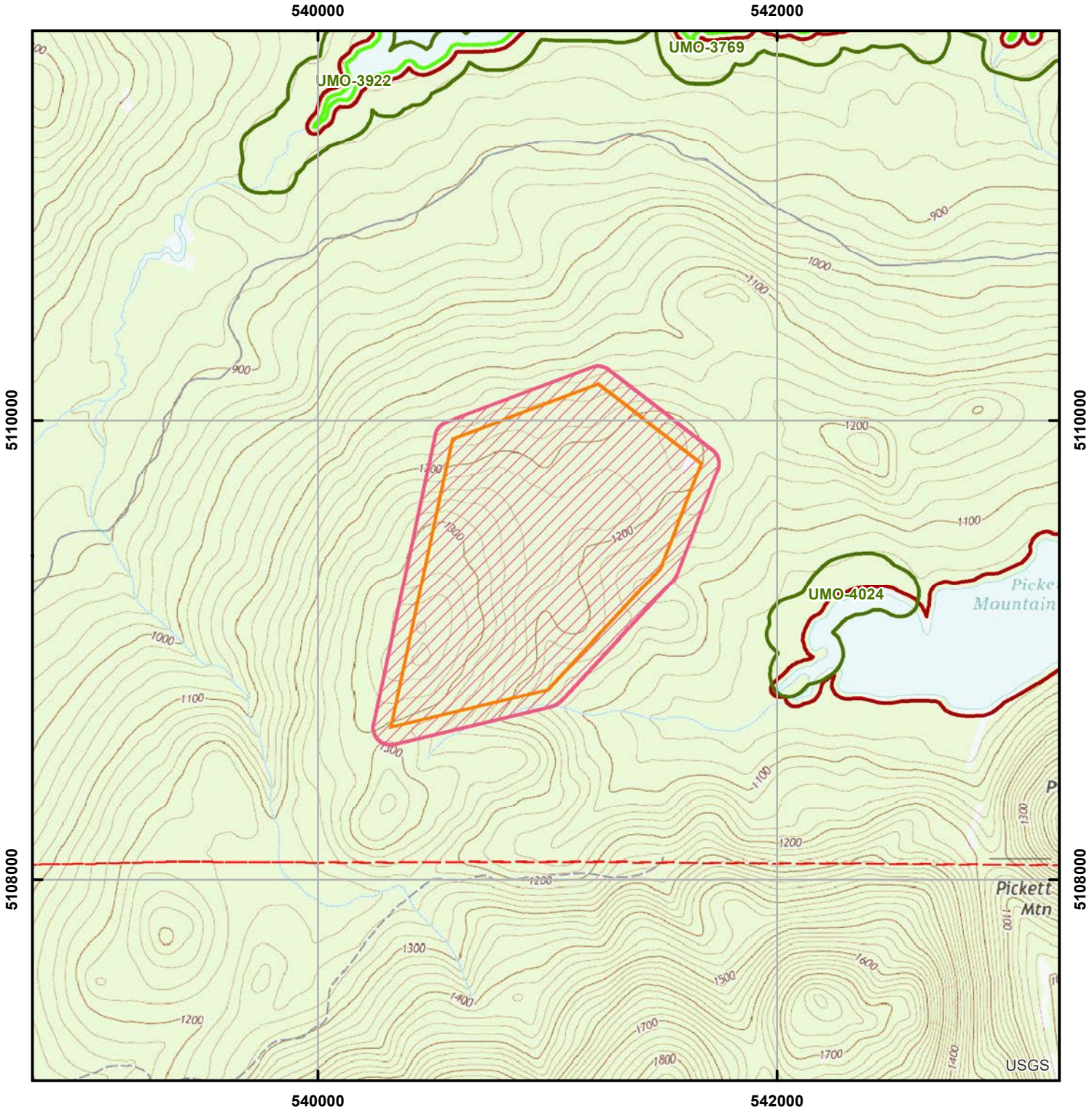
Bob Stratton, IFW

Robert D. Stratton
Environmental Program Manager
Maine Department of Inland Fisheries & Wildlife

cc: Tim Carr, Stacie Beyer (LUPC)
Mike Clark, Mark Stebbins (MDEP)
Kristen Puryear (MNAP)
Wende Mahaney (USFWS)
Kevin Dunham, Mark Caron (MDIFW)

Encl: MDIFW Preliminary Resource Map (2022)
MDIFW Fish and Wildlife Resources Review (September 11, 2020)
MDIFW Preliminary Resource Surveys (November 25, 2019)
Wolfden Preliminary Stream Resources Map (2020)
Representative Photographs of Suitable Bat Rock-Roosting Sites

ERid 3721




# Environmental Review of Fish and Wildlife Observations and Priority Habitats

Project Name: T6R6, Wolfden metalic mineral mining rezoning (Version 4)

Miles

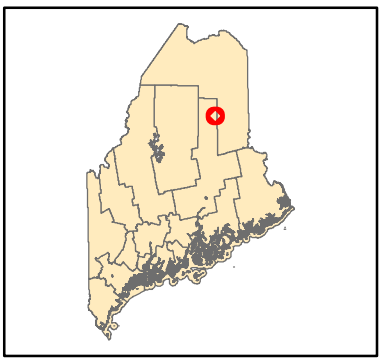
0 0.1250.25 0.5 0.75 1

Projection: UTM, NAD83, Zone 19N

Date: 7/5/2022

Maine Department of Inland Fisheries and Wildlife

- ProjectSearchAreas - All Versions
- Maine Cliff and Talus Areas
- Deer Winter Area
- LUPC p-fw
- Cooperative DWAs
- Seabird Nesting Islands
- Shorebird Areas
- Inland Waterfowl and Wading Bird
- 2008 Iwwh - Shoreland Zoning
- Tidal Waterfowl and Wading Bird
- Significant Vernal Pools
- Environmental Review Polygons
- Roseate Tern
- Piping Plover and Least Tern
- Aquatic ETSc - 2.5 mi review
- Rare Mussels - 5 mi review
- Maine Heritage Fish Waters
- Arctic Charr Habitat
- Redfin Pickerel and Swamp Darter Habitats - buffer100ft
- Special Concern occupied habitats - 100ft buffer
- Wild Lake Trout Habitats



**<u>Representative Photographs of Suitable Bat Rock-Roosting Sites</u>**

Prepared by the Maine Department of Inland Fisheries and Wildlife

***Photographs are for guidance only and should not be considered all-inclusive.***

***Arrows indicate sites of rock-roosting bats.***

Photographs used by permission: Paul R. Moosman, Jr., Department of Biology, Virginia Military Institute

JOURNAL
May 2016 -

MOOSMAN

JANET T. MILLS
GOVERNOR

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
284 STATE STREET
41 STATE HOUSE STATION
AUGUSTA ME 04333-0041

JUDITH CAMUSO
COMMISSIONER

September 11, 2020

Ms. Stacie J. Beyer
Planning Manager
Maine Land Use Planning Commission
22 State House Station,
Augusta, Maine 04333-0022

**RE: Wolfden Resources Mineral Mining Rezoning Petition, T6R6 WELS; Additional Resource Information.**

Dear Stacie,

Per your request, and as a follow up to the site visit conducted on September 3, 2020, the Maine Department of Inland Fisheries and Wildlife (MDIFW) offers the following additional observations and recommendations related to Wolfden Resources' petition to rezone 528 acres in T6R6 WELS to allow for an application to construct a metallic mineral mine. We appreciate the opportunity to attend the site visit, which was very informative and provided an opportunity to discuss resource concerns with the applicant and other parties present.

In MDIFW's letter of November 25, 2019, we described our agency's focus on Rare, Threatened, and Endangered Species and Habitats; Significant Wildlife Habitats; and Protected Natural Resources. Based on preliminary information provided, we also noted several resources for further investigation and of particular concern, some of which are further addressed below. The following is in response to your request for additional information related to the presence, use, and concerns for potential impacts to natural resources in the vicinity of the proposed project.

<u>Significant Wildlife Habitat, Potential for Maine Threatened Species</u>
It is noted that a designated Inland Waterfowl and Wading Bird Habitat (IWWH) is located on the inlet on the western end of Pickett Mountain Pond, adjacent to the proposed project site. MDIFW anticipates receiving and reviewing additional project information in the future to ensure that there are no unreasonable, adverse impacts to this resource, which is a Significant Wildlife Habitat (SWH) pursuant to the Natural Resources Protection Act (38 M.R.S., §480-B.10) and SWH Rules (06-096 CMR 335; 09-137 CMR 10). In addition, MDIFW recommends investigation of the IWWH for presence / absence of shrubby cinquefoil, the host plant for the State Threatened Clayton's copper butterfly. Aerial photo interpretation suggests that the IWWH may have conditions that favor this plant and there is an existing population of Clayton's copper butterflies in nearby Crystal. The Clayton's copper butterfly is currently known from only ten sites in Maine, including four in a ten square mile area of eastern Penobscot County in the vicinity of Lee and Springfield, and three sites in northern Piscataquis and eastern Aroostook Counties. Clayton's copper is found only in association with its larval host plant, the shrubby cinquefoil. This uncommon shrub requires limestone soils and has a scattered distribution throughout Maine, however, there are relatively few stands large enough to support viable Clayton's copper populations. Shrubby cinquefoil is intolerant of shade and can only thrive in open areas. It

typically occurs along the edge of calcareous (limestone) wetlands. It can also be found in old fields, but these stands are typically short-lived because of forest succession. All of the currently known occurrences for Clayton's copper are in enriched fens and bogs, and streamside shrublands or meadows. Please contact MDIFW's Reptile, Amphibian, and Invertebrate Biologist, Beth Swartz (beth.swartz@maine.gov, 207- 941-4476), for further guidance. If MDIFW-approved surveys are conducted and indicate that shrubby cinquefoil is not present, or if it can be demonstrated that the Wolfden proposal will not adversely affect shrubby cinquefoil and will avoid Take or Harassment of the Maine Threatened Clayton's copper butterfly, MDIFW anticipates having no concerns for this species.

Bat Habitat Creation, Post-Closure

During the September 3, 2020 site visit, we briefly explored the potential to create habitat for at-risk bat species as part of the post-operational site remediation plan. As I understand it, the main underground portal will consist of an approximately 16-foot x 16-foot opening surrounded by a larger rock face. There will also be both east and west ventilation raises with approximately 10-foot x 10-foot openings. Wolfden intends to fill and add concrete around the openings to prevent water intrusion after closure. We briefly discussed the potential to slope and berm around the openings to discourage water entry and to leave gated openings as possible caves for bat hibernacula. We also discussed the possibility of installing some piles of rock rubble on the closed tailings storage area as potential hibernacula. These discussions were conceptual but, Wolfden expressed interest in further exploring the concept to determine the potential for creating viable habitat conditions while also meeting site closure needs.

Aquatic Resources

The proposed project site is located in the Rockabema Lake subwatershed (HUC 12), in proximity and west of Pickett Mountain Pond, which flows to Grass Pond, then to Mud Lake, and other waters downstream. It is also east and south of the West Branch of the Mattawamkeag River, which flows to Pleasant Lake, Mud Lake, Duck Pond, Rockabema Lake, and other downstream resources along the West Branch of the Mattawamkeag River. The watershed contains other resources including intermittent and perennial streams, associated riparian habitats, and freshwater wetlands, and is considered important for brook trout.

Pickett Mountain Pond has a maximum depth of seven feet, with warm, well oxygenated water. The initial fisheries survey (1958) indicated that the inlet tributary had no potential for brook trout spawning, rearing, or adults, and the outlet had little potential. One trout was captured during the initial survey, none in subsequent samples (1996, 2004). MDIFW Regional Fisheries Biologist Kevin Dunham indicates that Pickett Mountain Pond contains white sucker, fine-scale dace, red-belly dace, fallfish, creek chub, golden shiner, common shiner, red-breasted sunfish, black-nose dace, and pearl dace, and would make a great place to harvest bait fish.

Pleasant Lake, Mud Lake, and Grass Pond are all designated as Heritage Fish Waters. Maine Heritage Fish Waters are native and wild brook trout lakes and ponds which represent unique, valuable, and irreplaceable ecological and angling resources. MDIFW recognizes the unrivaled historic and economic importance of Maine's wild and native brook trout resource and focuses on the conservation and protection of this uniquely valuable resource. MDIFW's primary intent for managing wild brook trout in lakes and ponds is the protection and conservation of these self-sustaining fisheries. The inlets of these lakes originate in the West Branch of the Mattawamkeag River as well as Picket Mountain Pond, positioned west and east of the proposed project site, respectively.

MDIFW regional fisheries staff consider Pleasant Lake and Mud Lake to be some of the best brook trout and landlock salmon waters available in the Region. Kevin Dunham notes, "*Though the initial survey of the lakes in 1953 describes them as being shallow and having warm water throughout, it does go on to say, 'trout and salmon seek the cool water of spring holes…'. Pleasant Lake has an adequate amount of cool-water spring holes to support an excellent trout and salmon fishery. Subsequent fishery surveys, the most recent conducted in June 2019, found extraordinary growth of one-year old wild brook trout averaging 9.1", most of which probably took place in a cooler tributary stream. Additionally, while the lake does not stratify and temperatures remain homogenous throughout the water column, dissolved oxygen levels also remain ideal from top to bottom. Multiple age-classes of brook trout were captured during recent surveys as well, indicating year to year holdover is taking place at Pleasant and Mud Lakes."* Anecdotal evidence suggests moderate angling pressure in these waters and the fisheries resources are protected and managed through specialized regulations. "*The landlocked salmon fishery is not as robust as the trout fishery, but past surveys have sampled multiple age-classes in the 7-17" size ranges. While the lakes are somewhat limiting in cold-water refugia they do support healthy populations of salmonids* (and other fish including smelt) *and it is vitally important to protect the tributaries as well as the lakes since they contain an abundance of spawning and rearing habitat*."

Merry Gallagher, MDIFW's Native Fish Conservation Biologist, provided the attached map of preliminary stream resources, and noted that the orange stream lines *"signify streams that are of medium/moderate value for wild brook trout conservation according to* (MDIFW's) *recent effort to classify streams.*" As noted during our November 5, 2019 meeting, brook trout streams are plentiful throughout this region. During surveys conducted in September 2008, one survey site indicated on the map yielded 16 wild brook trout, while the second site provided two wild brook trout, along with common shiner, black nose dace, creek chub, white sucker, and black nose shiner.

MDIFW requests additional information on the proposed mining operation and associated activities to ensure that it will not result in unreasonable adverse impacts to these valuable resources.

<u>Streams and Wetlands</u>

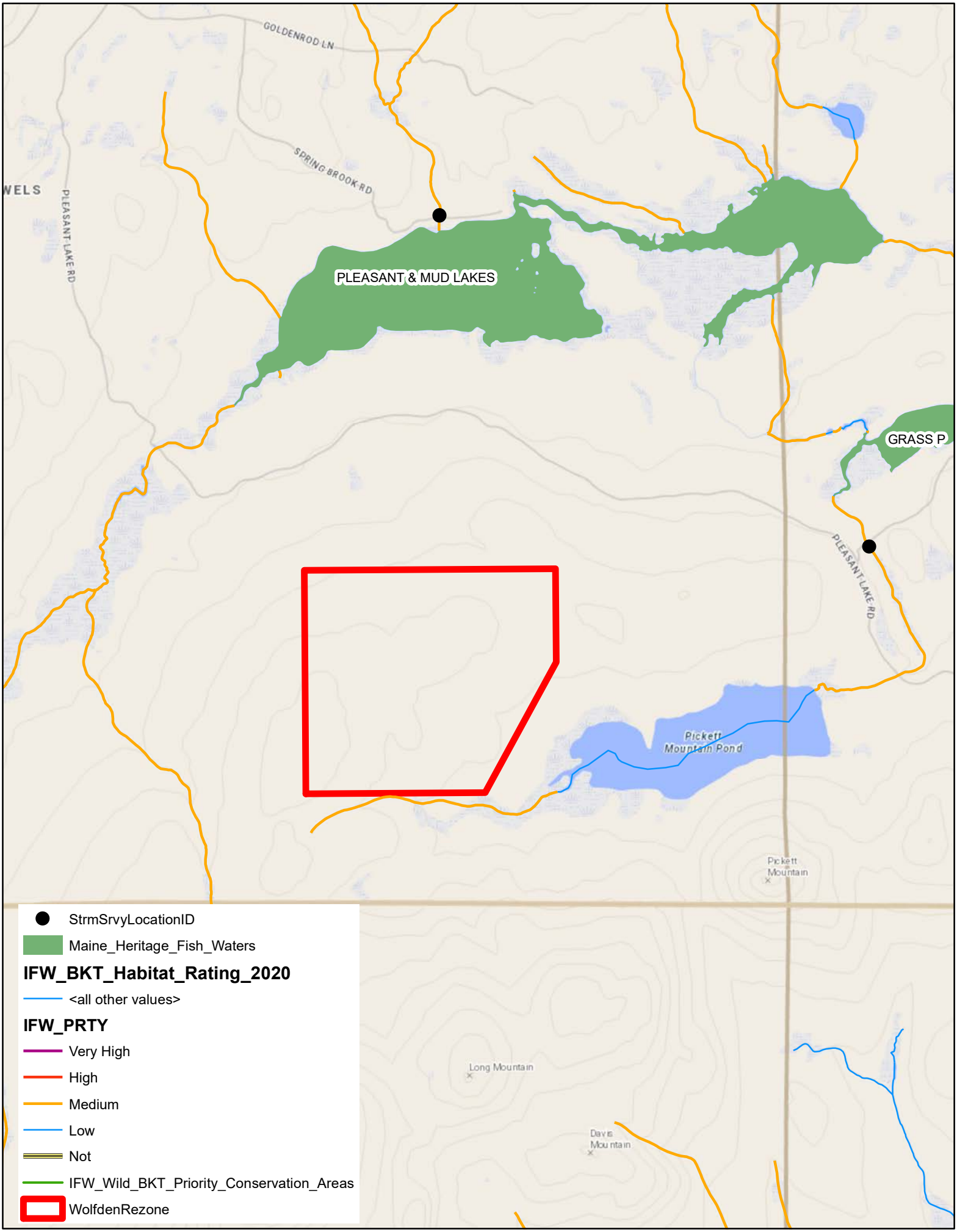
Wolfden's plan during the mining operation includes capturing water from runoff and infiltration on site, treating it to equal to or better than ambient conditions, and discharging treated water into bedrock aquifers. During the September 3, 2020 site visit, MDIFW noted that intermittent and perennial streams and freshwater wetlands in the area are likely supplied by water from shallow features that flow through the overburden and less likely from bedrock sources. MDIFW expressed concern with the potential for these natural resources to be adversely affected by removing water from surficial and shallow horizons and discharging it to bedrock aquifers. The concern is with a potential dewatering and/or change in water chemistry, temperature, etc. of these natural resources that are important habitats by themselves as well as through their contributions to the larger resources described above. Also, additional information is necessary to demonstrate that the proposed mining operation and associated activities will not cause physical interruptions in subsurface flow patterns that supply these resources, even if Wolfden is able to maintain recommended undisturbed, forested buffer distances. During the site visit, we discussed investigating spray irrigation of the treated water to the ground surface during operation, allowing it to infiltrate the overburden and potentially provide flows to surface water resources. However, even if this is determined feasible and beneficial, the question remains of potential long term/permanent effects as this practice will not be in use after operations cease. MDIFW requests additional information to address concerns for potential direct and indirect impacts to surface and groundwater features and flow patterns that contribute to these resources.

We hope that this information is valuable to your process. If you have any questions or concerns, please feel free to contact me at robert.d.stratton@maine.gov or (207) 287-5659.

Thank you,

Robert D. Stratton
Environmental Program Manager
Maine Department of Inland Fisheries & Wildlife

Cc: Jim Connolly, Director, Bureau of Resource Management, MDIFW


GOLDENROD LN
SPRING BROOK RD
WELS
PLEASANT LAKE RD
PLEASANT & MUD LAKES
GRASS P
PLEASANT LAKE RD
Pickett Mountain Pond
Pickett Mountain
Long Mountain
Davis Mountain
StrmSrvyLocationID
Maine_Heritage_Fish_Waters
IFW_BKT_Habitat_Rating_2020
<all other values>
IFW_PRTY
Very High
High
Medium
Low
Not
IFW_Wild_BKT_Priority_Conservation_Areas
WolfdenRezone

JANET T. MILLS
GOVERNOR

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
284 STATE STREET
41 STATE HOUSE STATION
AUGUSTA ME 04333-0041

JUDITH CAMUSO
COMMISSIONER

November 25, 2019

Peter Thompson
Wood PLC
511 Congress Street, Suite 200
Portland, Maine 04101

**RE: Information Request - Wolfden Resources Metallic Mineral Mining Rezoning, T6 R6 WELS**

Dear Peter,

Per your request received November 7, 2019, we have reviewed current Maine Department of Inland Fisheries and Wildlife (MDIFW) information for known locations of important fisheries, wildlife, and critical habitat resources within the vicinity of the proposed Wolfden Resources project noted above. Please note that our comments should be considered preliminary based on the limited information provided at this stage.

As described during our meeting on November 5, 2019, MDIFW concerns relate to Rare, Threatened, and Endangered (RTE) species occurrences and habitats; Significant Wildlife Habitats (SWHs); and Protected Natural Resources (PNRs). MDIFW's preliminary record searches identify known resources, but site surveys are necessary to identify other important resources that have not yet been investigated but may be present in an area. Some species are limited by specific region or habitat type, which quickly eliminates them from being present in some areas or, alternatively, indicates a potential presence in other areas that needs to be followed up by survey. Locating a project in or in proximity to certain habitats can result in adverse impacts to those habitats and the species that utilize them and, in those situations, MDIFW will likely recommend increased siting and design considerations, operational measures, monitoring practices, and/or other efforts in attempt to avoid, minimize, and possibly mitigate for such impacts. It should be noted that there is no comprehensive statewide inventory that includes all RTE species occurrences and habitats or SWHs and that the completeness of maps varies by habitat, location, and previous survey efforts. Resource surveys, project siting, facility design/layout, and operational practices are all very important steps in this process.

**Rare, Threatened, and Endangered Species and Habitats**

The Maine Endangered Species Act (MESA; 12 M.R.S, §12801 et. seq.) identifies all inland fish and wildlife species that are listed as Endangered or Threatened in Maine and provides the Commissioner of MDIFW with the authority to implement MESA. Pursuant to MESA, listed species are afforded special protection against activities that may cause "take" (kill or cause death), "harassment" (create injury or significantly disrupt normal behavior patterns), and other adverse actions. Further, the No Adverse Environmental Effect Standard of the Site Location Law (06-096, CMR 375) provides for the preservation of "*unusually important wildlife habitats, particularly those of rare or endangered species*", as well as protection of "*wildlife and fisheries by maintaining suitable and sufficient habitat*" and avoiding adverse effects on "*wildlife and fisheries lifecycles*". Rare or "Special Concern" species are defined by MDIFW as

species that do not meet the criteria as Endangered or Threatened, but are particularly vulnerable and could easily become Endangered, Threatened, or Extirpated due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors.

**Significant Wildlife Habitats**
Significant Wildlife Habitats are defined and protected pursuant to the Natural Resources Protection Act (38 M.R.S., §480-B.10) and SWH Rules (06-096 CMR 335; 09-137 CMR 10). Subject to the requirements of the Rules, SWHs include habitats for state and federal endangered and threatened animal species; high and moderate value deer wintering areas and travel corridors; seabird nesting islands; critical Atlantic salmon spawning and nursery areas; significant vernal pool habitat; high and moderate value waterfowl and wading bird habitat; and shorebird nesting, feeding, and staging areas.

**Protected Natural Resources**
Protected Natural Resources are defined and protected by the Natural Resources Protection Act (38 M.R.S., §480-B.8). PNRs include coastal sand dune systems, coastal wetlands, significant wildlife habitats, fragile mountain areas, freshwater wetlands, great ponds, rivers, streams, and brooks. Some of these resources are specifically managed by MDIFW based on the presence of, and unique habitat value for, certain species of fish or wildlife.

MDIFW's preliminary review of information on record indicated no known occurrences of Endangered, Threatened, or Special Concern species within the project area. Additionally, our Department has not mapped any Significant Wildlife Habitats that would be directly affected by your project, based on the information provided to date. As we discussed, the following resources require further investigation.

<u>Freshwater wetlands</u>
It was indicated in our meeting that a wandering survey has been performed for preliminary locations of natural resources but, formal wetland delineations have not yet been conducted. Therefore, accurate information is not yet available on the extent of wetlands on site. Freshwater wetlands are valuable natural resources that serve important functions to help preserve, protect, and enhance adjacent aquatic and terrestrial habitats as well as provide important habitats themselves for a myriad of species. MDIFW recommends that freshwater wetlands be definitively located and delineated on site to enable an informed assessment of resources and appropriate agency recommendations.

<u>Intermittent and perennial streams</u>
As noted during our meeting, one of our principal concerns will be to identify the presence of intermittent and perennial streams and stream-related species of concern. Rivers, streams, and brooks within remote project sites are often in or near headwaters, providing high water quality and habitat values for fish and other aquatic and wetland species. MDIFW recommends maintaining 100-foot undisturbed, vegetated buffers from the upland edge of all intermittent and perennial streams and any contiguous wetlands. Maintaining and enhancing buffers along these resources is critical to the protection of water temperatures, water quality, natural inputs of coarse woody debris, and various forms of aquatic life necessary to support conditions required by coldwater fish and other aquatic species. As discussed, there are numerous coldwater fisheries resources and watersheds throughout the area that are of importance. Riparian buffers also provide critical habitat and important travel corridors for a variety of wildlife species.

Stream crossings should be avoided but, if a stream crossing is necessary or an existing crossing needs to be modified, it should be designed to provide full fish passage. Small streams, including intermittent

streams, can provide crucial rearing habitat, cold water for thermal refugia, and abundant food for juvenile salmonids on a seasonal basis. Undersized crossings may inhibit these functions. Generally, MDIFW recommends that all new, modified, and replacement stream crossings be sized to span at least 1.2 times the bank-full width of the stream. In addition, we generally recommend that stream crossings be open bottomed (i.e. natural bottom), although embedded structures which are backfilled with representative streambed material have been shown to be effective in not only providing habitat connectivity for fish but also for other aquatic organisms. MDIFW encourages consideration of these factors during initial design of the project, selection of its position in the landscape, site preparation, and installation of infrastructure, to ensure continuation of these important habitat functions.

Significant Vernal Pools

At our meeting, it was noted that site surveys have not yet been conducted for Significant Vernal Pools. Vernal pools are shallow depressions that usually contain water for only part of the year and typically dry out by mid to late summer. Although vernal pools may only contain water for a relatively short period of time, they serve as unique breeding habitat for certain species of wildlife, including salamanders and frogs. The "significance" of vernal pools and their associated buffers (Critical Terrestrial Habitats) is dependent upon several factors, including the presence or use by state RTE species, or the presence and reproductive success of certain pool-breeding amphibians. It should be noted, a comprehensive statewide inventory for SVPs has not been conducted. And, since vernal pools dry out on a seasonal basis, they can easily be missed during dry conditions. Therefore, we recommend that surveys for vernal pools be conducted within the project site boundary by qualified wetland scientists prior to final project design to determine whether there are SVPs present in the area. These surveys should extend out to 250 feet beyond the anticipated project footprint to determine potential impacts to the critical terrestrial habitats of off-site SVPs, assuming such pools are located on land owned or controlled by the applicant. A MDEP Maine State Vernal Pool Assessment Form should be completed for each pool and submitted to MDIFW for pool status determination as soon as possible and **well before the project application is submitted**. The optimal time for assessing the presence of amphibian indicator species coincides with a 2-3-week spring breeding period that varies slightly with geography, elevation, and weather. Vernal Pools are designated as "Potentially Significant" until such time that a seasonally valid survey is conducted, and the true value determined. Because of the limited survey period, some developers may choose to initially consider their pools as Significant and reassess them in the future under viable conditions. Alternatively, a developer may choose to consider them as Significant Vernal Pools, not formally survey them, and design the proposed project accordingly to avoid (recommended), minimize, and mitigate for any impacts to these resources.

Great blue heron colonies

The great blue heron (*Ardea herodias*) is designated as a Species of Special Concern in Maine due to an 82% decline in the coastal breeding population observed from 1983 to 2018. Since 2009, MDIFW has been monitoring the statewide population to determine if the decline seen along the coast is also occurring statewide. Great blue herons build large stick nests in live, dead, or dying trees 8-100 feet or more above the ground, and may nest in uplands, wetlands, or on islands. Great blue herons nest in groups and generally occupy colonies from April 1$^{st}$ thru August 15$^{th}$ (known as the Sensitive Nesting Period). During this time, the birds can be extremely sensitive to disturbances caused by human intrusion, noise, and predators, and may even abandon a colony as a result.

Not all great blue heron colonies have been mapped in Maine. For this reason, MDIFW recommends that, while conducting further site investigations and resource surveys for project design and review, the applicant survey live trees in upland areas within the proposed project boundaries for great blue heron

nest colonies and level of use. Heron surveys should be conducted between May 1 and June 15 for projects in northern and Downeast Maine. If heron nest colonies are known or discovered, MDIFW recommends that these areas be avoided and that any construction activities (land clearing, road construction, and building of permanent structures) within 600 feet occur outside of the Sensitive Nesting Period. Also, any standing dead wood in the vicinity of heron nests that is not commercial and doesn't pose a safety hazard should be left to provide potential nesting habitat for waterfowl, wading birds, or cavity nesting birds/mammals.

Bat habitat

During our meeting, we discussed the dire statuses of bat populations in Maine. Of the eight species of bats that occur in Maine, three *Myotis* species are afforded special protection under Maine's Endangered Species Act: the little brown bat (*M. lucifugus,* State Endangered); northern long-eared bat (*M. septentrionalis,* State Endangered); and eastern small-footed bat (*M. leibii,* State Threatened). The five remaining bat species are designated as Species of Special Concern: red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), silver-haired bat (*Lasionycteris noctivagans*), tri-colored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*). Different bat species utilize specific types of habitat during critical periods of their life cycles. MDIFW and other parties are conducting surveys throughout the state. As discussed, please document if the project site contains any areas with ½-acre or more of talus fields or rocky outcrops, or cliffs visible from remote imagery.

This consultation review has been conducted specifically for known MDIFW jurisdictional features and should not be interpreted as a comprehensive review for the presence of other regulated features that may occur in this area. Prior to the start of any future site disturbance, we recommend additional consultation with other state agencies including the Maine Natural Areas Program, the Maine Land Use Planning Commission, and the Maine Department of Environmental Protection, in order to avoid unintended disturbances of protected resources. Further, as noted above, our comments should be considered preliminary based on the limited information provided at this stage. MDIFW requests the opportunity for further review of complete natural resource reports, application materials, and plans related to Wolfden Resources' proposed activities related to metallic mineral mining, solar energy, transmission line corridors, etc. and how design and operational measures are intended to protect groundwater, surface waters, and natural resources of concern.

MDIFW hopes that this information is of assistance to you in your project design. If you have any questions or concerns, please feel free to contact me at robert.d.stratton@maine.gov or (207) 287-5659.

Sincerely,

Bob Stratton IFW

Robert D. Stratton
Environmental Program Manager
Maine Department of Inland Fisheries & Wildlife

cc: Ron Little, Jeremy Ouellette (Wolfden Resources)
Stacie Beyer, Billie MacLean, Tim Carr (LUPC)
Kevin Dunham, Mark Caron (MDIFW)

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 26-C: MNAP Correspondence

| | |
|---|---|
| **From:** | St.Hilaire, Lisa |
| **To:** | Pries, Alex |
| **Cc:** | Puryear, Kristen; Jeremy Ouellette; Stewart, Doug (Topsham); Barnes, Brooke |
| **Subject:** | RE: Pickett Mountain Project Information Request |
| **Date:** | Wednesday, June 29, 2022 5:21:57 PM |
| **Attachments:** | stantec_t6r6wels_pickettmtn.pdf |

---

Hi Alex,

MNAP comments attached. Thank you,

**Lisa St. Hilaire** | Information Manager | 207-287-8044
Maine Natural Areas Program | Department of Agriculture, Conservation and Forestry
177 State House Station | Augusta, ME 04333 | she/her why pronouns matter

**From:** Pries, Alex <Alex.Pries@stantec.com>
**Sent:** Friday, June 24, 2022 3:35 PM
**To:** Puryear, Kristen <Kristen.Puryear@maine.gov>
**Cc:** Jeremy Ouellette <jouellette@wolfdenresources.com>; Stewart, Doug (Topsham) <doug.stewart@stantec.com>; Barnes, Brooke <brooke.barnes@stantec.com>
**Subject:** Pickett Mountain Project Information Request

**EXTERNAL: This email originated from outside of the State of Maine Mail System. Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Kristen,
On behalf of Wolfden Mount Chase, LLC, Stantec is providing the attached request to Maine Natural Areas Program for any information on any significant natural resources associated with the proposed Pickett Mountain Project.

As noted in the attached letter, Wolfden Mount Chase, LLC has made significant modifications to the Project area and proposed activities from the request previously made to your agency.

Please let us know if you have any further questions.

Best,
Alex

**Alex Pries**
Environmental Scientist/Project Manager

Direct: 603-263-4663
Mobile: 603-260-7434
Alex.Pries@stantec.com

Stantec
5 Dartmouth Drive Suite 200
Auburn NH 03032-3984

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**STATE OF MAINE**
**DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY**
177 STATE HOUSE STATION
AUGUSTA, MAINE 04333

**JANET T. MILLS**
**GOVERNOR**

**AMANDA E. BEAL**
**COMMISSIONER**

June 29, 2022

Alex Pries
Stantec Consulting
30 Park Drive
Topsham, ME 04086

Via email: alex.pries@stantec.com

Re: Rare and exemplary botanical features in proximity to: #195602317, Pickett Mountain LUPC Zoning Petition, T6 R6 WELS, Maine

Dear Mr. Pries:

I have searched the Maine Natural Areas Program's Biological and Conservation Data System files in response to your request received June 24, 2022 for information on the presence of rare or unique botanical features documented from the vicinity of the project in T6 R6 WELS, Maine. Rare and unique botanical features include the habitat of rare, threatened, or endangered plant species and unique or exemplary natural communities. Our review involves examining maps, manual and computerized records, other sources of information such as scientific articles or published references, and the personal knowledge of staff or cooperating experts.

Our official response covers only botanical features. For authoritative information and official response for zoological features you must make a similar request to the Maine Department of Inland Fisheries and Wildlife, 284 State Street, Augusta, Maine 04333.

According to the information currently in our Biological and Conservation Data System files, there are no rare botanical features documented specifically within the project area. This lack of data may indicate minimal survey efforts rather than confirm the absence of rare botanical features. You may want to have the site inventoried by a qualified field biologist to ensure that no undocumented rare features are inadvertently harmed.

If a field survey of the project area is conducted, please refer to the enclosed supplemental information regarding rare and exemplary botanical features documented to occur in the vicinity of the project site. The list may include information on features that have been known to occur historically in the area as well as recently field-verified information. While historic records have not been documented in several years, they may persist in the area if suitable habitat exists. The enclosed list identifies features with potential to occur in the area, and it should be considered if you choose to conduct field surveys.

This finding is available and appropriate for preparation and review of environmental assessments, but it is not a substitute for on-site surveys. Comprehensive field surveys do not exist for all natural areas in Maine, and in the absence of a specific field investigation, the Maine Natural Areas Program cannot provide a definitive statement on the presence or absence of unusual natural features at this site.

**MOLLY DOCHERTY, DIRECTOR**
MAINE NATURAL AREAS PROGRAM
BLOSSOM LANE, DEERING BUILDING

PHONE: (207) 287-804490
WWW.MAINE.GOV/DACF/MNAP

The Maine Natural Areas Program (MNAP) is continuously working to achieve a more comprehensive database of exemplary natural features in Maine. We would appreciate the contribution of any information obtained should you decide to do field work. MNAP welcomes coordination with individuals or organizations proposing environmental alteration or conducting environmental assessments. If, however, data provided by MNAP are to be published in any form, the Program should be informed at the outset and credited as the source.

The Maine Natural Areas Program has instituted a fee structure of $75.00 an hour to recover the actual cost of processing your request for information. You will receive an invoice for $150.00 for two hours of our services.

Thank you for using MNAP in the environmental review process. Please do not hesitate to contact me if you have further questions about the Natural Areas Program or about rare or unique botanical features on this site.

Sincerely,

*Lisa St. Hilaire*

Lisa St. Hilaire | Information Manager | Maine Natural Areas Program
207-287-8044 | lisa.st.hilaire@maine.gov

## Rare and Exemplary Botanical Features within 4 miles of
## Project: #195602317, Pickett Mountain, LUPC Zoning Petition, T6 R6 WELS, Maine

| Common Name | State Status | State Rank | Global Rank | Date Last Observed | Occurrence Number | Habitat |
|---|---|---|---|---|---|---|
| Montane Spruce - Fir Forest | | | | | | |
| | | S5 | G3G5 | {LAST_OBS_D} | 9 | {HABITAT} |
| Spruce - Pine Woodland | | | | | | |
| | | S4 | G3G5 | {LAST_OBS_D} | 8 | {HABITAT} |

Date Exported: 2022-06-29 16:16

# Conservation Status Ranks

**State and Global Ranks**: This ranking system facilitates a quick assessment of a species' or habitat type's rarity and is the primary tool used to develop conservation, protection, and restoration priorities for individual species and natural habitat types. Each species or habitat is assigned both a state (S) and global (G) rank on a scale of critically imperiled (1) to secure (5). Factors such as range extent, the number of occurrences, intensity of threats, etc., contribute to the assignment of state and global ranks. The definitions for state and global ranks are comparable but applied at different geographic scales; something that is state imperiled may be globally secure.

The information supporting these ranks is developed and maintained by the Maine Natural Areas Program (state ranks) and NatureServe (global ranks).

| Rank | Definition |
|---|---|
| **S1**<br>**G1** | **Critically Imperiled** – At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors. |
| **S2**<br>**G2** | **Imperiled** – At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. |
| **S3**<br>**G3** | **Vulnerable** – At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors. |
| **S4**<br>**G4** | **Apparently Secure** – At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. |
| **S5**<br>**G5** | **Secure** – At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats. |
| **SX**<br>**GX** | **Presumed Extinct** – Not located despite intensive searches and virtually no likelihood of rediscovery. |
| **SH**<br>**GH** | **Possibly Extinct** – Known from only historical occurrences but still some hope of rediscovery. |
| **S#S#**<br>**G#G#** | **Range Rank** – A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. |
| **SU**<br>**GU** | **Unrankable** – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. |
| **GNR**<br>**SNR** | **Unranked** – Global or subnational conservation status not yet assessed. |
| **SNA**<br>**GNA** | **Not Applicable** – A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., non-native species or ecosystems. |
| **Qualifier** | **Definition** |
| **S#?**<br>**G#?** | **Inexact Numeric Rank** – Denotes inexact numeric rank. |
| **Q** | **Questionable taxonomy that may reduce conservation priority** – Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable. The "Q" modifier is only used at a global level. |
| **T#** | **Infraspecific Taxon (trinomial)** – The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. |

**State Status**: Endangered and Threatened are legal status designations authorized by statute. Please refer to MRSA Title 12, §544 and §544-B.

| Status | Definition |
|---|---|
| E | **Endangered** – Any native plant species in danger of extinction throughout all or a significant portion of its range within the State or Federally listed as Endangered. |
| T | **Threatened** – Any native plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range in the State or Federally listed as Threatened. |
| SC | **Special Concern** – A native plant species that is rare in the State, but not rare enough to be considered Threatened or Endangered. |
| PE | **Potentially Extirpated** – A native plant species that has not been documented in the State in over 20 years, or loss of the last known occurrence. |

**Element Occurrence (EO) Ranks**: Quality assessments that designate viability of a population or integrity of habitat. These ranks are based on size, condition, and landscape context. Range ranks (e.g., AB, BC) and uncertainty ranks (e.g., B?) are allowed. The Maine Natural Areas Program tracks all occurrences of rare plants and natural communities/ecosystems (S1-S3) as well as exemplary common natural community types (S4-S5 with EO ranks A/B).

| Rank | Definition |
|---|---|
| A | **Excellent** – Excellent estimated viability/ecological integrity. |
| B | **Good** – Good estimated viability/ecological integrity. |
| C | **Fair** – Fair estimated viability/ecological integrity. |
| D | **Poor** – Poor estimated viability/ecological integrity. |
| E | **Extant** – Verified extant, but viability/ecological integrity not assessed. |
| H | **Historical** – Lack of field information within past 20 years verifying continued existence of the occurrence, but not enough to document extirpation. |
| X | **Extirpated** – Documented loss of population/destruction of habitat. |
| U | **Unrankable** – Occurrence unable to be ranked due to lack of sufficient information (e.g., possible mistaken identification). |
| NR | **Not Ranked** – An occurrence rank has not been assigned. |

Visit the Maine Natural Areas Program website for more information
http://www.maine.gov/dacf/mnap

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 26-D: MDEP Correspondence

**From:** Clark, Michael S
**To:** Pries, Alex
**Subject:** FW: Pickett Mountain Project Information Request
**Date:** Monday, June 27, 2022 8:52:53 AM
**Attachments:** image001.jpg
ltr_mdep_nat_resources_request_20220624.pdf
Wolfden prelim resource surveys 25Nov2019.pdf
6.19_2021_01_20_Wolfden__Request for Review__USFWS.pdf

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Hello Alex,

My files contain a copy of the attached MEDIFW memo from the prior request by your client. I do not know if a Natural Areas Program review was requested at that time. Your request indicates that a recent review request has been made to both of those agencies, so that is your best source for current information. My files also contain the attached letter from the US Fish and Wildlife Service in response to a request for review that was made by Stacie Beyer, Planning Manager, LUPC.

Hope this helps,
Mike

*Michael S. Clark*
*Mining Coordinator*
*Bureau of Land Resources*
*Land Division*
*Maine Department of Environmental Protection*
17 State House Station, Augusta ME 04333-0017
(207)441-1136

---

**From:** Beyer, Jim R <Jim.R.Beyer@maine.gov>
**Sent:** Monday, June 27, 2022 5:55 AM
**To:** Clark, Michael S <Michael.S.Clark@maine.gov>
**Subject:** FW: Pickett Mountain Project Information Request

Mike,
I will let you handle this one.

James R. Beyer
Director, Eastern Maine Regional Office
Maine Department of Environmental Protection
Mobile (207) 446-9026
www.maine.gov/dep

---

**From:** Pries, Alex <Alex.Pries@stantec.com>
**Sent:** Friday, June 24, 2022 3:33 PM

**To:** Beyer, Jim R <Jim.R.Beyer@maine.gov>
**Cc:** Jeremy Ouellette <jouellette@wolfdenresources.com>; Stewart, Doug (Topsham) <doug.stewart@stantec.com>; Barnes, Brooke <brooke.barnes@stantec.com>
**Subject:** Pickett Mountain Project Information Request

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Jim,
On behalf of Wolfden Mount Chase, LLC, Stantec is providing the attached request to MDEP for any information on any significant natural resources associated with the proposed Pickett Mountain Project.

As noted in the attached letter, Wolfden Mount Chase, LLC has made significant modifications to the Project area and proposed activities from the request previously made to your agency.

Please let us know if you have any further questions.

Best,
Alex

**Alex Pries**
Environmental Scientist/Project Manager

Direct: 603-263-4663
Mobile: 603-260-7434
Alex.Pries@stantec.com

Stantec
5 Dartmouth Drive Suite 200
Auburn NH 03032-3984

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# United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Maine Field Office
306 Hatchery Road
East Orland, Maine 04431
Telephone: 207/469-7300 Fax: 207/902-1588

January 20, 2021

Stacie R. Beyer
Planning Manager
Land Use Planning Commission
22 State House Station
Augusta, Maine 04333

**REF: Request for U.S. Fish and Wildlife Service Review, Wolfden Rezoning Petition, ZP 779, T6 R6 WELS**

Dear Ms. Beyer:

This letter responds to the Maine Land Use Planning Commission's (LUPC) December 4, 2020, letter requesting technical assistance from the U.S. Fish and Wildlife Service (Service) on the potential impacts the Wolfden Mt. Chase proposal could have on federally listed fish and wildlife species and their habitat.

Section 7 of the Endangered Species Act (ESA) and associated regulations, requires that if there is a federal nexus for a project, federal agencies, in consultation with the Service, will determine the effects of the construction, operation, and post-operation (e.g., restoration) of the proposed project on federally listed species and designated critical habitat. This is defined as all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. For large or complex projects, the effects to federally listed species and critical habitat are analyzed by a consulting federal agency in a biological evaluation document. Effects to designated critical habitat for listed species would be separate from the analysis of effects to individuals. Critical habitat are specific areas within the geographic area that contain the physical or biological features that are essential to the conservation of endangered and threatened species.

Federal agencies request formal consultation with the Service when projects have adverse effects (i.e., the likely take of listed species). In a formal consultation, the Service prepares a biological opinion document that evaluates these effects and ensures that project does not jeopardize the continued existence of listed species or causes adverse modification of the critical habitat. Measures to avoid and minimize adverse effects to listed species and designated critical habitat would be considered during a section 7 consultation.

Based on the project description and location of the Wolfden Mt. Chase proposal provided by LUPC, this project has the potential to affect Canada lynx (*Lynx canadensis*), northern long-eared bat (*Myotis septentrionalis*), and Atlantic salmon (*Salmo salar*), though this list is subject to change and the potential listed species affected by project activities should be reexamined if there is a federal nexus created.

The Service is uncertain whether this project will have a federal nexus (require a federal permit or uses federal funding) and whether the Maine Field Office will review this project under the ESA. The Army Corps of Engineers or other federal agencies that may have jurisdiction concerning wetlands, mining, and environmental regulations have not contacted our office concerning ESA consultation. Federal agencies nor the Service have fully evaluated the effects of the Wolfden Mt. Chase proposal and the following is a preliminary review by the Service. If the proposal has a federal nexus in the future the federal agencies and the Service will complete a more thorough examination and analysis of the effects to listed species and critical habitat.

## Canada Lynx

Canada lynx occur in T6 R6 and adjacent townships (Figure 1, data from Maine Inland Fisheries and Wildlife [MDIFW]). MDIFW has documented lynx tracks, locations of radio-tagged lynx, and lynx incidentally trapped in T6 R6 and surrounding townships. Forested habitat described in the Wolfden Mt. Chase petition includes recently logged (in the last 7 to 10 years) sapling and pole stage spruce-fir stands, habitat that is considered high quality for snowshoe hare, the primary prey for Canada lynx. Aerial photography of the project location confirms recent logging activity. Based on this information, it is likely that resident lynx have established home ranges that include or are near the proposed Wolfden project. Additionally, the proposed project location overlaps with Canada lynx designated critical habitat. Loss of habitat due to project related activities would typically be considered in relation to the value of the foraging habitat and size of lynx home range (average home range for females is about 6,550 acres, males 14,300 acres).

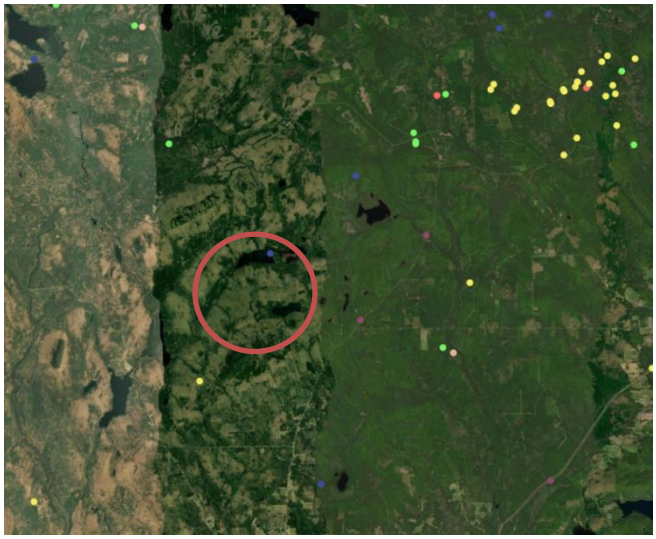

**Figure 1. Canada lynx occurrences, indicated by the colored dots, in the vicinity of the Wolfden Mt. Chase proposal location, indicated by the colored circle.**

## Atlantic Salmon

Although species specific occurrence data is not available for the proposed location of the Wolfden Mt. Chase project, the location does overlap designated critical habitat and several streams in the immediate vicinity have been modeled as suitable Atlantic salmon rearing streams. These streams include the West Branch Mattawamkeag, which flows from south to north along the west side of the project into Pleasant Lake and Mud Pond; the unnamed stream flowing west to east along the south portion of the project into Pickett Mountain Pond; and the unnamed streams flowing south to north along the east portion of the project connecting Pickett Mountain Pond with Grass Pond, Mud Lake, and the West Branch Mattawamkeag.

Without doing site specific surveys and requesting data from the Maine Department of Marine Resources, it is difficult to say with any confidence whether these streams are or aren't occupied by Atlantic salmon. Atlantic salmon have been observed spawning in the East Branch Mattawamkeag, approximately 30 river miles from the project vicinity, though there is a potential barrier to fish passage on the West Branch Mattawamkeag in the town of Island Falls, approximately 15 miles downstream of the project vicinity.

### Northern Long-eared Bat

Although critical habitat has not been designated for the northern long-eared bat, they have the potential to occur throughout Maine, including the proposed location of the project. Though there are no known hibernacula in the immediate vicinity and the closest known hibernacula is approximately 50 miles west of project, northern long-eared bats are known to travel great distances from hibernacula, sometimes hundreds of miles, to summer roosts, a distance that would overlap the proposed project location. In general, the northern long-eared bat is considered a habitat generalist, and has flexible habitat requirements when it comes to the breeding season, which lasts from approximately April through October. The easiest way to minimize impacts to northern long-eared bats in the project vicinity would be to prohibit tree removal activities within these dates.

### Potential Effects to Listed Species

Potential effects to Canada lynx, Atlantic salmon, or northern long-eared bat from the proposed Wolfden Mt. Chase project may include:

- effects to quality and status of habitat
- anticipated management of the acreage, including the areas beyond where ground disturbance will occur, during construction and future operations
- effects of construction activities including noise, lighting, road building, pedestrian and vehicular traffic
- extent of new infrastructure; including road, buildings, gates, fencing, and equipment housing and pads
- vehicle traffic to and from the mine and risk of road mortality
- possible barriers to terrestrial and aquatic movements, such as fencing or inadequate water crossing structures
- risks posed by contaminated materials, settling ponds, ore washing areas, flotation ponds, wastewater storage and open septic systems, various types of equipment used in mining operations, both above and below ground
- sources of human disturbance from mine operations, including lighting, noise, waste
- frequency and duration of above- or below-ground blasting, crushing, use of compressed air and attenuation of this noise
- possible entrapment animals in fenced areas, open slurry ponds, other infrastructure
- possible plans for future expansion
- reclamation plans and effects on listed species and its habitat
- nature of any land conservation offered by the applicant

This list is not exhaustive and other factors may exist that have not been addressed or mentioned in this letter. A more thorough examination of potential impacts to listed species and their habitat from the proposed project would take place between the Service and the consulting federal agencies if a federal nexus is created. Please contact Patrick Dockens at 207/902-1586 or by email at *Patrick_Dockens@fws.gov* if you have any questions.

Sincerely,

Nate Carle,
Acting Project Leader
Maine Field Office
Maine Fish and Wildlife Service Complex

JANET T. MILLS
GOVERNOR

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
284 STATE STREET
41 STATE HOUSE STATION
AUGUSTA ME 04333-0041

JUDITH CAMUSO
COMMISSIONER

November 25, 2019

Peter Thompson
Wood PLC
511 Congress Street, Suite 200
Portland, Maine 04101

**RE: Information Request - Wolfden Resources Metallic Mineral Mining Rezoning, T6 R6 WELS**

Dear Peter,

Per your request received November 7, 2019, we have reviewed current Maine Department of Inland Fisheries and Wildlife (MDIFW) information for known locations of important fisheries, wildlife, and critical habitat resources within the vicinity of the proposed Wolfden Resources project noted above. Please note that our comments should be considered preliminary based on the limited information provided at this stage.

As described during our meeting on November 5, 2019, MDIFW concerns relate to Rare, Threatened, and Endangered (RTE) species occurrences and habitats; Significant Wildlife Habitats (SWHs); and Protected Natural Resources (PNRs). MDIFW's preliminary record searches identify known resources, but site surveys are necessary to identify other important resources that have not yet been investigated but may be present in an area. Some species are limited by specific region or habitat type, which quickly eliminates them from being present in some areas or, alternatively, indicates a potential presence in other areas that needs to be followed up by survey. Locating a project in or in proximity to certain habitats can result in adverse impacts to those habitats and the species that utilize them and, in those situations, MDIFW will likely recommend increased siting and design considerations, operational measures, monitoring practices, and/or other efforts in attempt to avoid, minimize, and possibly mitigate for such impacts. It should be noted that there is no comprehensive statewide inventory that includes all RTE species occurrences and habitats or SWHs and that the completeness of maps varies by habitat, location, and previous survey efforts. Resource surveys, project siting, facility design/layout, and operational practices are all very important steps in this process.

**Rare, Threatened, and Endangered Species and Habitats**

The Maine Endangered Species Act (MESA; 12 M.R.S, §12801 et. seq.) identifies all inland fish and wildlife species that are listed as Endangered or Threatened in Maine and provides the Commissioner of MDIFW with the authority to implement MESA. Pursuant to MESA, listed species are afforded special protection against activities that may cause "take" (kill or cause death), "harassment" (create injury or significantly disrupt normal behavior patterns), and other adverse actions. Further, the No Adverse Environmental Effect Standard of the Site Location Law (06-096, CMR 375) provides for the preservation of "*unusually important wildlife habitats, particularly those of rare or endangered species*", as well as protection of "*wildlife and fisheries by maintaining suitable and sufficient habitat*" and avoiding adverse effects on "*wildlife and fisheries lifecycles*". Rare or "Special Concern" species are defined by MDIFW as

species that do not meet the criteria as Endangered or Threatened, but are particularly vulnerable and could easily become Endangered, Threatened, or Extirpated due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors.

**Significant Wildlife Habitats**
Significant Wildlife Habitats are defined and protected pursuant to the Natural Resources Protection Act (38 M.R.S., §480-B.10) and SWH Rules (06-096 CMR 335; 09-137 CMR 10). Subject to the requirements of the Rules, SWHs include habitats for state and federal endangered and threatened animal species; high and moderate value deer wintering areas and travel corridors; seabird nesting islands; critical Atlantic salmon spawning and nursery areas; significant vernal pool habitat; high and moderate value waterfowl and wading bird habitat; and shorebird nesting, feeding, and staging areas.

**Protected Natural Resources**
Protected Natural Resources are defined and protected by the Natural Resources Protection Act (38 M.R.S., §480-B.8). PNRs include coastal sand dune systems, coastal wetlands, significant wildlife habitats, fragile mountain areas, freshwater wetlands, great ponds, rivers, streams, and brooks. Some of these resources are specifically managed by MDIFW based on the presence of, and unique habitat value for, certain species of fish or wildlife.

MDIFW's preliminary review of information on record indicated no known occurrences of Endangered, Threatened, or Special Concern species within the project area. Additionally, our Department has not mapped any Significant Wildlife Habitats that would be directly affected by your project, based on the information provided to date. As we discussed, the following resources require further investigation.

<u>Freshwater wetlands</u>
It was indicated in our meeting that a wandering survey has been performed for preliminary locations of natural resources but, formal wetland delineations have not yet been conducted. Therefore, accurate information is not yet available on the extent of wetlands on site. Freshwater wetlands are valuable natural resources that serve important functions to help preserve, protect, and enhance adjacent aquatic and terrestrial habitats as well as provide important habitats themselves for a myriad of species. MDIFW recommends that freshwater wetlands be definitively located and delineated on site to enable an informed assessment of resources and appropriate agency recommendations.

<u>Intermittent and perennial streams</u>
As noted during our meeting, one of our principal concerns will be to identify the presence of intermittent and perennial streams and stream-related species of concern. Rivers, streams, and brooks within remote project sites are often in or near headwaters, providing high water quality and habitat values for fish and other aquatic and wetland species. MDIFW recommends maintaining 100-foot undisturbed, vegetated buffers from the upland edge of all intermittent and perennial streams and any contiguous wetlands. Maintaining and enhancing buffers along these resources is critical to the protection of water temperatures, water quality, natural inputs of coarse woody debris, and various forms of aquatic life necessary to support conditions required by coldwater fish and other aquatic species. As discussed, there are numerous coldwater fisheries resources and watersheds throughout the area that are of importance. Riparian buffers also provide critical habitat and important travel corridors for a variety of wildlife species.

Stream crossings should be avoided but, if a stream crossing is necessary or an existing crossing needs to be modified, it should be designed to provide full fish passage. Small streams, including intermittent

streams, can provide crucial rearing habitat, cold water for thermal refugia, and abundant food for juvenile salmonids on a seasonal basis. Undersized crossings may inhibit these functions. Generally, MDIFW recommends that all new, modified, and replacement stream crossings be sized to span at least 1.2 times the bank-full width of the stream. In addition, we generally recommend that stream crossings be open bottomed (i.e. natural bottom), although embedded structures which are backfilled with representative streambed material have been shown to be effective in not only providing habitat connectivity for fish but also for other aquatic organisms. MDIFW encourages consideration of these factors during initial design of the project, selection of its position in the landscape, site preparation, and installation of infrastructure, to ensure continuation of these important habitat functions.

Significant Vernal Pools

At our meeting, it was noted that site surveys have not yet been conducted for Significant Vernal Pools. Vernal pools are shallow depressions that usually contain water for only part of the year and typically dry out by mid to late summer. Although vernal pools may only contain water for a relatively short period of time, they serve as unique breeding habitat for certain species of wildlife, including salamanders and frogs. The "significance" of vernal pools and their associated buffers (Critical Terrestrial Habitats) is dependent upon several factors, including the presence or use by state RTE species, or the presence and reproductive success of certain pool-breeding amphibians. It should be noted, a comprehensive statewide inventory for SVPs has not been conducted. And, since vernal pools dry out on a seasonal basis, they can easily be missed during dry conditions. Therefore, we recommend that surveys for vernal pools be conducted within the project site boundary by qualified wetland scientists prior to final project design to determine whether there are SVPs present in the area. These surveys should extend out to 250 feet beyond the anticipated project footprint to determine potential impacts to the critical terrestrial habitats of off-site SVPs, assuming such pools are located on land owned or controlled by the applicant. A MDEP Maine State Vernal Pool Assessment Form should be completed for each pool and submitted to MDIFW for pool status determination as soon as possible and **well before the project application is submitted**. The optimal time for assessing the presence of amphibian indicator species coincides with a 2-3-week spring breeding period that varies slightly with geography, elevation, and weather. Vernal Pools are designated as "Potentially Significant" until such time that a seasonally valid survey is conducted, and the true value determined. Because of the limited survey period, some developers may choose to initially consider their pools as Significant and reassess them in the future under viable conditions. Alternatively, a developer may choose to consider them as Significant Vernal Pools, not formally survey them, and design the proposed project accordingly to avoid (recommended), minimize, and mitigate for any impacts to these resources.

Great blue heron colonies

The great blue heron (*Ardea herodias*) is designated as a Species of Special Concern in Maine due to an 82% decline in the coastal breeding population observed from 1983 to 2018. Since 2009, MDIFW has been monitoring the statewide population to determine if the decline seen along the coast is also occurring statewide. Great blue herons build large stick nests in live, dead, or dying trees 8-100 feet or more above the ground, and may nest in uplands, wetlands, or on islands. Great blue herons nest in groups and generally occupy colonies from April 1$^{st}$ thru August 15$^{th}$ (known as the Sensitive Nesting Period). During this time, the birds can be extremely sensitive to disturbances caused by human intrusion, noise, and predators, and may even abandon a colony as a result.

Not all great blue heron colonies have been mapped in Maine. For this reason, MDIFW recommends that, while conducting further site investigations and resource surveys for project design and review, the applicant survey live trees in upland areas within the proposed project boundaries for great blue heron

nest colonies and level of use. Heron surveys should be conducted between May 1 and June 15 for projects in northern and Downeast Maine. If heron nest colonies are known or discovered, MDIFW recommends that these areas be avoided and that any construction activities (land clearing, road construction, and building of permanent structures) within 600 feet occur outside of the Sensitive Nesting Period. Also, any standing dead wood in the vicinity of heron nests that is not commercial and doesn't pose a safety hazard should be left to provide potential nesting habitat for waterfowl, wading birds, or cavity nesting birds/mammals.

Bat habitat

During our meeting, we discussed the dire statuses of bat populations in Maine. Of the eight species of bats that occur in Maine, three *Myotis* species are afforded special protection under Maine's Endangered Species Act: the little brown bat (*M. lucifugus,* State Endangered); northern long-eared bat (*M. septentrionalis,* State Endangered); and eastern small-footed bat (*M. leibii,* State Threatened). The five remaining bat species are designated as Species of Special Concern: red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), silver-haired bat (*Lasionycteris noctivagans*), tri-colored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*). Different bat species utilize specific types of habitat during critical periods of their life cycles. MDIFW and other parties are conducting surveys throughout the state. As discussed, please document if the project site contains any areas with ½-acre or more of talus fields or rocky outcrops, or cliffs visible from remote imagery.

This consultation review has been conducted specifically for known MDIFW jurisdictional features and should not be interpreted as a comprehensive review for the presence of other regulated features that may occur in this area. Prior to the start of any future site disturbance, we recommend additional consultation with other state agencies including the Maine Natural Areas Program, the Maine Land Use Planning Commission, and the Maine Department of Environmental Protection, in order to avoid unintended disturbances of protected resources. Further, as noted above, our comments should be considered preliminary based on the limited information provided at this stage. MDIFW requests the opportunity for further review of complete natural resource reports, application materials, and plans related to Wolfden Resources' proposed activities related to metallic mineral mining, solar energy, transmission line corridors, etc. and how design and operational measures are intended to protect groundwater, surface waters, and natural resources of concern.

MDIFW hopes that this information is of assistance to you in your project design. If you have any questions or concerns, please feel free to contact me at robert.d.stratton@maine.gov or (207) 287-5659.

Sincerely,

Bob Stratton IFW

Robert D. Stratton
Environmental Program Manager
Maine Department of Inland Fisheries & Wildlife

cc: Ron Little, Jeremy Ouellette (Wolfden Resources)
Stacie Beyer, Billie MacLean, Tim Carr (LUPC)
Kevin Dunham, Mark Caron (MDIFW)

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

# Attachment 26-E: Botanical Desktop Assessment

Stantec

# Memo

| | | | |
|---|---|---|---|
| To: | Project File | From: | Matt Arsenault<br>Topsham, ME Office |
| File: | 195602317 | Date: | August 31, 2022 |

**Reference: Botanical Desktop Assessment, Proposed Pickett Mountain Mine, T6 R6 WELS, Maine**

Wolfden Mount Chase LLC is proposing to rezone a portion of Pickett Mountain in T6 R6 WELS, Penobscot County, Maine, to support the development of a metallic mineral mine (Project). A preliminary review of the Project site for rare and exemplary botanical resources by the Maine Natural Areas Program (MNAP) did not identify known locations of state-listed plants or occurrences of rare or exemplary natural communities at the site.[1] However, MNAP acknowledged that site-specific data does not exist for all areas of Maine and recommended considerations of conducting surveys to identify if previously undocumented state-listed plants or rare and exemplary natural communities occur at the Project site. To further evaluate the potential of the Project site to support rare and exemplary botanical resources, Stantec conducted a desktop assessment using publicly available and site-specific data. This memo summarizes the desktop assessment.

## METHODS

The desktop assessment was conducted by Matt Arsenault, a professional botanist and Certified Ecologist with over 20 years of botanical field survey experience across the Maine landscape. The following sources of information were reviewed:

- Beginning with Habitat data[2] available for nearby organized towns
- The list of known rare and exemplary features within 4 miles of the Project site as provided in the MNAP June 29, 2022, letter
- Aerial imagery available through publicly available sources (e.g., Google Earth®)
- Topography based on digitized US Geological Survey topographic quadrangle maps
- Bedrock geology maps available spatially through the Maine Geological Survey
- On-site natural resource data collected by Stantec wetland scientists during June 2022 wetland and watercourse delineations, including field notes, photographs, spatial data, and interviews with wetland staff

In addition, the Stantec botanist's personal knowledge of the associated northern Penobscot County and southern Aroostook County botanical resources through past project experience and personal travels was considered in the desktop assessment.

## RESULTS AND DISCUSSION

The June 29, 2022, MNAP letter identified the presence of two exemplary natural communities present within 4 miles of the Project site: a Montane Spruce-Fir Forest and a Spruce-Pine Woodland. No rare plants were identified within 4 miles of the Project area.

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[1] June 29, 2022, letter from Lisa St. Hilaire (MNAP) to Alex Pries (Stantec), RE: Rare and exemplary botanical feature in proximity to #195602317, Pickett Mountain LUPC Zoning Petition, T6 R6 WELS, Maine.
[2] Beginning with Habitat data available from the Maine Department of Inland Fisheries and Wildlife (https://www.maine.gov/ifw/fish-wildlife/wildlife/beginning-with-habitat/maps/index.html); accessed August 29, 2022.

Reference: Botanical Desktop Assessment, Proposed Pickett Mountain Mine, T6 R6 WELS, Maine

Publicly available Beginning with Habitat data is limited to organized towns and no Beginning with Habitat data was available for the closest organized towns to the Project area (i.e., Mount Chase, Merrill, and Hersey)

Based on a review of the available on-site natural resource data, topography, and aerial imagery review, the Project site contains common and non-exemplary forested habitat conditions. Aerial imagery and on-site observations indicate that the majority of the forest communities have been harvested for timber and aerial imagery indicates that timber harvests have occurred as recently as 15 years ago (ca. 2007) with additional timber harvests within the past 5 years. The upland forested communities are best characterized as a low-elevation beech-birch-maple forest, a matrix-level and widespread hardwood forest of the northern Maine landscape. This forest community has inclusions of softwood species in portions of the Project site. Based on on-site data, tree species in the upland forested areas include American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), gray birch (*Betula populifolia*), paper birch (*Betula papyrifera*), eastern white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), and balsam fir (*Abies balsamea*). The upland sapling and shrub layer is dominated by regenerating species present in the forest canopy, as well as striped maple (*Acer pensylcanicum*) and hobblebush (*Viburnum lantanoides*). The upland herbaceous layer is dominated by evergreen wood fern (*Dryopteris intermedia*), Canada mayflower (*Maianthemum canadense*), and Canadian bunchberry (*Cornus canadensis*).

The overall topography of the Project site is convex with small concave drainage features. Several of these concave topographic areas support wetland communities. The larger wetlands present within the Project site are forested and dominated by common matrix-level species such as balsam fir, red maple, yellow birch (*Betula alleghaniensis*) trees and a variety of common understory species such as sensitive fern (*Onoclea sensibilis*), manna grasses (*Glyceria* spp.), and interrupted fern (*Osmunda claytoniana*). Hydrology of the on-site wetlands ranges from seasonally inundated to seasonally saturated. Several portions of the on-site wetlands have similarly been affected from past timber harvests including tree removal and forestry equipment trails.

Based on the available information, the on-site wetland and upland natural communities are not considered rare or exemplary.

Within the northern Penobscot County and southern Aroostook County landscape, many of the known rare plant occurrences in low elevation habitats are associated with habitats that have circumneutral pH or otherwise enriched habitat conditions. These habitats are often first recognized by the presence of “indicator” plant species; that is, species that are more typically associated with enriched habitat. Common indicator species for enriched upland forested habitats in this region of Maine include basswood (*Tilia americana*), northern maidenhair fern (*Adiantum pedatum*), blue cohosh (*Caulophyllum thalictroides*), plantain-leaved sedge (*Carex plantaginea*), baneberry (*Actaea* spp.), sweet-cicely (*Osmorhiza* spp.), and American spikenard (*Aralia racemosa*), amongst others. For circumneutral wetland habitats, common indicator species are often found in the presence of northern white cedar (*Thuja occidentalis*) and include chestnut sedge (*Carex castanea*), sheathed sedge (*Carex vagainta*), alder-leaved buckthorn (*Rhamnus alnifolia*), and yellow lady’s-slipper (*Cypripedium parviflorum*), amongst others. No potential indicator species were recorded during field surveys based on a review of collected field data or identified during a review of representative photographs taken of the existing ecological conditions of the Project site.

Reference: Botanical Desktop Assessment, Proposed Pickett Mountain Mine, T6 R6 WELS, Maine

In summary, the Project site has low to very low potential to support rare or exemplary botanical resources based on a review of the available ecological site data, landscape position, and past disturbances from forestry operations. As such, botanical field surveys are not recommended at this time.

**Stantec Consulting Services Inc.**

**Matt Arsenault** Ecologist, PWS, NHCWS
Botanist
Phone: 207 798 2135
matt.arsenault@stantec.com

**LAND USE PLANNING COMMISSION APPLICATION FOR ZONE CHANGE**
**PICKETT MOUNTAIN METALLIC MINE, T6 R6 WELS, PENOBSCOT COUNTY**

January 2023

## Attachment 26-F: MDIFW Memorandum on Clayton's Copper Butterfly

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
LAND USE PLANNING COMMISSION
22 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0022

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

JUDY C. EAST
EXECUTIVE DIRECTOR

# Memorandum

**To:** File, ZP 779, Wolfden Rezoning Petition

**From:** Stacie R. Beyer, Planning Manager

**Date:** October 7, 2020

**Re:** Site Visit, Pickett Mountain Pond

---

In a review memo dated September 11, 2020, the Maine Department of Inland Fisheries and Wildlife (MDIFW) identified potential habitat for the State Threatened Clayton's copper butterfly (*Lycaena dorcas claytoni*) located on the inlet, western end, of Picket Mountain Pond. MDIFW recommended investigation of the habitat for the presence or absence of the shrubby cinquefoil (*Potentilla fruticose)*, host plant for the butterfly. On October 1, 2020, Kristen Puryear, Maine Natural Areas Program; Beth Swartz, MDIFW; Stacie Beyer, LUPC; and Jeremy Ouellette, Wolfden Mt. Chase, LLC. visited the area of interest at the inlet end of Pickett Mountain Pond. No shrubby cinquefoil plants were found, and it was determined that the habitat was not suitable for shrubby cinquefoil based on the plant community present at the site.

Photos taken by Stacie Beyer, LUPC, October 1, 2020

Attachment: E-mail message from MDIF&W, dated October 2, 2020

| | |
|---|---|
| **From:** | Swartz, Beth |
| **To:** | Stratton, Robert D |
| **Cc:** | Puryear, Kristen; Beyer, Stacie R; deMaynadier, Phillip; Caron, Mark |
| **Subject:** | Pickett Mountain Pond site visit |
| **Date:** | Friday, October 02, 2020 1:57:43 PM |

---

Bob,

Yesterday, Stacie Beyer (DEP), Kristin Puryear (MNAP), and I - along with Jeremy Ouellette from Wolfden - conducted a site visit to the wetland located along the western shore and inlet stream to Pickett Mountain Pond (T6 R6 WELS) to check for presence of shrubby cinquefoil, the host plant for Clayton's copper (state-threatened). We did not find any and determined the wetland was not appropriate habitat for either the host plant or the butterfly, therefore any concerns for Clayton's copper related to the re-zoning proposal are no longer relevant.

beth

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

**Beth I. Swartz, Wildlife Biologist**
Reptile, Amphibian and Invertebrate Group
Maine Department of Inland Fisheries and Wildlife
650 State Street, Bangor, ME 04401
(207) 941-4476

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*Correspondence to and from this office is considered a public record and may be subject to a request under the Maine Freedom of Access Act.*
*Information that you wish to keep confidential should not be included in email correspondence.*
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

# EXHIBIT 27.0 ADDITIONAL INFORMATION (CUSTOM ZONING)

This Exhibit describes the proposed land use activities and structures proposed for the Project. These structures are shown on **Exhibit 2, Figure 2-1**, with the preliminary size and square footage of those structures set forth in **Exhibit 7, Table 7-1.** The layout in **Exhibit 2, Figure 2-1** and the size of the proposed structures in **Exhibit 7, Table 7-1** are based on preliminary survey and design data; the location and the size of the various project features will be refined as part of the final mine design and comprehensive permitting process required by MDEP Chapter 200 mining regulations.

To maintain the appropriate flexibility to adjust the location and size of project structures and ensure that the final design reflects the most comprehensive and detailed environmental and engineering data, the Project has identified three development area envelopes in the D-PD subdistrict within which various Project features may be located. As shown on **Figure 27-1**, the three areas include the following:

- Major Mine Development, shown in blue, and that includes features such as office space, laydown area(s), waste rock storage pads, ore storage pads, and water management facilities.
- Solar Field Array, shown in green, and that includes the proposed solar array and potential WRAs; and
- Mine Development Phase II, shown in beige, and that includes the ore storage pads, mine headframe and hoist, organics storage, and temporary explosives storage.

These development areas avoid sensitive resources such as wetlands and streams. The activities and structures identified on **Figure 27-1** may be relocated within their applicable building envelope and may be increased in size consistent with the thresholds identified below. In addition, there are certain activities/structures that may be located outside of the three development area envelopes, such as roads, and utility/stormwater infrastructure that are not shown on **Exhibit 2, Figure 2-1** or **Figure 27-1**, but that may be allowed pursuant to the permitting requirements set forth below.

## 27.1 PROPOSED LAND USE ACTIVITIES AND STRUCTURES ALLOWED IN THE PROJECT (D-PD) PLANNED DEVELOPMENT SUBDISTRICT

Land uses anticipated for the Project D-PD subdistrict include:

- Uses and activities allowed without a permit;
- Uses allowed without a permit subject to standards; and
- Uses and activities allowed with a permit.

The Project D-PD subdistrict is an undivided, custom subdistrict. The following uses are allowed within the subdistrict.

### 27.1.1 Uses Allowed Without a Permit

The following uses are allowed without a permit within the Project D-PD subdistrict:

1. Baseline and ongoing environmental monitoring and data collection necessary to finalize design and establish and maintain compliance with applicable State regulatory requirements, including the requirements of the MDEP's Chapter 200 rules, 06-096 CMR 200
2. Emergency operations conducted for the public health, safety or general welfare, such as emergency medical response, firefighting, law enforcement, resource protection, and search and rescue operations
3. Forest management activities, except for timber harvesting
4. Hunting and trapping of wild animals provided such hunting and trapping is conducted at least 500 feet away from existing development including legally existing structures
5. Primitive recreation
6. Motorized vehicular traffic on roads and trails, parking areas, storage pads, and similar legally existing impervious surfaces, including snowmobile and all-terrain vehicle traffic on-and off roads
7. Normal maintenance and repair
8. The repair and maintenance of vehicles, vehicular equipment, and other mobile equipment provided that repair and maintenance activities occur in on-site maintenance buildings to the fullest extent practicable
9. The normal maintenance and repair of legally existing structures (including underground or subsurface structures), parking areas, lined pads; and other impervious surfaces, provided that adequate measures are taken to control runoff and minimize soil erosion
10. Security operations conducted for public health, safety, or general welfare, and the protection of onsite personnel, equipment, and assets including but not limited to installation or relocation of security fencing
11. Shipping and receiving of materials
12. Surveying and other resource analysis
13. Wildlife and fishery management practices

### 27.1.2 Uses Allowed Without a Permit Subject to Standards

The following uses are allowed without a permit within the Project D-PD subdistrict subject to applicable standards.

1. Accessory structures: New structures accessory to any structures and uses reflected on the Conceptual Site Plan (**Exhibit 2, Figure 2-1**) provided that:
    a. The total square footage of the footprint of all new accessory structures built within a two-year period is not more than 2,000 square feet; and
    b. All other requirements and standards of the Commission's Chapter 10, Section 10.27(P) are met
2. Security checkpoint buildings (note the footprint of a checkpoint building is excluded from the limit of accessory structures in (1)(a) above)
3. Filling and grading associated with uses allowed in the D-PD subdistrict
4. Tree removal associated with uses allowed in the D-PD subdistrict

5. Mineral exploration activities: Level A and B mineral exploration activities, including associated temporary access ways, in conformance with the requirements for such activities in Chapter 13 of the Commission's rules
6. Road projects: Level A road projects in conformance with the requirements for such activities in Chapter 10, Section 10.27(D) of the Commission's rules
7. Service drops to legally existing structures
8. Signs in conformance with the requirements for such activities in Chapter 10, Section 10.27(J) of the Commission's rules
9. Water crossings of minor flowing waters in conformance with Chapter 10, Section 10.27(D) of the Commission's rules.

### 27.1.3 Uses Requiring a Permit

The following uses, and related accessory structures, are allowed within the Pickett Mountain D-PD subdistrict upon issuance of a permit by LUPC or DEP, as applicable.

1. Pre- and Post-Treatment Water Storage Ponds, provided that:
   a. The ponds are in conformance with the Conceptual Site Plan and located within the applicable development area envelope (**Figure 27-1**); and
   b. A footprint expansion is allowed if the cumulative surface area expansion of ponds within an applicable development area envelope does not increase by more than 20%. The location of the ponds may be adjusted as long as the ponds are located within the applicable development area envelope as shown on the Conceptual Site Plan.
2. WRSs and WRAs (e.g., drip or spray irrigation, snowmaking, infiltration galleries), provided that:
   a. The footprint of the WRAs may be modified from that shown on the Conceptual Site Plan; and
   b. The location and final design will be as approved by MDEP under Chapter 200, within the rezone area
3. Lined Storage Pads for Ore and Waste Rock provided that:
   a. The pads are in conformance with the Conceptual Site Plan; and
   b. The footprint of the pads may be reduced in size from what is depicted on the Conceptual Site Plan. The footprint of the pads may be increased if the cumulative expansion of lined storage pads within an applicable development area envelope does not increase by more than 20%. The location of lined storage pads may be adjusted as long as the lined storage pads are located within the applicable development area envelope as shown on the Conceptual Site Plan.
4. Driveways and parking areas
5. Land management roads
6. Metallic mineral mining activities: In addition to those activities more specifically identified in this section, metallic mineral mining activities, as defined in Chapter 10, Section 10.02 and that are in conformance with the Conceptual Site Plan including, but not limited to, subsurface facilities, mine access portal(s), operations support infrastructure, and assets necessary to conduct metallic mineral mining activities and not specifically listed on the

Conceptual Site Plan as well as above-ground structures and uses identified on and in conformance with the Conceptual Site Plan

7. Mineral exploration activities: Access ways for Level A and B mineral exploration activities, and Level A and B mineral exploration activities which are not in conformance with the standards of Chapter 13 of the Commission's rules
8. On-site storage and disposal of land clearing and construction debris in compliance with applicable MDEP rules
9. Stormwater management structures including but not limited to piping conveying water to Water Storage Ponds, ditching and pumping structures
10. Subsurface Wastewater Disposal System
11. Snow storage area(s)
12. Organic storage area(s)
13. Relocations: Relocations of metallic mineral mining activities and structures that are shown on the Conceptual Site Plan provided that the relocated activity or structure:
    a. Will be located within an applicable development area envelope as shown on the Conceptual Site Plan
    b. Does not involve the addition of a land use not previously approved in the Development Plan
14. Road projects: Level A road projects not in conformance with the requirements for such activities in Chapter 10, Section 10.27(D) of the Commission's rules; and Level B and C road projects
15. Signs that are not in conformance with the standards of Chapter 10, Section 10.27(J) of the Commission's rules
16. Solar energy systems, including grid-scale solar energy generation facilities and associated structures, located within the applicable development area envelope
17. Structures: All structures depicted on the Conceptual Site Plan are allowed uses. New structures that are not shown on the Conceptual Site Plan or expansion of structures shown on the Conceptual Site Plan (but excluding water storage ponds, WRSs and lined storage pads, which are addressed separately above) provided that the new or expanded structures:
    a. Will be located within one of the three development areas as shown on the Conceptual Site Plan;
    b. Will not exceed a total maximum structure footprint increase of 20,000 square feet for the lifetime of the subdistrict based on the total structure footprint shown on the Conceptual Site Plan and reflected in Exhibit 7 (as noted, this limit does not apply to the Water Storage Ponds, Water Recharge Systems or Lined Storage Pads, which may be expanded in accordance with Sections 2 and 3 above);
    c. Will not exceed 120 feet in height as measured from the lowest adjacent grade; and
    d. Will not involve the addition of a land use not previously approved in the Development Plan
18. Timber harvesting
19. Utility facilities, excluding service drops
20. Ventilation shafts, raises, surface shafts and attendant headworks that are needed to facilitate deeper ore removal and provide for safe working conditions in the mine

21. All uses and structures identified on the Conceptual Site Plan to the extent not otherwise expressly authorized as allowed with or without a permit

### 27.1.4 Prohibited Uses

All uses not expressly allowed, with or without a permit, shall be prohibited in the Project D-PD subdistrict.

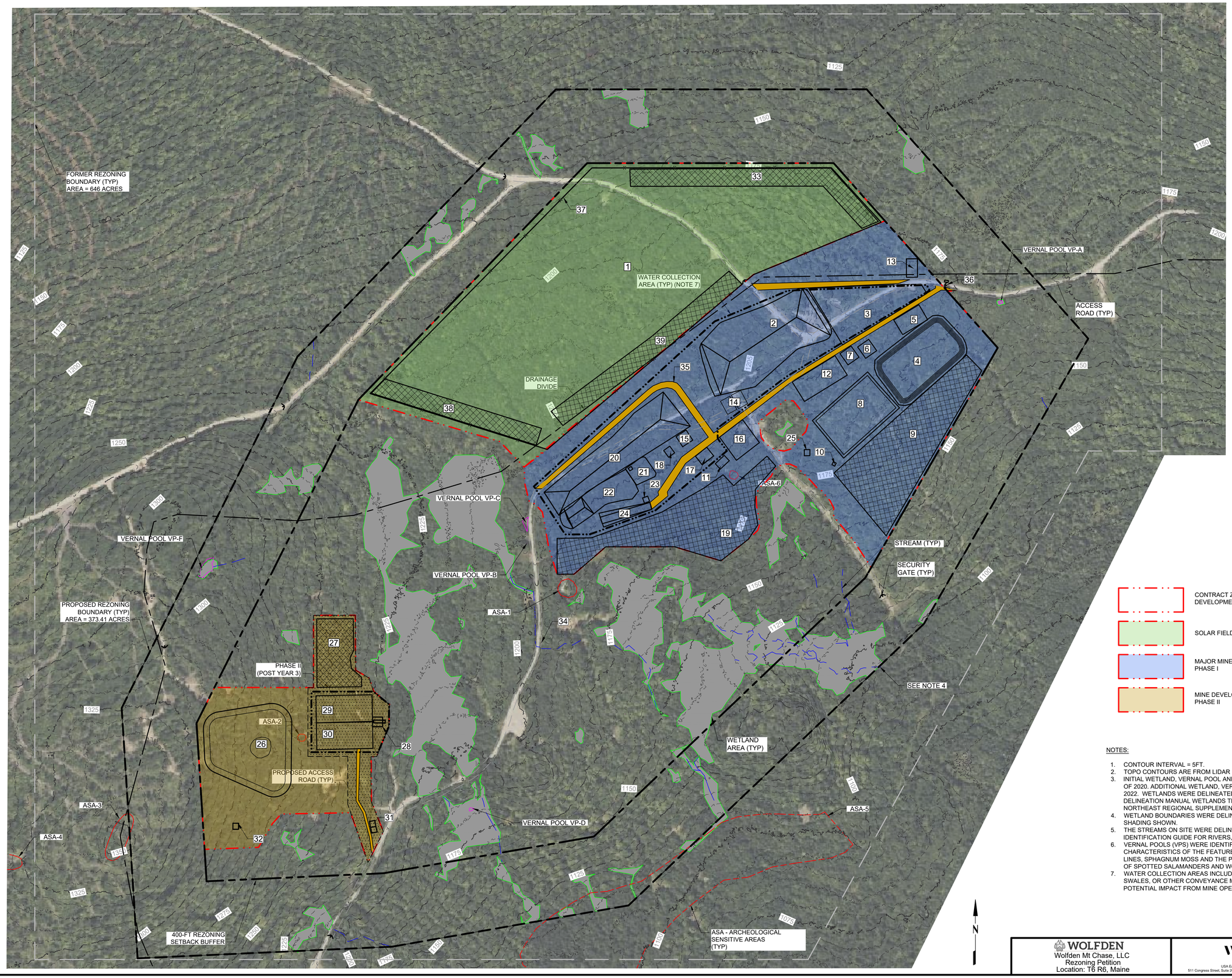
# EXHIBIT 27 FIGURES

Figure 27-1: Contract Zone Development Areas

# EXHIBIT 27 ATTACHMENTS

Not Applicable

## Figure 27-1: Contract Zone Development Areas




| Map ID | Facility Name |
|---|---|
| 1 | SOLAR FACILITY (APPROX.) |
| 2 | LOW GRADE ORE STORAGE PAD |
| 3 | SNOW STORAGE |
| 4 | PRE-TREATMENT WATER STORAGE POND |
| 5 | WATER TREATMENT FACILITY |
| 6 | ELECTRICAL SUBSTATION |
| 7 | BACK-UP POWER GENERATION (DIESEL OR PROPANE) |
| 8 | POST-TREATMENT WATER STORAGE POND |
| 9 | WATER RECHARGE AREA #1 |
| 10 | FIRE WATER PUMPHOUSE |
| 11 | SANITARY SUBSURFACE DISPOSAL SYSTEM |
| 12 | PARKING FACILITY |
| 13 | WAREHOUSE |
| 14 | OFFICES AND MINE RESCUE FACILITY |
| 15 | CORE SHACK AND STORAGE |
| 16 | LAYDOWN (EQUIPMENT/SUPPLIES STORAGE) |
| 17 | MAINTENANCE SHOP |
| 18 | EQUIPMENT FUELING STATION |
| 19 | WATER RECHARGE AREA #2 |
| 20 | WASTE ROCK STORAGE PAD #1 |
| 21 | BACKFILL PLANT |
| 22 | ORE (MILL FEED) STORAGE PAD #1 |
| 23 | BLAST SHACK |
| 24 | MINE ACCESS (PORTAL) |
| 25 | EAST VENTILATION RAISE |
| 26 | ORGANICS STORAGE |
| 27 | WATER RECHARGE AREA #3 |
| 28 | HEADFRAME AND HOIST |
| 29 | ORE (MILL FEED) STORAGE PAD #2 |
| 30 | WASTE ROCK STORAGE PAD #2 |
| 31 | TEMPORARY EXPLOSIVES STORAGE |
| 32 | WEST VENTILATION RAISE |
| 33 | WATER RECHARGE AREA #4 |
| 34 | EXISTING SITE ROAD |
| 35 | PROPOSED SITE ROAD |
| 36 | SECURITY GUARD HOUSE/GATE |
| 37 | SECURITY FENCING |
| 38 | WATER RECHARGE AREA #5 |
| 39 | WATER RECHARGE AREA #6 |

LEGEND:

- 1125 — MAJOR CONTOURS
- 1124 — MINOR CONTOURS
- STREAM
- EXISTING SITE ROAD
- VERNAL POOLS
- ASA - ARCHEOLOGICAL SENSITIVE AREAS
- 400-FEET REZONING
- SETBACK BUFFER
- PROPOSED REZONING
- OLD REZONING
- WETLAND
- 14 — FACILITIES DESIGN
- WATER COLLECTION AREA
- WATER RECHARGE AREA
- PHASE II (POST YEAR)
- PROPOSED SITE ROAD
- DRAINAGE DIVIDE
- SECURITY FENCE
- SECURITY GATE
- CONTRACT ZONE DEVELOPMENT AREAS
- SOLAR FIELD AREA
- MAJOR MINE DEVELOPMENT PHASE I
- MINE DEVELOPMENT PHASE II

NOTES:

1. CONTOUR INTERVAL = 5FT.
2. TOPO CONTOURS ARE FROM LIDAR DATA (NOAA.GOV), MARCH 2021.
3. INITIAL WETLAND, VERNAL POOL AND STREAM DATA WERE COLLECTED BY WOOD AND OTHERS IN MAY-JUNE OF 2020. ADDITIONAL WETLAND, VERNAL POOL, AND STREAM DATA WERE COLLECTED BY STANTEC-JUNE OF 2022. WETLANDS WERE DELINEATED IN ACCORDANCE WITH THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL WETLANDS TECHNICAL REPORT (Y-87-1) AND THE NORTH CENTRAL AND THE NORTHEAST REGIONAL SUPPLEMENT (ERDC/EL TR-12-1).
4. WETLAND BOUNDARIES WERE DELINEATED WITHIN THE REZONE BOUNDARY AND MAY CONTINUE BEYOND THE SHADING SHOWN.
5. THE STREAMS ON SITE WERE DELINEATED FOLLOWING THE NATURAL RESOURCE PROTECTION ACT (NRPA) IDENTIFICATION GUIDE FOR RIVERS, STREAMS, AND BROOKS (DANIELSON, 2018).
6. VERNAL POOLS (VPS) WERE IDENTIFIED ON MAY 17, MAY 18, AND MAY 28, 2020, BASED ON PHYSICAL CHARACTERISTICS OF THE FEATURES INCLUDING ISOLATED WATER BODIES, WATER STAINED LEAVES, WATER LINES, SPHAGNUM MOSS AND THE PRESENCE OF HYDROPHYTIC VEGETATION AS WELL AS EGG MASS COUNTS OF SPOTTED SALAMANDERS AND WOOD FROGS WERE COLLECTED.
7. WATER COLLECTION AREAS INCLUDE AREAS WHERE STORMWATER RUNOFF IS COLLECTED BY BERMS, SWALES, OR OTHER CONVEYANCE METHODS AND TREATED AT THE WATER TREATMENT FACILITY DUE TO POTENTIAL IMPACT FROM MINE OPERATIONS.

0 125 250 500
SCALE IN FEET

Prepared/Date: WJW 10/03/22
Checked/Date: MAP 10/03/22

WOLFDEN
Wolfden Mt Chase, LLC
Rezoning Petition
Location: T6 R6, Maine

wsp
USA Earth & Environment
511 Congress Street, Suite 200, Portland, ME: 04112 (207) 775 - 5401

CONTRACT ZONE DEVELOPMENT AREAS
Project 3617-22-7547
Figure 27-1

C:\Users\william.whitten\OneDrive - Wood PLC\Projects\Wolfden Resources\9.0 Drawings\Design 2022\Sheets\Figure 27-1_Contract Zone Development Areas.dwg Mon, 03 Oct 2022 - 1:06pm william.whitten