REPORT

17-1017 S

May 11, 2018

Explorations and Geotechnical Engineering Services

Proposed Converter Station
Merrill Road
Lewiston, Maine

Prepared For:
Central Maine Power Company
Attention: Gerry Mirabile
83 Edison Drive
Augusta, Maine 04336

Prepared By:
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S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

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Attention: Gerry Mirabile
83 Edison Drive
Augusta, Maine 04336

Subject: Explorations and Geotechnical Engineering Services
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Lewiston, Maine

Dear Gerry:

In accordance with our revised Proposal, dated March 13, 2018, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop preliminary geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included test boring explorations, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The proposed converter substation is located north of Merrill Road and east of the existing CMP transmission right-of-way in Lewiston, Maine. Based on an updated plan you provided dated March 6, 2018, we understand the proposed substation yard will be on the order of 580 by 510 feet in plan dimensions. An underdrain soil filter is planned on the westerly side of the substation pad area. We understand the proposed access road to the proposed substation is not yet defined and therefore not included in this scope of services.

Based on topographic information shown on the plan, the wooded site slopes upward from about elevation 305 feet on the westerly side, near the existing transmission right-of-way, to about elevation 380 feet on the easterly side. Bedrock outcrops are visible in the upper elevations of the site (easterly side) and ponded surface water was observed in the lower elevations (northwest corner) during drilling.

Based on information shown on the site plan, we understand the general substation yard finish grade will slope downward from southeast to northwest from about elevation 332 to 318 feet. Considering the existing grades at the site, we anticipate cuts approaching 60 feet will be needed to achieve finish grade on the easterly side of the site and fills approaching 20 feet will be needed on the westerly side of the site.

Based on limited information available at this time, we anticipate the converter substation may include new equipment structures (transformers, dead-end, switchgear and steel pole structures) on the westerly side and a one story heated building on the easterly side. We understand the one-story, steel-framed building may be about 200 by 400 feet in plan dimensions with spread footing foundations and a slab-on-grade. We understand spread footings, surficial concrete pads, foundations with rock anchors and drilled shafts are being considered for equipment foundation support.

Since the substation is still in concept design, proposed equipment locations and structural loads and the actual size, location and structural loads for the proposed building are not known. Existing grades and possible proposed grading are shown on the “Exploration Location Plan” attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Twelve test borings (B-1 through B-12) and three auger probes (P-1 through P-3) were made at the site during the period of March 15 through 20, 2018 by S. W. Cole Explorations, LLC. The exploration locations were selected by Power Engineers and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using mapping grade GPS equipment. The approximate exploration locations are shown on the

"Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the "Exploration Location Plan".

Open standpipe piezometers were installed in borings B-3, B-7, B-9 and B-12. Piezometer installation details are noted on the logs.

2.2 Field Testing

The test borings were drilled using a combination of hollow-stem auger, solid-stem auger, cased wash-boring and NQ rock coring techniques. The soils were sampled at 2 to 5 foot intervals using a split-spoon sampler and Standard Penetration Testing (SPT) methods. SPT blow count results are shown on the logs.

Rock coring was performed at borings B-4, B-5, B-7, B-9, B-10 and B-12 using a NQ2 (2 in) core bit. At several borings, a roller bit was used to penetrate the surface of the bedrock prior to coring. At B-3, the borehole was advanced into the bedrock using solid stem auger and a roller cone in order to install a groundwater piezometer (no rock core).

2.3 Laboratory Testing

2.3.1 Geotechnical Laboratory Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Moisture content test results as well as Laboratory rock core compression and unit weight test results and RQD (Rock Quality Designation) are noted on the logs.

2.3.2 Laboratory Soil Chemistry Testing

Three soil samples were submitted to Alpha Analytical Services for determination of pH (EPA 9045), water soluble chloride content (EPA 9251) and water soluble sulfate content (EPA 9038) testing. Results of the pH and water soluble chloride and sulfate testing as well as sulfate exposure classifications in accordance with ACI 318 Table 4.3.1 are included in Appendix D and summarized in the following table:

Exploration/ sample interval	pH Testing	Chloride Testing (ppm)	Sulfate Testing (ppm)	Sulfate Exposure Classification (ACI 318 Table 4.3.1)
B-1 /0'-2'	5.4	< PQL	< PQL	Negligible
B-9/0'-2'	5.6	< PQL	< PQL	Negligible
B-11/5'-7'	6.8	< PQL	< PQL	Negligible

Notes

ppm = parts per million
PQL – Procedure Quantification Limit
PQL for chloride testing is 20 ppm
PQL for sulfate testing is 10 ppm

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

In general, the explorations encountered a soils profile consisting of forest duff and topsoil overlying medium dense silty sand overlying dense brown gravelly silty sand (glacial till) overlying bedrock. The topsoil and forest duff varies from about 6 inches to 1.5 feet in thickness at the explorations. Where encountered, the silty sand varies in thickness from about 1 to 5.5 feet and the glacial till varies in thickness from about 1 to 17 feet. Approximate depths to and elevations of apparent bedrock are shown below.

APPARENT DEPTH/ELEVATION TO BEDROCK			
Exploration/Approx. Surface Elevation (ft)	**Approximate Depth/Elevation (ft)**	**Exploration/Approx. Surface Elevation (ft)**	**Approximate Depth/Elevation (ft)**
B-1/308	1.0/307	B-9/339	4.0/335
B-2/304	11.2/293	B-10/333	6.2/327
B-3/309	2.5/306.5	B-11/304	5.0/299
B-4/314	4.8/309	B-12/378	3.5/374.5
B-5/311	7.2/304	P-1/330	4.5/325.5
B-6/318	4.0/314	P-2/345	7.5/337.5
B-7/311	4.9/306	P-3/334	5.0/329
B-8/310	18.0/292		

Photos of the recovered bedrock core are attached in Appendix C.

Not all the strata were encountered at each exploration; refer to the attached logs in Appendix C for more detailed subsurface information.

3.2 Groundwater

The soils encountered at the test borings were moist to wet from the ground surface. Saturated soils were encountered at depths varying from about 3 to 10 feet. Groundwater likely becomes perched on the relatively impervious silty clay and glacial till encountered at the test borings. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

Open standpipe piezometers were installed in borings B-3, B-7, B-9 and B-12. Depths to groundwater were measured in the piezometers approximately 24 hours after installing the piezometers. Depths were measured to be about 4.5, 7.4, 9.8 and 23.6 (shallow)/29.6 (deep) feet below the existing ground surface at these borings, respectively, on March 21, 2018.

<u>3.3 General Geological Conditions</u>

The Maine Geological Survey (MGS) *Surficial Geologic Map of Maine* (Thompson and Borns, 1985) and the *Surficial Geologic Map of The Lake Auburn East Quadrangle, Maine*[1] (Hildreth, 2008) indicate the surficial geology of the project area consists of glacial till overlying bedrock with limited bedrock exposures possible in the general area. Field observations and boring overburden observations are generally consistent with the mapped surficial geology.

The MGS *Bedrock Geologic Map of Maine*[2] (Osberg et al., 1985) and detailed mapping of the *Bedrock Geology of the Lewiston 15-minute Quadrangle* (Hussey, 1983) interpret the bedrock in the project area to be Sangerville Formation. The Sangerville Formation in the area is described as impure marble, coarsely crystalized calc-silicate rocks, and feldspathic biotite- and hornblende biotite granofels, with garnet rich laminations.

The observed bedrock core, is generally consistent with the published geologic mapping with some variations. A calcareous feldspar pegmatite was observed in the upper 3 feet of the core recovered from boring B-5 (see boring logs and core photographs). This bedrock is generally described as a feldspar mica schist (equivalent to the feldspathic biotite granofels) with calc-silicates and variable amounts of garnet. Limited weathering and alternation associated with foliation plane fractures was observed, which may be related to seasonal variations in the water table.

[1] Thompson, W. B. and Borns, H. B., eds., 1985, Surficial Geologic Map of Maine, Maine Geological Survey.

[2] Osberg, P. H., Hussey, A. M. , and Boone, G. M., eds., 1985, Bedrock Geologic Map of Maine, Maine Geological Survey.

3.4 Seismic – Faulting Data

Seismic activity can impact a site from two sources: ground rupture directly beneath a site or shaking produced at the site from nearby seismic activity. There are no documented cases of ground rupture that can be definitely attributed to seismic activity in New England since the departure of glaciers more than 10,000 years ago. Bedrock deformation has occurred over geologic time; however, evidence of faulting in the project area is limited to inferred faults associated with bedrock contacts and observed healed angular bedrock conglomerate and wacke observed in the core.

3.5 Seismic and Frost Conditions

According to IBC 2015/ASCE 7, we interpret the following Seismic Site Classes using the N-Value method for soil:

- Seismic Site Class B (for foundations on sound bedrock)
- Seismic Site Class D (for foundations on compacted fill or native soil)

We recommend the following seismic design parameters for the 2,500-year design earthquake:

RECOMMENDED SEISMIC DESIGN PARAMETERS (2,500-year Design Earthquake)		
Peak Ground Acceleration (PGA)	0.2-second Spectral Acceleration (S_s)	1-second Spectral Acceleration (S_1)
0.186	0.249g	0.081g

NOTE: Seismic design parameters from USGS accessed April 12, 2018. (https://earthquake.usgs.gov/designmaps/us/application.php)

Liquefiable soils typically consist of loose, fine sands and non-plastic silts below the groundwater table. Based on the subsurface findings, it is our opinion the soils at the site are not susceptible to liquefaction during a seismic event and therefore the risk of lateral spread and seismic induced settlement are negligible.

The 100-year Air Freezing Index for the Lewiston area is about 1,500 Fahrenheit degree days, which corresponds to a frost penetration depth on the order of 5.0 feet. We recommend foundations exposed to freezing be covered with at least 5.0 feet of soil for frost protection.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings and limited project information at this time, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations include:

- Bedrock Excavations: Based on the subsurface conditions encountered, bedrock excavation and removal will require blasting to achieve the necessary grades.

- Converter Station Pad: All topsoil and organics, soils with roots and disturbed or soft yielding soil must be completely removed from beneath the proposed converter station pad and embankment areas. We recommend bedrock removal extend to at least 6 feet below finish substation pad grade to allow for a 6 foot thick zone of material including the pad surface (designed by others) overlying compacted Gravel Borrow to allow for excavations for shallow foundations and subgrade utilities.

- Building Structure: Spread footing foundations and a slab-on-grade floors bearing on properly prepared subgrades appear suitable for the proposed building. Building footings should bear on at least 12-inches of compacted Structural Fill overlying properly prepared subgrades. On-grade floor slabs for heated structures should bear on at least 12-inches of compacted Structural Fill overlying properly prepared subgrades.

- Equipment Foundations: We recommend substation equipment foundations bear on at least 12-inches of compacted Structural Fill overlying properly prepared subgrades. Foundations for heavier, moment carrying structures such as A-frames are anticipated to bear directly on sound, intact bedrock with rock anchors, or on caissons drilled into the bedrock to resist overturning.

- Groundwater: The depth to groundwater upon completion of the test borings ranged from within a few feet of the ground surface to depths of about 24 and 30 feet below ground surface at boring B-12. Excavations will require dewatering techniques to help control below excavation grades.

- Reuse of Native Soils: In our opinion, the native, non-organic granular soils can likely be reused as mass embankment fill provided they are at a moisture content that is workable for achieving the required compaction. The silty sand and glacial till soils are moisture sensitive and may be difficult to compact when above the optimum moisture content. Therefore, we do not recommend reuse of the native soils during wet and freezing conditions.

- Reuse of Blasted Bedrock: The bedrock is a resource for production of embankment fills. The blasted bedrock can be used as Rock Borrow for embankment fill provided the rock is crushed to be well graded and the maximum particle size is less than 24 inches and used in appropriate size lifts. The Rock Borrow should be mixed with sands and gravel and finer rock particles to reduce the percentage of voids in the fill. However, where there is a lack of overburden soil available or the blasting and/or crushing operations create a poorly graded borrow; the use of a choke stone material will be required to fill voids in each lift of Rock Borrow.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

Based on the subsurface findings, the thickness of forest duff and/or topsoil varies across the site. The contractor should anticipate areas where roots and soils containing organics will extend several feet into the underlying soil. The methods used by the contractor for removal and the moisture condition of the site will affect the volume of material removal required. Topsoil and organics may be stockpiled and screened for reuse as a new topsoil layer in landscape areas. Suitability of the topsoil re-use from a nutrient and fertility standpoint should be evaluated by soil testing prior to its use.

4.3 Excavation and Dewatering

4.3.1 Excavations

Excavations will generally encounter forest duff and topsoil, silty sand and glacial till with varying amounts of gravel and cobbles and boulders, and shallow bedrock. Care must be exercised during construction to reduce potential for disturbance of subgrades. We recommend a smooth-edged bucket be utilized to excavate to final subgrade in soils. Construction traffic on wet soil subgrades should be avoided when practical. Should subgrades become disturbed, the subgrade should be over-excavated to expose suitable soil and replaced with compacted Structural Fill or Crushed Stone or moisture conditioned glacial till and be compacted.

Based on the proposed grading and subsurface conditions, mass bedrock removal will be needed to achieve the required subgrade elevations. Bedrock removal will require drilling and blasting techniques. We recommend a licensed blasting contractor be engaged for bedrock removal. Pre-blast surveys should be completed on surrounding structures (including interior walls), water supply wells and infrastructure prior to commencing blasting activities. Vibrations due to blasting should be monitored during construction. In addition, we recommend the subcontractor submit a detailed drilling and blasting plan with qualifications and references prior to blasting.

Temporary, unsupported soil excavations should be sloped back to 1½(H):1(V) or flatter. In all cases, excavations must be properly shored and/or sloped according to OSHA regulations to prevent sloughing and caving of the sidewalls during construction.

4.3.2 Dewatering

Sumping and pumping and the use of temporary diversion ditching dewatering techniques should be adequate to control water inflow into excavations above the groundwater table. When working at the bottom of slopes, temporary dewatering may require construction of uphill cut-off swales and/or diversion berms to direct up gradient runoff water away from the work areas.

4.4 Embankment Construction

The proposed topographic information shown on the plan indicates fill soil slopes for the substation pad will generally be constructed with slopes of 2(H):1(V) or flatter and cut slopes will generally be constructed with slopes of 3(H):1(V) or flatter.

4.4.1 General

Fill slopes should be constructed as level benches, which are overbuilt to facilitate compaction. The final slope face should be constructed by cutting back into the compacted core prior to placing slope surface materials. Fill slopes constructed on existing terrain steeper than 3(H):1(V) should be keyed into the existing ground surface with continuous level benches. Fill slopes constructed on existing slopes flatter than 3(H):1(V) do not need continuous benching. We recommend a 10 foot wide bench be cut into the native soil beneath the toe of fill slopes for installation of a 1-foot thick drainage blanket consisting of Gravel Borrow or Rock Borrow mixed with Gravel Borrow prior to placing fill soils. The drainage blanket should be day-lighted for gravity drainage.

4.4.2 Fill Slopes 2(H):1(V) or Flatter

Fill materials needed to construct fill slopes at inclinations of 2(H):1(V) or flatter should consist of compacted Common Borrow, Gravel Borrow, Rock Borrow, Structural Fill or Crushed Stone. Exposed soil slopes will be susceptible to surface erosion, slumping and sloughing, particularly during heavy rain and freeze/thaw events. Exposed slopes should be surfaced with an erosion control blanket and loam and seed, as soon as practicable, to create a vegetated mat. In areas of concentrated surface water, we recommend 8-inch minus rip-rap overlying a geotextile fabric be used in lieu of the erosion blanket and loam and seed. We recommend cross-slope stone lined drainage channels underlain with geotextile fabric be construct into the slope face when the height of the embankment exceeds 25 feet.

4.4.3 Fill Slopes Steeper than 2(H):1(V)

Although not anticipated, if proposed fill slopes are to be constructed steeper than 2(H):1(V), we recommend these slopes be constructed with compacted Rock Borrow and the slopes be covered with at least 2 feet of compacted rip-rap. Further, lateral edges where the riprap terminates along the face of the embankment should be similarly keyed into the ground surface. We recommend slopes be constructed no steeper than 1.5(H):1(V). Rock Borrow should be controlled to maximum particle size of 24 inches and be placed in horizontal lifts not exceeding 36 inches. The Rock Borrow should be placed in a manner to reduce the potential for voids by infilling with sand and smaller stone particles to create a well graded matrix. If overburden soil is not available for infilling or the blasting operations create a course poorly graded rock borrow lacking fines, a choke stone layer will be required for between each lift and at the top of subgrade prior to placing aggregate road base products.

4.4.4 Cut Slopes

We recommend proposed soil cut slopes less than 15 feet in height consider slope inclinations of 2H: 1V or flatter since the depth to bedrock is unknown between exploration locations and areas of outcropping bedrock. The final slope inclination will be dependent on the subsurface conditions (soil or bedrock) encountered during construction. Cut slopes in bedrock should be sloped back to a stable condition, which will depend on rock fracturing, as well as bedrock formation strike and dip in relation to slope orientation. We recommend a representative from S.W.COLE observe the bedrock slopes during construction.

We recommend a rock fall catchment zone be provided at the toe of rock cut slopes following FHWA Publication No. HI-99-007 *Rock Slopes Reference Manual.*

In addition, we recommend a minimum 5-foot wide bench be constructed at the interface of the overburden soil and bedrock to reduce potential erosion that could cause soils, cobbles and boulders to wash down the rock slopes potentially clogging drainage swales and causing blocking hazards.

In areas of concentrated surface water or locations of groundwater seeps, rip-rap should be used in lieu of the erosion blanket and loam/seed. We recommend cross-slope stone lined drainage channels underlain with geotextile fabric be constructed into the slope when the height of the slope exceeds 25 feet.

4.4.5 Slope Surface Erosion Control

Unprotected and un-established slopes, regardless of inclination, will be susceptible to surface erosion, slumping, and sloughing especially during precipitations and freeze/thaw events. Topsoil and seed should be installed, as soon as practicable, to create a vegetated mat over the entire surface of the slope. We recommend the use of UV resistant synthetic erosion control mesh to reinforce the surface soils until the vegetated mat is established, particularly if constructed during the winter or spring seasons.

Groundwater seepage and up gradient runoff water can make establishment of soil slopes difficult. In areas where surface water may be concentrated and discharged over the slope or where groundwater seepage is encountered, we recommend locally covering the slope with a small diameter rip-rap placed over a layer of crushed gravel and a woven filter fabric.

4.5 Foundations

4.5.1 Building and Equipment Foundations:

We recommend the proposed building foundation be supported on spread footings founded on at least 12-inches of compacted Structural Fill overlying compacted Gravel Borrow. Non-moment-carrying equipment foundations and lightweight equipment pads should also be founded on at least 12-inches of compacted Structural Fill overlying compacted Gravel Borrow. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

GEOTECHNICAL PARAMETERS	
Net Allowable Soil Bearing Pressure	4.0 ksf or less (Spread Footings on compacted structural fill or crushed stone)
Net Allowable Bedrock Bearing Pressure	15.0 ksf (Clean, sound, intact bedrock)
Design Frost Depth of Footings on Soil	5.0 ft
Design Frost Depth for Footings Pinned to Sound Bedrock Depth	2.5 ft
Base Friction Factor	0.35 (Mass concrete to structural fill)
Base Friction Factor	0.45 (Mass concrete to bedrock)
Passive Lateral Earth Pressure Coeff. (K_p)	3.0 (compacted Structural Fill)
Equivalent Fluid Pressure (Passive)	390 psf/ft (compacted Structural Fill)
Active Lateral Earth Pressure Coeff. (K_a)	0.3 (compacted Structural Fill)
Equivalent Fluid Pressure (Active)	40 psf/ft (compacted Structural Fill)
At-Rest Lateral Earth Pressure Coeff. (K_o)	0.5 (compacted Structural Fill)
Equivalent Fluid Pressure (At-Rest)	60 psf/ft (compacted Structural Fill)
Total Unit Weight of Backfill (γ_t)	125 pcf (compacted Structural Fill)
Internal Friction Angle (Φ)	32 degrees (compacted Structural Fill)

Spread footings should be at least 24 inches in width regardless of the bearing pressure. We recommend spread footings be placed on at least 12 inches of compacted Structural Fill (if overlying soil or soil fills) or at least 12 inches of Crushed Stone (if overlying fractured bedrock or blasted bedrock fills). We understand all foundations and concrete structures and slabs will be designed by others.

4.5.2 Rock Anchorage:

Based on the subsurface conditions and guidance from the Post-Tensioning Institute's manual entitled *Recommendations for Prestressed Rock and Soil Anchors* (PTI, 2004), we recommend the use of prestressed, Class I corrosion protection, grouted rock anchors be considered by the foundation designer where rock anchors are being considered. We recommend the following geotechnical parameters for preliminary rock anchor design consideration:

GEOTECHNICAL PARAMETERS FOR ROCK ANCHORS	
RQD of Rock Core (see boring logs)	55 to 100%
Average Dry Unit Weight of Bedrock Samples	174 pcf
Rock Cone Pull-Out Angle (from vertical)	45 degrees (from vertical)
Average Ultimate Grout to Bedrock Bond Strength	120 psi

Based on guidance from the *Recommendations for Prestressed Rock and Soil Anchors* (PTI, 2004) we recommend a minimum unbonded length (free-stressing length) of 15 feet for strand tendons and 10 feet for bar tendons be considered for preliminary rock anchor design. The bonded length will depend upon the uplift load and the diameter of the drill hole. Rock anchor spacing should be at least 1.2 times the free-stressing length; closer spacing will reduce allowable anchor loads. Rock anchors installed in groups should be designed with consideration of pullout resistance from overlapping failure surfaces extending from the midpoint of the anchor bond zone to the bedrock surface.

The drill-hole for each rock anchor should be cleaned of any drilling fines and tightness tested to determine the need for pre-grouting. Rock anchors should be installed, tested and locked-off according to the design engineer's recommendations.

4.5.3 A-Frame Foundations

We anticipate A-Frames structures will be constructed within the westerly portion of the proposed substation. Structural loads and locations are not known at this time. Based on the findings at the explorations, depths to bedrock may vary from about 6 feet (below Gravel Borrow zone) to nearly 20 feet in the low area in the northwesterly corner.

Depending upon anticipated structural loads, we anticipate A-Frame foundations will need to derive support from the underlying bedrock. Depending upon the location, the foundation could consist of a large mat foundation bearing on and pinned to bedrock, or if rock is deep, drilled shafts socketed into bedrock. If glacial till is encountered we recommend excavation continue to bedrock, creating a level bearing area. Soft, weathered bedrock, if encountered, should be removed. An allowable bearing contact pressure of 15.0 ksf or less should be considered for sound, intact bedrock. A concrete leveling mat may be placed on the prepared bedrock surface prior to placing reinforced concrete foundations. The foundation should be anchored to the bedrock if the rock is sloping steeper than 3(H):1(V) and/or if structural loads dictate. The leveling mat should extend beyond the footing edges or piers by at least 24 inches. Rock anchors extending into bedrock will likely be needed to provide uplift capacity for the A-Frame pier foundations. We understand the A-frame foundation type and design will be by the project structural engineer.

4.6 Foundation Drainage

We recommend an underdrain system be installed on the outside edge of the perimeter building footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe bedded in Crushed Stone and covered with non-woven geotextile fabric. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building and other structures for positive surface water drainage. General underdrain details are illustrated on the “Foundation Detail Sketch” attached in Appendix B.

4.7 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 120 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill placed over properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer’s recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.8 Backfill and Compaction

Although a wide range of soil materials can be used successfully, it has been our experience granular soils with good drainage characteristics provide significant advantages particularly in wet conditions and during cold weather construction. We have made recommendation for materials that are suitable for support of the proposed construction from a geotechnical standpoint. However, the electrical designer must develop parameters for fill to achieve proper compatibility between the fill soils and the electrical grounding system. In general, we recommend the following materials for consideration:

Common Borrow: Fill to raise grades in landscape areas.

Gravel Borrow: Fill to raise grades in the converter station pad area above bedrock and/or rock borrow should be sand or silty sand meeting the requirements of 2014 MaineDOT Standard Specification 703.20 Gravel Borrow. We anticipate Gravel Borrow will be made from on-site crushing of blasted bedrock and blending with existing granular fills or imported sand.

Rock Borrow: Blasted bedrock used for embankment fill should be hard durable blasted bedrock broken to various sizes of 2 feet minus to form a compact embankment with minimum of voids and meeting the requirements of 2014 MaineDOT Standard Specification 703.21. Finer crushed bedrock and granular soil shall be worked into the surface of each lift as necessary to fill voids.

Structural Fill: Backfill below footings, equipment pads, adjacent to foundations and material below floor slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 6

Crushed Stone: Crushed Stone, used for underdrain aggregate should be washed ¾-inch crushed stone meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type C.

Reuse of Site Soils: The non-organic on-site granular soils are likely suitable to blend and process with crushed blasted bedrock to create Gravel Borrow provided they are at a compactable moisture content at the time of blending and reuse. The native till may be suitable for reuse as Common Borrow, such as pond berms, provided it is at a compactable moisture content at the time of reuse.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds. Rock Borrow should be placed in lifts approximating the largest material diameter size and be thoroughly tracked in with heavy tracked equipment with several passes in several directions.

4.9 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork and foundation recommendations have been properly interpreted and implemented.

A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces and installation of rock anchors, as well as to provide testing and IBC Special Inspection services for soils, concrete, steel, spray-applied fireproofing, structural masonry and asphalt construction materials.

4.11 Recommendations for Additional Study

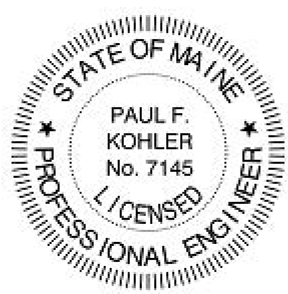
We understand design of the converter station pad, building and equipment is still in development. Additional explorations, laboratory soils and rock testing and evaluation is likely needed as design of the converter station progresses. Field soil resistivity and an acidic rock evaluation should also be made.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the design and construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.



Paul F. Kohler, P.E.
Senior Geotechnical Engineer

PFK:mas/tjb

APPENDIX A

Limitations

This report has been prepared for the exclusive use of Central Maine Power Company for specific application to the proposed Converter Station on Merrill Road in Lewiston, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

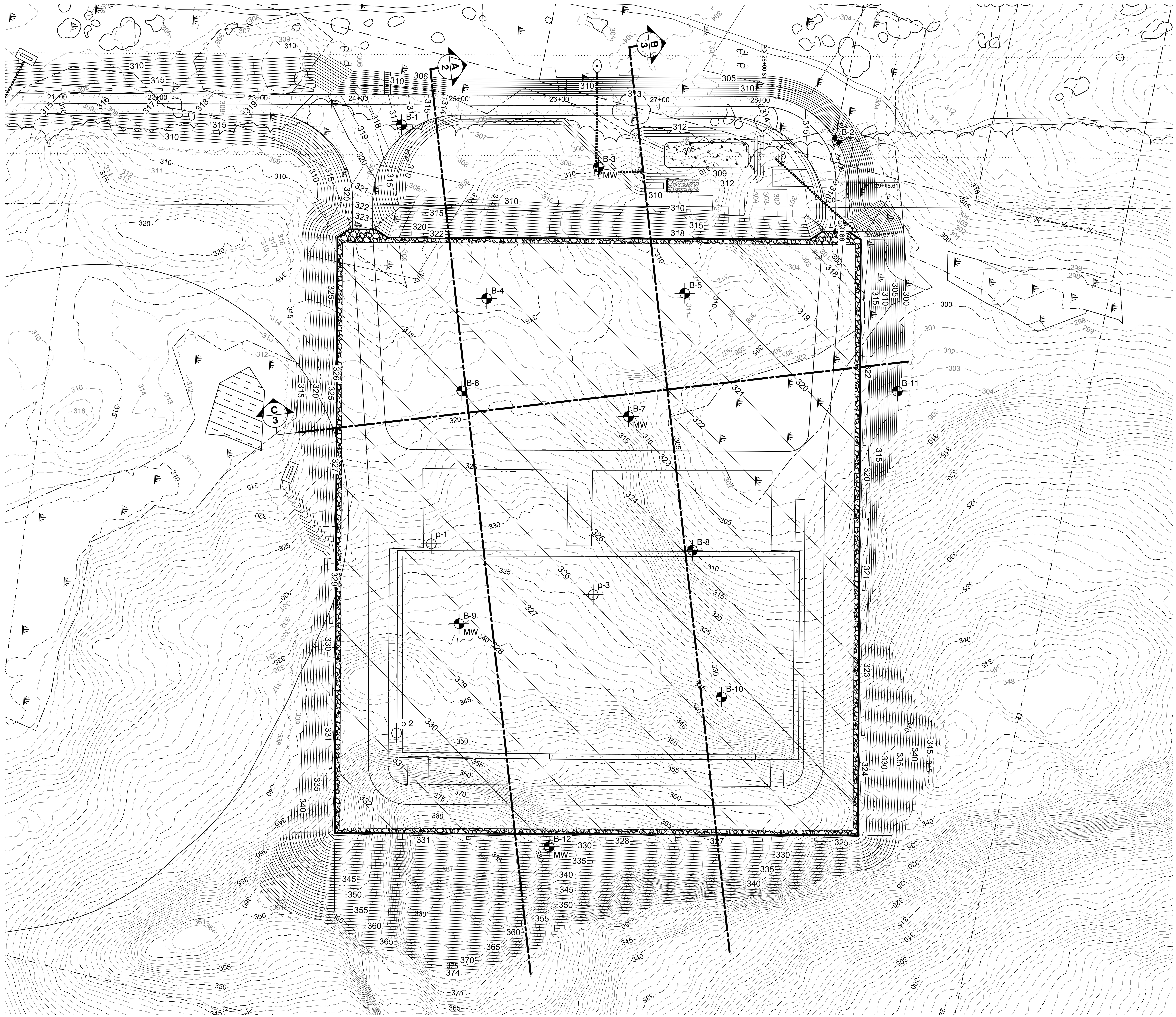
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



LEGEND:

APPROXIMATE BORING LOCATION

APPROXIMATE BORING LOCATION WITH MONITORING WELL (MW)

APPROXIMATE PROBE LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=100' SCALE PLAN OF THE SITE ENTITLED "BORING LOCATION PLAN, PROPOSED CONDITIONS," PREPARED BY POWER ENGINEERS, INC., DATED 4/10/2018.
2. THE BORINGS WERE LOCATED IN THE FIELD BY GPS SURVEY BY S. W. COLE ENGINEERING, INC. USING A MAPPING GRADE TRIMBLE GPS RECEIVER.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 50 100 Feet

NO.	DATE	DESCRIPTION	BY
1	05/11/2018	FINAL REPORT SUBMISSION	CEM
0	05/02/2018	PRELIMINARY FINDINGS SUBMISSION	CEM

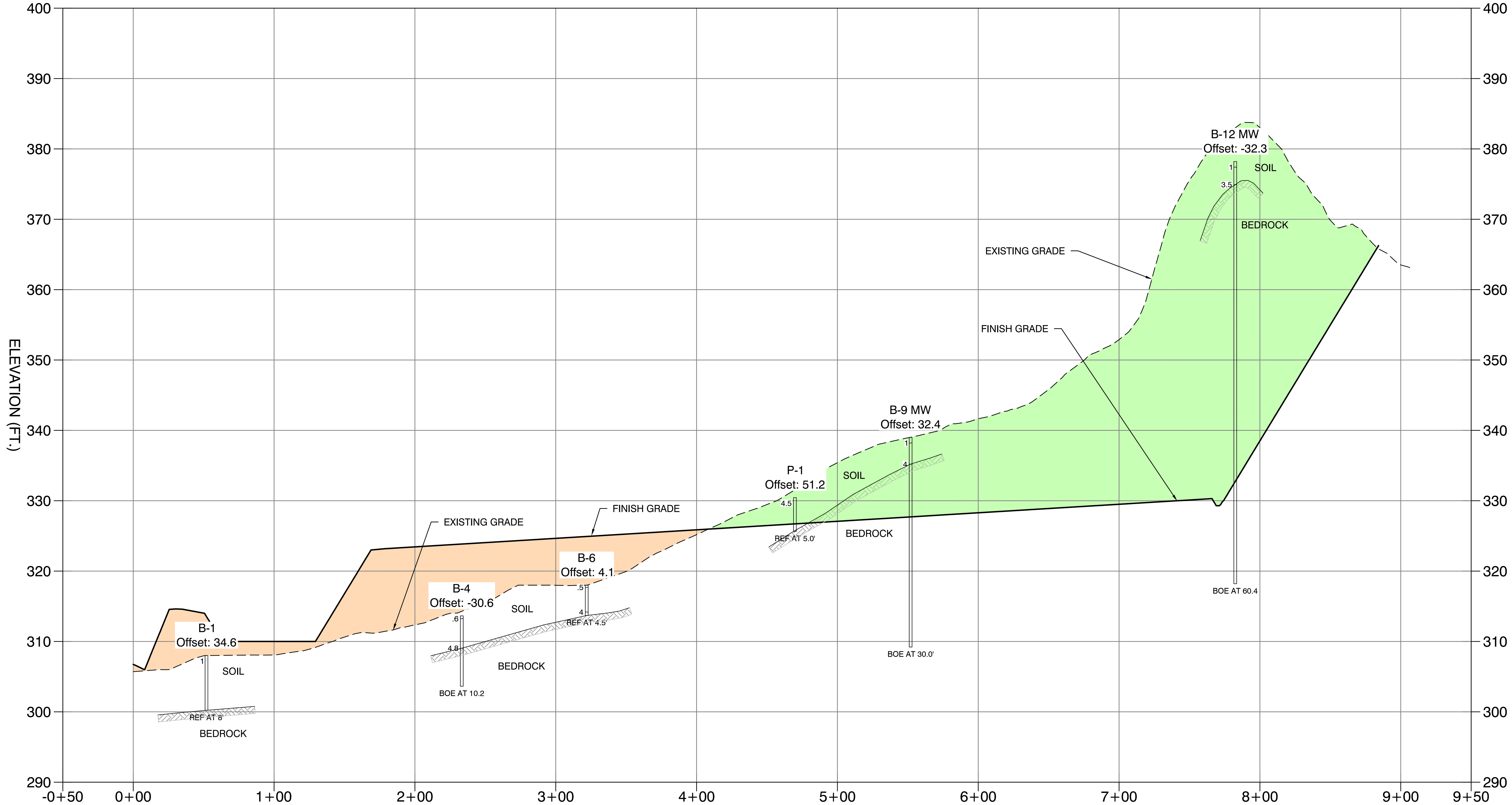
S.W.COLE ENGINEERING, INC.

CENTRAL MAINE POWER

EXPLORATION LOCATION PLAN

PROPOSED AC/DC CONVERTER STATION
MERRILL ROAD
LEWISTON, MAINE

Job No.:	17-1017	Scale:	As Noted
Date:	05/02/2018	Sheet:	1



PROFILE A

SCALE: 1" = 50' HORIZ.
1" = 10' VERT.

LEGEND

- **B-9 (MW)** BORING NUMBER PIEZOMETER INSTALLED
- APPROXIMATE EXISTING GROUND SURFACE
- 7' STRATA CHANGE
- SILT STRATA DEFINITION
- BOE BOTTOM OF EXPLORATION

NOTES:

1. THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTION WERE GENERALIZED FROM AND INTERPOLATED BETWEEN EXPLORATION LOCATIONS. THE TRANSITION BETWEEN MATERIALS MAY BE MORE OR LESS GRADUAL THAN INDICATED. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE SPECIFIC LOCATIONS INDICATED AND AT THE TIME OF EXPLORATION. SEE BORING LOGS FOR MORE DETAILED INFORMATION.
2. THIS PROFILE SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHINCAL REPORT AND IS NOT TO BE USED FOR CONSTRUCTION.

NO.	DATE	DESCRIPTION	BY
1	05/11/2018	FINAL REPORT SUBMISSION	CEM
0	05/02/2018	PRELIMINARY FINDINGS SUBMISSION	CEM

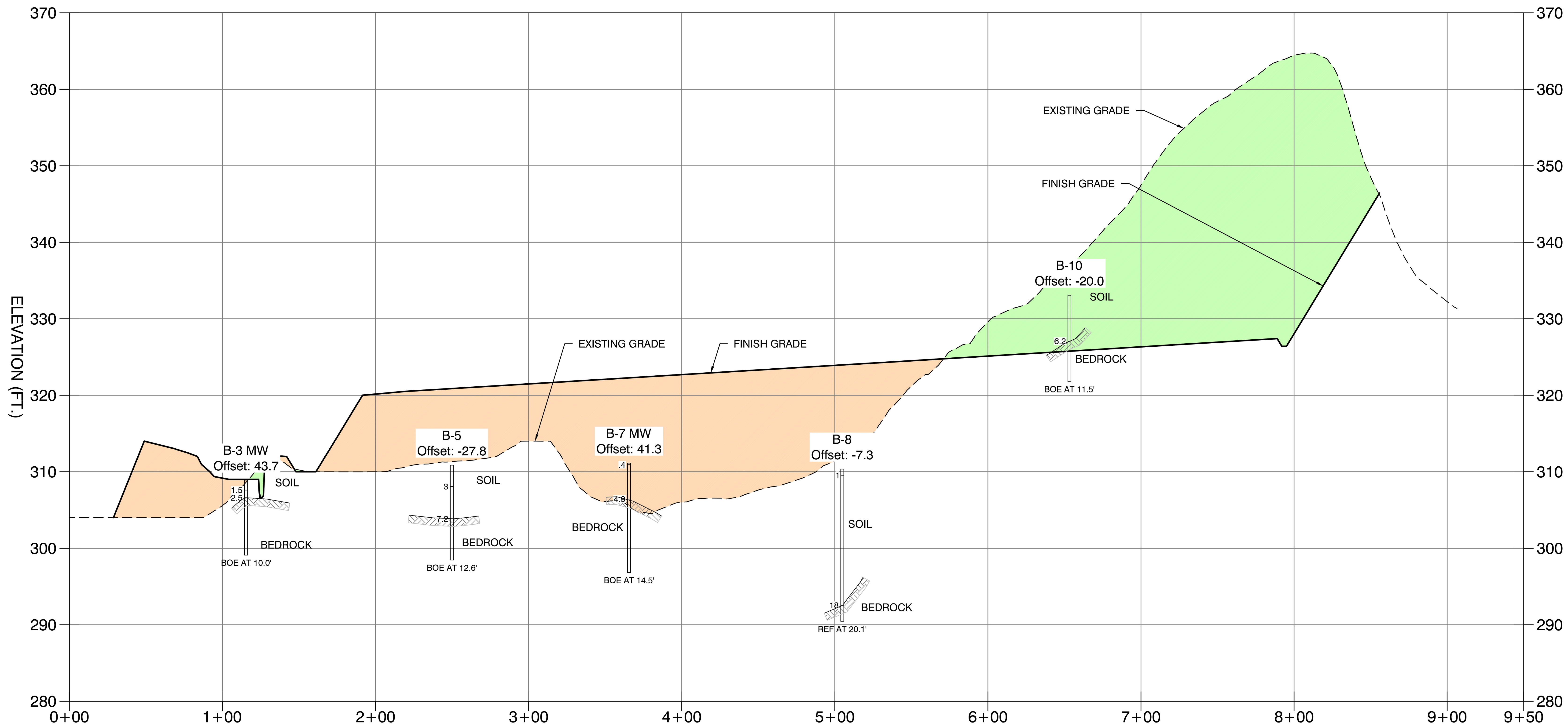
S.W.COLE ENGINEERING, INC.

CENTRAL MAINE POWER

INTERPRETIVE GEOLOGIC PROFILE A

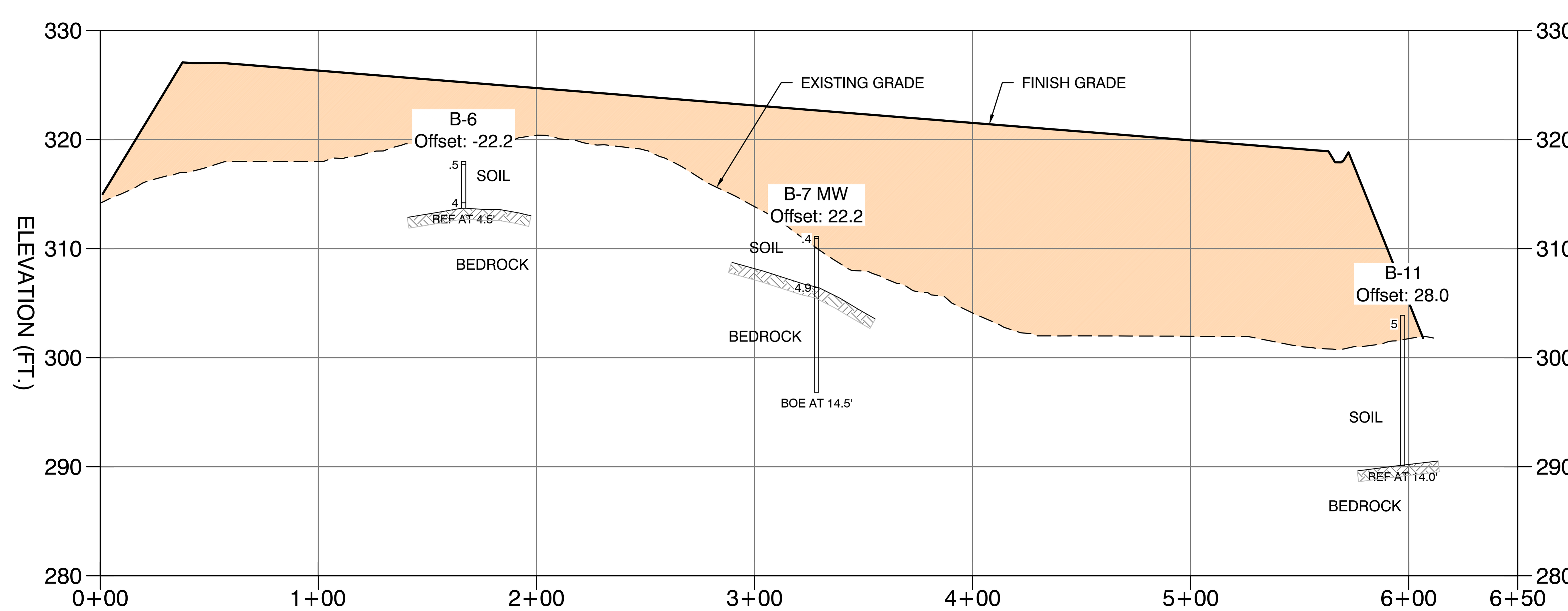
PROPOSED AC/DC CONVERTER STATION
MERRILL ROAD
LEWISTON, MAINE

Job No.:	17-1017	Scale:	As Noted
Date :	05/02/2018	Sheet:	2



PROFILE B

SCALE: 1" = 50' HORIZ.
1" = 10' VERT.



PROFILE C

SCALE: 1" = 50' HORIZ.
1" = 10' VERT.

LEGEND

B-9 (MW)	BORING NUMBER PIEZOMETER INSTALLED
	APPROXIMATE EXISTING GROUND SURFACE
7'	STRATA CHANGE
SILT	STRATA DEFINITION
BOE	BOTTOM OF EXPLORATION

NOTES:

1. THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTION WERE GENERALIZED FROM AND INTERPOLATED BETWEEN EXPLORATION LOCATIONS. THE TRANSITION BETWEEN MATERIALS MAY BE MORE OR LESS GRADUAL THAN INDICATED. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE SPECIFIC LOCATIONS INDICATED AND AT THE TIME OF EXPLORATION. SEE BORING LOGS FOR MORE DETAILED INFORMATION.
2. THIS PROFILE SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHINCAL REPORT AND IS NOT TO BE USED FOR CONSTRUCTION.

NO.	DATE	DESCRIPTION	BY
1	05/11/2018	FINAL REPORT SUBMISSION	CEM
0	05/02/2018	PRELIMINARY FINDINGS SUBMISSION	CEM

S.W.COLE ENGINEERING, INC.

CENTRAL MAINE POWER

INTERPRETIVE GEOLOGIC PROFILES B & C

PROPOSED AC/DC CONVERTER STATION
MERRILL ROAD
LEWISTON, MAINE

Job No.:	17-1017	Scale:	As Noted
Date :	05/02/2018	Sheet:	3

APPENDIX C

Exploration Logs and Key and Rock Core Photos

BORING LOG

BORING NO.:	B- 1
SHEET:	1 of 1
PROJECT NO.	17-1017
DATE START:	3/15/2018
DATE FINISH:	3/15/2018

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 308' +/- **TOTAL DEPTH (FT):** 8.0 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 2.5 ft 3/20/2018 Borehole open to 5.5' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/14	2-2-5-21			Forest Duff, topsoil and organics		
									1.0	Dense, brown Gravelly Silty SAND (Glacial Till)	▼	
305												
	5		2D		5-5.3	3/3	50/3"					
300									8.0	Refusal at 8.0 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B- 1**

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 2
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/15/2018
DATE FINISH: 3/15/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 304' +/- **TOTAL DEPTH (FT):** 11.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 2.4 ft 3/20/2018 Borehole open to 3' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/16	2-1-8-11			Forest Duff, topsoil and organics		
									1.0	Medium dense, gray Silty fine SAND	▼	
300	5		2D		4-6	24/10	19-21-18-16		3.0	Dense, brown Silty Gravelly SAND with cobbles (Glacial Till)		
295	10		3D		9-11	24/22	32-33-36-49		9.0	Very dense, gray Gravelly Silty SAND with cobbles (Glacial Till)		
									11.2 / 11.5	Probable Weathered Bedrock		

Refusal at 11.5 feet
Probable Bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 2

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 3
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/15/2018
DATE FINISH: 3/15/2018

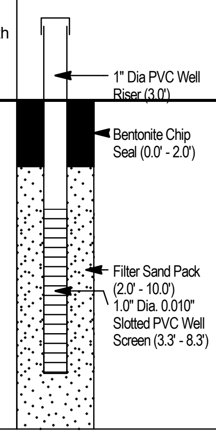
Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 309' +/- **TOTAL DEPTH (FT):** 10.0 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ∇ 4.5 ft 3/21/2018 Piezometer Installed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth
			1D		0-2	24/18	2-4-4-45		0.5	Forest Duff, topsoil and organics	
									1.5	Medium dense, reddish-brown Silty SAND, some gravel	
									2.5	Dense, brown Gravelly Silty SAND (Glacial Till)	
305	5									Bedrock Advanced by SSA and rollercone to 10' (for well installation)	∇
300	10								10.0	Bottom of Exploration at 10.0 feet	

Well Diagram



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 3

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.: B- 4
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/20/2018
DATE FINISH: 3/20/2018

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 314' +/- **TOTAL DEPTH (FT):** 10.2 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 2.3 ft 3/20/2018 Borehole open to 8.0' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/13	3-4-6-6			0.6 Forest Duff, topsoil and organics		
										Medium dense, brown Silty SAND, some gravel	▼	
310	5		R1		5.2-10.2	60/50	55			4.8 Bedrock, Mica Schist / Calcsilicate and Hornblende with garnet, locally coarse		
305	10									10.2 Bottom of Exploration at 10.2 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 4

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.:	B- 5
SHEET:	1 of 1
PROJECT NO.	17-1017
DATE START:	3/20/2018
DATE FINISH:	3/20/2018

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 311' +/- **TOTAL DEPTH (FT):** 12.6 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Borehole caved - no groundwater readings
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/6	2-2-3-3		0.5	Forest Duff, topsoil and organics		
310										Medium dense, reddish-brown Silty SAND		
									3.0	Dense, brown Silty Gravelly SAND (Glacial Till)		
	5											
305			2D		5-7	24/22	14-19-21-20	w =9.2 %				
									7.2	Bedrock, coarse white Feldspar Pegmatite overlying Mica (Biotite) Schist / Calcsilicate and Hornblende		
			R1		7.6-12.6	60/53	70					
	10											
300												
									12.6	Bottom of Exploration at 12.6 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 5

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 6
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/20/2018
DATE FINISH: 3/20/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 318' +/- **TOTAL DEPTH (FT):** 4.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Borehole caved- no groundwater readings
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H₂0 Depth	Remarks
			1D		0-2	24/16	3-3-3-3		0.5	Forest Duff, topsoil and organics		
										Medium dense, brown Silty SAND		
315									4.0	Probable Weathered Bedrock		
									4.5	Refusal at 4.5 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 6

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 7
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/20/2018
DATE FINISH: 3/20/2018

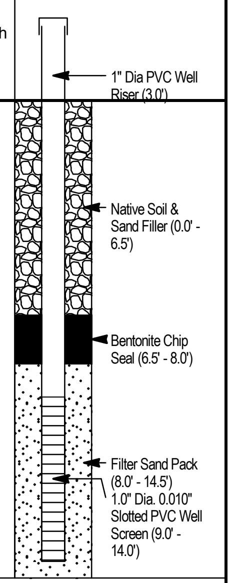
Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 311' +/- **TOTAL DEPTH (FT):** 14.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): 7.4 ft 3/21/2018 Piezometer Installed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth
310			1D		0-2	24/14	3-3-7-7			0.4 Forest Duff, topsoil and organics	
										Medium dense, brown Gravelly SAND, some silt (Glacial Till)	
	5									4.9 Bedrock, Mica Schist / Calcsilicate and Hornblende with garnet, locally coarse	
305			R1		5.5-10.5	60/48	80	q_U=1450 ksf			7.4
	10										
300			R2		10.5-14.5	48/58	79				
										14.5 Bottom of Exploration at 14.5 feet	

Well Diagram



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 7

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 8
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/19/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 310' +/- **TOTAL DEPTH (FT):** 20.1 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ⊻ 2.3 ft 3/20/2018 Borehole open to 4.6' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
⊽ At time of Drilling
⊻ At Completion of Drilling
⊻ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/4	1-1-3-1			Forest Duff, topsoil and organics		
									1.0	Medium dense, brown Gravelly SAND, some silt (Glacial Till)	⊻	
305	5		2D		5-6.4	17/12	12-23-50/5"					
300	10		3D		10-12	24/18	14-17-18-31					
295	15		3D		15-15.9	11/10	31-50/5"		15.0	Dense, brown Silty Gravelly SAND (Glacial Till)		
									18.0	Probable Weathered Bedrock		
290	20		MD		20-20.1	1/0	50/1"		20.1	Refusal at 20.1 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 8

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B- 9
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/20/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 339' +/-
TOTAL DEPTH (FT): 30.0
LOGGED BY: Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Scott Hollabaugh
DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted Diedrich D-50
AUGER ID/OD: N/A / N/A
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
CASING ID/OD: 4 in / 4 1/2 in
CORE BARREL: NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ▼ 9.8 ft 3/21/2018 Piezometer Installed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

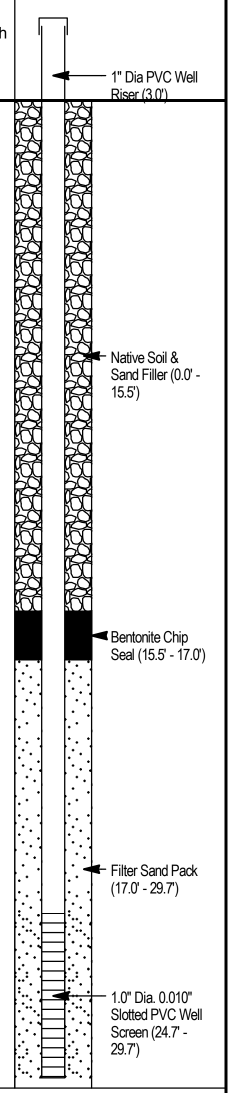
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Strata Depth (ft)	Sample Description & Classification	H_20 Depth
			1D	D	0-2	24/15	1-1-2-6			Forest Duff, topsoil and organics	
									1.0	Medium dense, brown Silty SAND, some gravel	
335	5		R1	R	4-7.5	42/36	88		4.0	Bedrock, Mica Schist / Calcsilicate and Hornblende with garnet, locally coarse	
								q_U=940 ksf			
330	10		R2	R	7.5-12.5	60/66	85				▼
325	15		R3	R	12.5-16.4	47/46	63				
			R4	R	16.4-17.5	13/13	100				
320	20		R5	R	17.5-22.5	60/55	83				
315	25		R6	R	22.5-27.5	60/64	68				
310	30		R7	R	27.5-30	30/26	67		30.0	Bottom of Exploration at 30.0 feet	

Well Diagram



Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 9

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B-10
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/19/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 333' +/- **TOTAL DEPTH (FT):** 11.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 3.1 ft 3/20/2018 Borehole open to 3.8' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/16	2-2-2-3		0.5	Forest Duff, topsoil and organics		
										Medium dense, reddish-brown Silty fine SAND, trace gravel		
330									3.0	Medium dense, brown Silty SAND, some gravel	▼	
	5		2D		5-6.3	15/14	15-18-50/3"	w =11 %				
			R1		6.5-11.5	60/60	100		6.2	Bedrock, Mica Schist / Calcsilicate and Hornblende with garnet, locally coarse		
325												
	10											
									11.5	Bottom of Exploration at 11.5 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

BORING NO.: **B-11**
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/19/2018

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 304' +/- **TOTAL DEPTH (FT):** 14.0 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Borehole caved - no groundwater readings
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
▽ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/10	2-2-2-6			Forest Duff, topsoil and organics		
									1.5	Medium dense, brown Silty SAND, some gravel		
300												
	5		2D		5-7	24/18	11-10-10-11		5.0	Medium dense to dense, brown Gravelly SAND, some silt (Glacial Till)		
295	10		3D		10-12	24/19	19-43-16-28					
290									14.0	Refusal at 14.0 feet Probable Bedrock		

BORING / WELL 17-1017.GPJ SWCE TEMPLATE.GDT 4/30/18

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B-12
SHEET: 1 of 2
PROJECT NO. 17-1017
DATE START: 3/15/2018
DATE FINISH: 3/16/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 378' +/- **TOTAL DEPTH (FT):** 60.4 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2 / 2
HAMMER EFFICIENCY FACTOR: 0.87 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ∇ 23.6 ft 3/21/2018 ▼ 29.6 ft 3/21/2018 Piezometer Installed
GENERAL NOTES: Water level at 29.6' in deep well and 23.6' in shallow well on 3-21-18

KEY TO NOTES AND SYMBOLS:
Water Level: ∇ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Sample Description & Classification	H_20 Depth
	1.0								Brown Silty SAND, some gravel	
	3.5								Bedrock, Mica (Biotite) Hornblende Feldspar Schist - trace calcsilicate, locally pegmatitic with quartz and garnet, altered near oxidized fracture zones	
375	5		R1		4.5-8	42/42	74			
370			R2		8-13	60/60	88			
	10									
365			R3		13-18	60/57	85			
	15									
360			R4		18-20	24/24	92			
	20		R5		20-23	36/36	100			
355			R6		23-28	60/61	87			∇
	25									
350			R7		28-33	60/61	100			▼
	30									
345			R8		33-38	60/60	95			

Well Diagram
3/4" Dia PVC Well Riser (3.0')
3/4" Dia PVC Well Riser (2.9')
Native Soil & Sand Filler (0.0' - 14.4')
Bentonite Chip Seal (14.4' - 16.5')
Filter Sand Pack (16.5' - 29.5')
3/4" Dia. 0.010" Slotted PVC Well Screen (24.5' - 29.5')
Bentonite Chip Seal (29.5' - 31.0')

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: B-12
SHEET: 2 of 2
PROJECT NO. 17-1017
DATE START: 3/15/2018
DATE FINISH: 3/16/2018

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Well Diagram
340			R9		38-43	60/60	100					Filter Sand Pack (31.0' - 46.0')
	40											
335			R10		43-48	60/60	93					
	45											
330			R11		48-53	60/60	100					Bentonite Chip Seal (46.0' - 48.5')
	50											
325			R12		53-57.8	57/57	100					
	55											Filter Sand Pack (48.5' - 60.4')
320			R13		57.8-60.4	31/31	100					3/4" Dia. 0.010" Slotted PVC Well Screen (55.4' - 60.4')
	60								60.4	Bottom of Exploration at 60.4 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-12

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

BORING NO.: P- 1
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/19/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 330' +/-
TOTAL DEPTH (FT): 5.0
LOGGED BY: Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Scott Hollabaugh
DRILLING METHOD: Solid Stem Auger
RIG TYPE: Track Mounted Diedrich D-50
AUGER ID/OD: N/A / 4 1/2 in
SAMPLER:
HAMMER TYPE: N/A
HAMMER WEIGHT (lbs): N/A
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER EFFICIENCY FACTOR:
HAMMER DROP (inch): N/A
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling

D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear

Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot

WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector

S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
										Forest duff overlying probable glacial till soils		
									4.5	Probable Weathered Bedrock		
325	5								5.0	Refusal at 5.0 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: P- 1

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.:	P- 2
SHEET:	1 of 1
PROJECT NO.	17-1017
DATE START:	3/19/2018
DATE FINISH:	3/19/2018

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 345' +/- **TOTAL DEPTH (FT):** 8.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / 4 1/2 in **SAMPLER:**
HAMMER TYPE: N/A **HAMMER WEIGHT (lbs):** N/A **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: **HAMMER DROP (inch):** N/A
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
										Forest duff overlying probable glacial till soils		
340	5											
	7.5									Probable Weathered Bedrock		
	8.5									Refusal at 8.5 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: P- 2

BORING LOG

S.W.COLE ENGINEERING, INC.

BORING NO.: P- 3
SHEET: 1 of 1
PROJECT NO. 17-1017
DATE START: 3/19/2018
DATE FINISH: 3/19/2018

CLIENT: Central Maine Power
PROJECT: Proposed AC/DC Converter Substation
LOCATION: Merrill Road, Lewiston, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 334' +/- **TOTAL DEPTH (FT):** 8.5 **LOGGED BY:** Nate Strout
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Scott Hollabaugh **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** N/A / 4 1/2 in **SAMPLER:**
HAMMER TYPE: N/A **HAMMER WEIGHT (lbs):** N/A **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: **HAMMER DROP (inch):** N/A
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
∇ At time of Drilling
▼ At Completion of Drilling
▼ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_U = Unconfined Compressive Strength, kips/sq.ft.
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
										Forest duff overlying probable glacial till soils		
330	5								5.0	Probable Weathered Bedrock		
									8.5	Refusal at 8.5 feet Probable Bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: P- 3

S.W.COLE ENGINEERING, INC. • Geotechnical Engineering • Field & Lab Testing • Scientific & Environmental Consulting

KEY TO NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

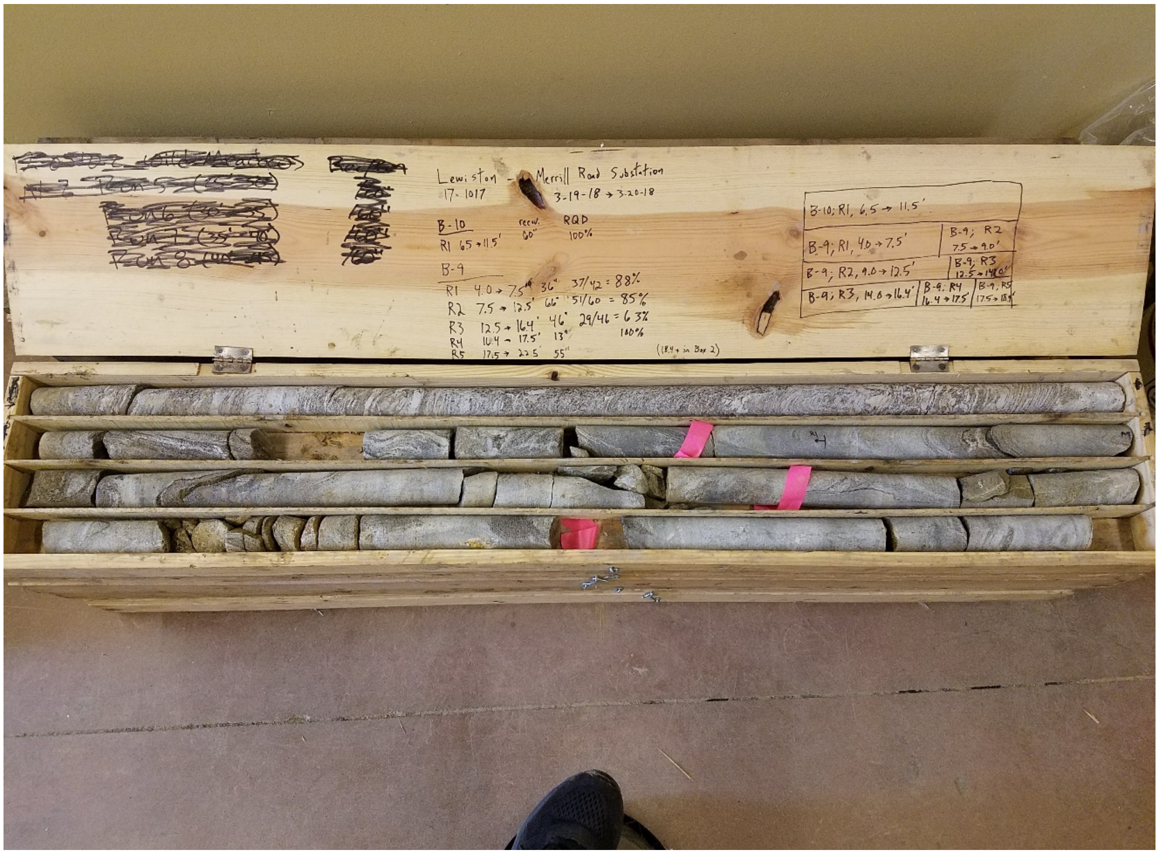
Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

B-4, R-1

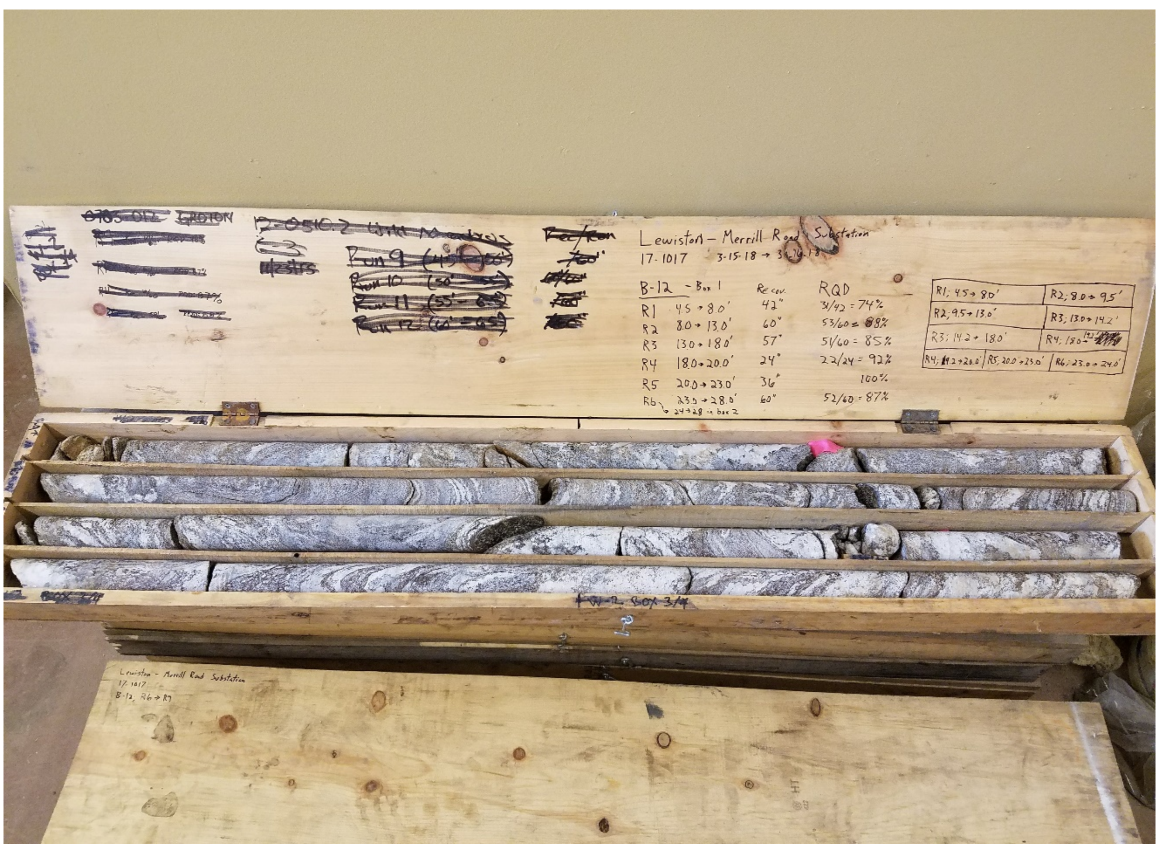
B-5, R-1 and
B-7, R-1 through R-2

B-9 (Box 1), R-1 through R-5

B-9 (Box 2), R-5 through R-7



B-10, R-1



B-12 (Box 1), R-1 through R-6

B-12 (Box 2), R-6 through R-9

B-12 (Box 3), R-9 through R-7

APPENDIX D

Laboratory Test Results

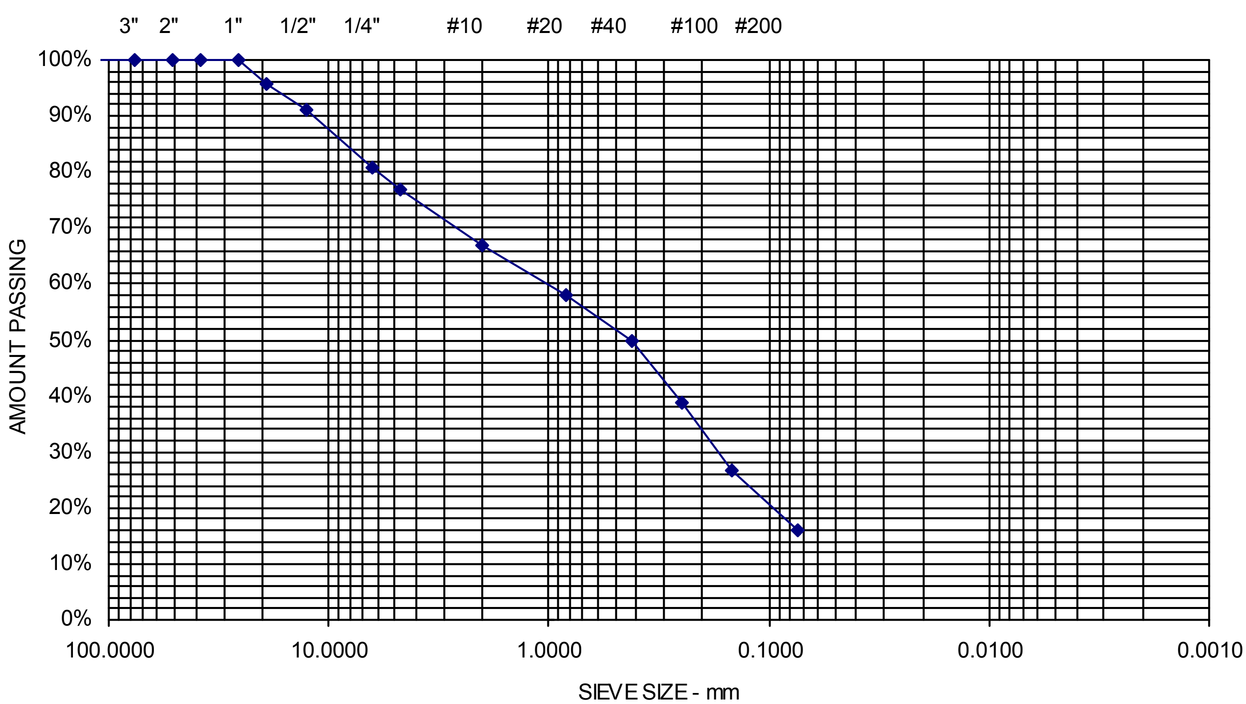
Report of Gradation

ASTM C-117 & C-136

Project Name	LEWISTON ME - MERRILL ROAD CMP SUBSTATION - GEOTECHNICAL ENGINEERING SERVICES	Project Number	17-1017
Client	CENTRAL MAINE POWER COMPANY	Lab ID	21428B
Exploration	**B-5, 5-7'**	Date Received	4/2/2018
Material Source	**2D**	Date Completed	4/3/2018
		Tested By	NICOLAS TRÉBOUET

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150	**6"**	**100**	
125	**5"**	**100**	
100	**4"**	**100**	
75	**3"**	**100**	
50	**2"**	**100**	
38.1	**1-1/2"**	**100**	
25.0	**1"**	**100**	
19.0	**3/4"**	**96**	
12.5	**1/2"**	**91**	
6.3	**1/4"**	**81**	
4.75	**No. 4**	**77**	23% Gravel
2.00	**No. 10**	**67**	
850	**No. 20**	**58**	
425	**No. 40**	**50**	61% Sand
250	**No. 60**	**39**	
150	**No. 100**	**27**	
75	**No. 200**	**16.0**	16% Fines

SILTY GRAVELLY SAND



Comments: W=9.2%

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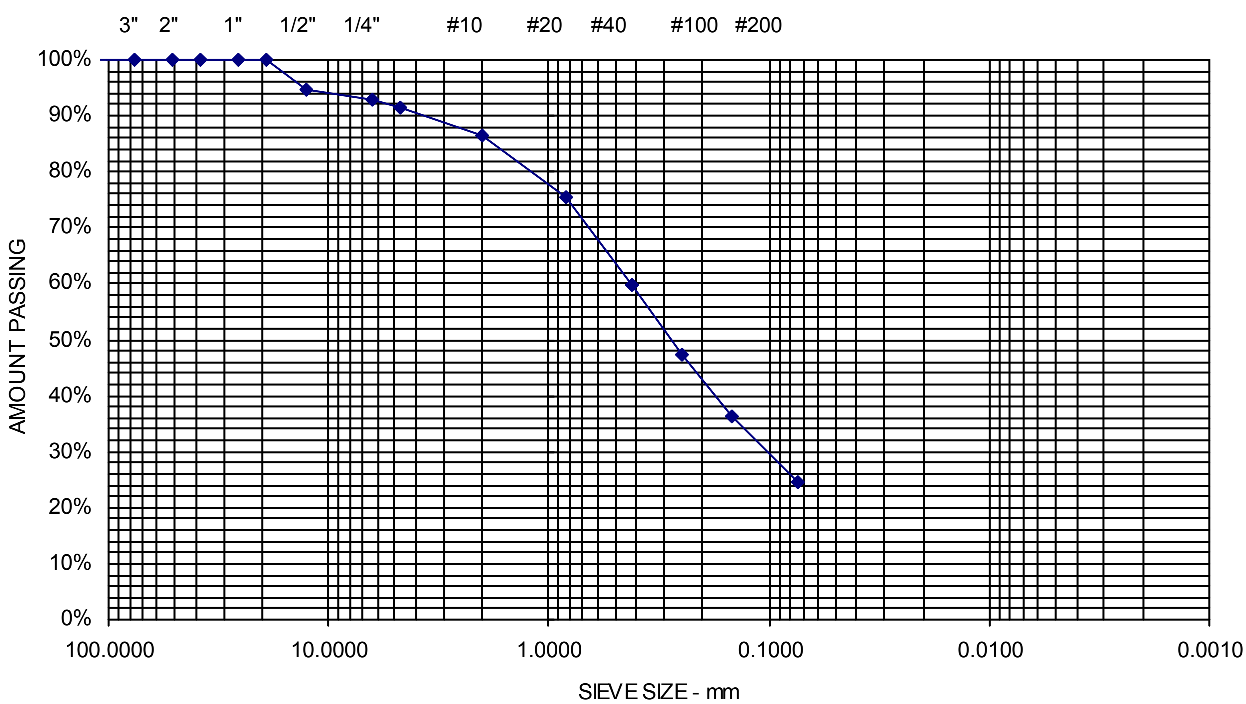
Report of Gradation

ASTM C-117 & C-136

Project Name	LEWISTON ME - MERRILL ROAD CMP SUBSTATION - GEOTECHNICAL ENGINEERING SERVICES	Project Number	17-1017
Client	CENTRAL MAINE POWER COMPANY	Lab ID	21429B
Exploration	**B-10, 5-6.2'**	Date Received	4/2/2018
Material Source	**2D**	Date Completed	4/3/2018
		Tested By	

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150	**6"**	**100**	
125	**5"**	**100**	
100	**4"**	**100**	
75	**3"**	**100**	
50	**2"**	**100**	
38.1	**1-1/2"**	**100**	
25.0	**1"**	**100**	
19.0	**3/4"**	**100**	
12.5	**1/2"**	**95**	
6.3	**1/4"**	**93**	
4.75	**No. 4**	**91**	8.6% Gravel
2.00	**No. 10**	**87**	
850	**No. 20**	**76**	
425	**No. 40**	**60**	66.8% Sand
250	**No. 60**	**47**	
150	**No. 100**	**36**	
75	**No. 200**	**24.6**	24.6% Fines

SILTY SAND, SOME GRAVEL



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