SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work included under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals to conduct and complete the Work related to the planned building, parking, structures, landscaped areas, utilities and site improvements as specified herein and shown on the Drawings.

1. Thoroughly read, fully understand, and abide by all data, evaluations, and recommendations of the S.W. Cole Engineering, Inc. Explorations and Geotechnical Engineering Services Report, dated February 25, 2016. If any conflict exists between the requirements of the Geotechnical Engineering Report, these specifications, and/or the plan, request clarification from the ENGINEER prior to performing the work.
2. Excavate all materials, including soil, boulders, abandoned utilities, pavements, curbs, granite blocks, and all other materials as necessary to construct the improvements shown on the Drawings.
3. The CONTRACTOR shall be solely responsible for impacts and damage to structures due to his/her work, and for corrective action or repairs needed to restore the structure(s) to its original condition at no additional cost to the OWNER. Where structures are adversely affected by construction operations, they shall be repaired, restored and replaced in accordance with the requirements outlined herein.
4. The CONTRACTOR shall note that some over-excavation and replacement of fill may be required as noted on the plans.
5. Handle, process, re-handle, segregate, and stockpile materials during the course of the Work. Existing on-site materials may require processing prior to reuse. Processing may include crushing, blending, screening, and other measures to meet the requirements herein and as directed by the ENGINEER. Only those soils and other materials approved by the ENGINEER shall be reused on-site.
6. Prepare, grade, shape, compact and protect all subgrades, backfills, and ground surfaces shown on the Drawings.
7. Dewater as necessary to enable construction of site improvements, including backfilling, in-the-dry. The CONTRACTOR shall be responsible for control, pumping, and legal disposal of groundwater, precipitation, or other water which enters or accumulates in excavations to maintain stable subgrades and allow all below-grade construction to be conducted in-the-dry.
8. Provide, place, moisture condition, compact, and grade fill, backfill and other materials to the horizontal and vertical limits to construct the proposed site improvements and achieve the lines and grades as shown on the Drawings.
9. Place plastic separators, vapor barriers, mudmats, and geotextiles as necessary and required.
10. Install foundation drainage system elements at the locations and elevations shown on the Drawings.
11. Preserve and protect existing structures and utilities and new site improvements during the course of the Work.
12. Manage and legally dispose off-site all excess excavated materials, including, but not limited to, soil, rock, boulders, water, demolition waste, and debris that cannot be reused on-site.
13. Obtain, maintain and pay for all required permits, licenses, and approvals prior to commencing the Work of this and other related Sections.
14. Off-site disposal of Contaminated Material, if required, shall not be conducted without approval of the OWNER and ENGINEER.

15. Provide and install erosion control during the Work as indicated on the Drawings, as required in the Specifications, and in accordance with applicable regulations and permits.
16. The CONTRACTOR shall be solely responsible for impacts and damage to any existing structures due to their Work, and for corrective action or repairs needed to restore the structure(s) to original condition at no additional cost to the OWNER.
17. Furnish and place all fill and gravel as required to complete work for contract at the compactions specified herein.
18. Removal of all unsuitable material from site.
19. Removal of all abandoned utility lines incidental to work.

1.02 RELATED REFERENCES:

A. S.W. Cole Engineering, Inc. Explorations and Geotechnical Engineering Services Report, dated February 25, 2016.

B. Specification Sections:
   1. Erosion and Sedimentation Control: Section 31 25 13

C. State of Maine Department of Transportation "Standard Specifications", most recent revision

D. State of Maine Department of Transportation "Supplemental Specifications – Corrections, Additions & Revisions to Standard Specifications – Latest Edition"

E. Manual of Accident Prevention in Construction - Associated General Contractors of America, Inc.

F. 29 CFR 1926/1910 - OSHA Safety and Health Standards for Construction Industry

G. City of Portland Technical and Design Standards, latest edition (available online http://me-portland.civicplus.com/757/Technical-Design-Standards)

1.03 PROTECTION:

A. Paved Surfaces: Do not operate equipment that will cause damage on paved surfaces to remain. Any damage to existing roads or other paved surfaces caused by construction equipment shall be repaired at no additional cost to OWNER.

B. Maintain excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the ENGINEER.

C. Protect structures, utilities, monitoring wells, property monuments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. The CONTRACTOR shall be responsible for actual cost of repair or replacement of any items damaged as a result of construction activities, including any professional services required for inspection of repairs and replacement.

1.04 QUALITY ASSURANCE:

A. Testing and Inspection: OWNER shall be responsible for all testing, unless otherwise noted. The cost for retesting due to failed tests shall be the responsibility of the CONTRACTOR.

The CONTRACTOR shall be responsible for coordinating with ENGINEER to allow for testing to be performed at the frequencies specified. A minimum of 48 hours notice for in-place testing shall be given to allow proper scheduling by ENGINEER.

B. The ENGINEER may observe the CONTRACTOR'S earthwork activities, including excavation, dewatering, subgrade preparation, backfilling and on-site reuse of excavated materials. The Contractor shall provide sufficient notice to the ENGINEER to allow the ENGINEER to be present to observe the Work.

C. The ENGINEER or OWNER's Representative will conduct field and laboratory density testing of placed and compacted soils to confirm compliance with the requirements of this Section. Field and laboratory density testing will be conducted in general conformance with ASTM or other applicable reference standards. The CONTRACTOR shall cooperate with the ENGINEER in all respects to facilitate any testing or observations.

D. The CONTRACTOR shall not place or compact any fill, prepare subgrades or place concrete on bearing surfaces unless the ENGINEER or OWNER's Representative is present to observe the Work. Materials placed and/or compacted which do not conform to project specifications for the area, shall be removed and replaced with appropriate, suitable material when directed by the OWNER or the ENGINEER at no additional cost to the OWNER. Costs related to testing or replacement of nonconforming Work or materials, and/or delays caused by nonconforming Work or materials, shall be paid for by the CONTRACTOR at no additional cost to the OWNER.

E. The presence of the ENGINEER shall not relieve the CONTRACTOR of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the CONTRACTOR from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site. The CONTRACTOR shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, and the City of Portland relative to the work performed on the site and any CONTRACTOR activities on or adjacent to the site.

F. The CONTRACTOR shall adhere to the applicable requirements of the specifications, OSHA Standards and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

G. The CONTRACTOR may conduct additional field and laboratory testing or screening tests for its own information at no additional cost to the OWNER.

H. In case of conflict between regulations or between regulations and Specifications, the CONTRACTOR shall comply with the strictest applicable codes, regulations, or Specifications.

I. CONTRACTOR shall coordinate pre-excavation meetings with OWNER and ENGINEER.

1.05 JOB AND SUBSURFACE CONDITIONS:

A. Site Information: A geotechnical investigation was completed for this project. A copy of the report and associated borings can be provided upon request.

The CONTRACTOR may make his own borings, hand probes, explorations, and observations to determine soil, water levels, and other subsurface conditions at no additional cost to OWNER. Coordinate with OWNER prior to start of additional investigative work.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations. Coordinate with utility companies for actual locations and shut-off services. If utilities are encountered that are not shown or that are shown incorrectly on the Drawings, notify ENGINEER immediately. Repair damaged utilities to satisfaction of ENGINEER and utility.

1.06 LINES, GRADES AND TOLERANCES:

A. The CONTRACTOR shall be responsible for establishing all lines, grades and other survey control to complete the Work as shown on the Drawings.

B. Maintain the moisture content of backfill materials as necessary to allow for the material to be readily placed to the degree of compaction specified herein.

C. Construct finished soil and backfill surfaces to the elevations indicated on the Drawings.

D. Compact backfill materials to the specified degree of compaction.

PART 2 - MATERIALS

2.01 MATERIALS:

A. General: All materials utilized for this Project shall be obtained from a source that has been licensed or permitted for such use by local and state authorities. The CONTRACTOR shall be required to submit evidence of such if so requested.

1. Suitable materials: Suitable soil materials are defined as those complying with ASTM D2487 soil classification groups GW, SM, SW, and SP.

2. Unsuitable materials: Materials containing excessive amounts of water, clay, vegetation, organic matter, debris, pavement, stones or boulders over 6-inches in greatest dimension, frozen material, and material which, in the opinion of the ENGINEER, will not provide a suitable foundation or subgrade.

3. On-Site Material: Any suitable material from on-site excavation.

4. Material for embankments and general site fills outside of the building envelope may contain pieces of excavated ledge having a greatest dimension of up to 6-inches, unless otherwise approved by ENGINEER.

5. Inspection: The ENGINEER may inspect off-site sources of materials and order tests of these materials to verify compliance with these Specifications.

6. Sieve Analysis: Submit sieve analysis in accordance with ASTM D422 for all materials prior to start of construction.

B. Gravel/Aggregate Base: Hard, durable gravel equal to MDOT 703.06 Type B material as specified on the drawings. Sieve analyses by weight:

Sieve Size	% Passing by Weight
4"	100
1/2"	35 - 75
1/4"	25 – 60
No. 40	0 – 25
No. 200	0 – 5

C. Aggregate Subbase: Sand or gravel of hard, durable particles; equal to MDOT 703.06 Type D material. Aggregate subbase shall not contain particles that will not pass the 6-inch sieve. The part that passes the 3-inch sieve shall meet the following gradation requirements:

Sieve Size	% Passing by Weight
3”	100
1/2"	35 – 80
1/4"	25 – 65
No. 40	0 – 30
No. 200	0 – 7

D. Structural Fill: Well-graded sand and gravel mixture meeting the following gradation requirements:

Sieve Size	% Passing by Weight
4”	100
3”	90 – 100
¼”	25 – 90
No. 40	0 – 30
No. 200	0 – 5

Structural fill is recommended for use as backfill for over-excavations, backfill to repair soft areas, backfill for foundations, slab and paver base material and material below exterior entrances and sidewalks, as recommended in the S.W. Cole report.

E. Granular Borrow: Imported materials consisting of a mixture of sand, gravel and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand to create a compactable fill meeting the following gradation:

Sieve Size	% Passing by Weight
6 inch	100
¼ inch	25 to 90
No. 40	0 to 50
No. 200	0 to 20

Granular borrow shall be used to raise exterior parking areas to bottom of subbase materials; backfill after removal of relic foundation elements and other deleterious materials outside of the building footprints; and in other locations as identified in the Construction Documents.

F. ¾” Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material. Gradation shall be:

Sieve Size	% Passing by Weight
1”	100
¾”	90 – 100
3/8”	20 – 55
No. 4	0 – 10
No. 200	0 – 1.5

Crushed stone shall be used beneath walkways and exterior slabs and in all other areas as indicated on the plans.

G. Sand: Sand shall be well-graded coarse sand without excessive fines and free from loam, clay, and organic matter. Beach sand shall not be used. The grading requirements are as follows:

Sieve Size	% Passing by Weight
3/8”	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 – 10

Sand shall be used beneath interior building slabs and in all other areas as indicated on the plans.

H. Underdrain backfill: In accordance with MDOT 703.22 underdrain backfill, Type C:

Sieve Size	% Passing by Weight
1”	100
3/4"	90 – 100
3/8”	0 – 75
No. 4	0 – 25
No. 10	0 – 5

I. Riprap: In accordance with MDOT 703.26 – Plain and Hand Laid Riprap, or as otherwise noted.

J. Refill Material: Use 3/4" crushed stone for refilling excavation below normal grade, rock excavation or refilling excavations of unsuitable material, unless otherwise directed by ENGINEER.

K. Fabric Protection Layer: As specified on the Contract Plans.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. General: Excavation shall include the removal of all encountered materials, including but not limited to, soil, boulders, asphalt pavement, concrete (reinforced and unreinforced), miscellaneous debris, buried and abandoned foundations and utilities, site improvements, incidental structures and all

other materials encountered to the limits shown on the Drawings, or designated in the Specifications.

B. All topsoil, peat, organic material, debris, rubbish, frozen soils, muck, loose, or disturbed soils and other unsuitable materials should be removed from the area of new construction. Topsoil may be stockpiled outside the construction area for reuse in landscaped areas. Topsoil may not be used as common fill below pavements or as fill below proposed building.

C. Call Dig Safe prior to beginning any excavation.

D. Rock Excavation includes removal and disposal of materials and obstructions encountered that cannot be excavated with modern, track-mounted, heavy-duty excavating equipment without drilling or ripping; includes boulders larger than 2 cubic yards each.

Do not perform rock excavation or excavation of unsuitable materials until material to be excavated has been cross-sectioned and classified by ENGINEER.

E. Earth Excavation: Remove and dispose of obstructions visible on ground surface, underground structures, utilities, and items indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

F. Excavation in Paved Areas: Cut pavement prior to excavation to provide a clean, uniform edge. Minimize disturbance of remaining pavement. Cut and remove the minimum amount of pavement required to do the Work. Use shoring and bracing where sides of excavation will not stand without undermining pavement.

G. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for foundations, take care not to disturb bottom of excavation. Excavate the final 1.0 feet to foundation subgrade level using methods and equipment designed to prevent disturbance to the bearing soils (by hand or by smooth bucket excavator).Trim bottoms to required lines and grades to leave solid base to receive other Work. When excavating in clay material, use a smooth-edged bucket to avoid disturbance of the bottom of the excavation. Use shoring and bracing as required by OSHA standards.

H. Excavation for Utility Trenches: Excavate to widths shown on the Drawings and depths indicated or required to establish indicated slope and invert elevations. Produce an evenly graded, flat trench bottom at the subgrade elevation required for installation of pipe and bedding material. Place backfill material directly into trench or excavation. Do not stockpile material to be used as backfill along edges of trenches. Load excavated material directly into trucks, unless otherwise permitted by the ENGINEER.

I. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, including refilling, shall be at CONTRACTOR's expense.

J. Refilling Unauthorized Excavation: For trenches, use 3/4-inch crushed stone. A geotextile barrier may be required at the discretion of the ENGINEER. Elsewhere, backfill and compact unauthorized

excavations as specified for authorized excavations of same classification, unless otherwise directed by ENGINEER.

K. Excavation of Unsuitable Materials: When excavation has reached required subgrade elevations, notify ENGINEER who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper only at the direction of the ENGINEER and replace excavated material with ¾" crushed stone on a non-woven geotextile fabric (Mirafi 140N or approved equal).

L. Material Storage: Stockpile and maintain suitable surplus excavated materials for re-use as backfill within the Project limits, as directed by ENGINEER. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.

3.02 STABILITY OF EXCAVATIONS:

A. General: Side slopes of excavations shall comply with OSHA Regulations and Local Codes. Shore and brace where sloping is not possible due to space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 DEWATERING:

A. General: Perform all Work in the dry. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Dewatering should be continuous until the permanent foundation drainage system is installed and foundations are built and backfilled.

A layer of crushed stone underlain with geotextile might be needed to protect subgrades from disturbance during construction.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey water removed from excavations and rainwater to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

Utilize discharge filter systems to remove sediment prior to discharge to receiving waters.

3.04 SUBGRADE PREPARATION:

A. General

1. Care shall be taken to avoid disturbance to subgrades.
2. Provide a firm, smooth, stable, undisturbed subgrade as judged by the ENGINEER. Loose, disturbed soil shall be removed by hand shovel.
3. Subgrades consisting of cohesive soils shall not be "backbladed" or compacted to prepare a smooth surface.

4. Subgrades shall be prepared as recommended in the geotechnical report.
5. Stripped subgrades beneath planned building and paved area and composed of granular soil should be proof-rolled with a minimum of two passes of a 10-ton roller in each of two perpendicular directions to improve the density of suitable soils. Silty clay to sandy silt subgrades should not be proof-rolled. Rolling of subgrades should be observed for areas of soil rutting or weaving, indicative of unsuitable underlying materials. Unsuitable fill and/or soft, loose, and/or disturbed native soil materials should be excavated and replaced with structural fill. If high groundwater is present during subgrade preparation, the vibratory roller should be operated in the "static" mode to avoid liquefying the soil.
6. Movement of construction equipment directly over exposed final subgrades, except for compaction equipment, shall not be permitted.
7. The exposed subgrade will be examined in the field by the ENGINEER to observe the strength and bearing capacity of the soils. Disturbed or soft or unstable soils, as judged by the ENGINEER, shall be excavated and replaced with lean concrete, granular fill, or other acceptable materials at no additional cost to the Owner.
8. Prevent soil subgrades from freezing and frost. Soil subgrades that freeze prior to concrete or backfill placement shall be thawed and recompacted, or removed and replaced with non-frozen backfill, lean concrete or other acceptable material as directed by the ENGINEER.
9. Excavations shall not undermine existing foundations, streets, sidewalks, or structures.

B. Plaza Paver Area
   1. The subgrade in the plaza paver area is anticipated to consist of uncontrolled fill. The uncontrolled fill should be proof-rolled and densified with 3 to 5 passes of a vibratory roller having a static weight of at least 5 tons. Areas of subgrade that yield or become soft after proof-rolling or are observed to have voided rubble should be overexcavated and replaced with compacted Structural Fill.

3.05 BACKFILL AND FILL:

A. General: Place suitable soil material in layers to required elevations as shown on the Drawings. Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material. Place material in approximately horizontal layers of beginning at lowest area to be filled. Do not impair drainage.

B. Placement: Place backfill and fill materials in layers not more than 9-inches in loose depth in uncompacted thickness. In confined areas, within 4 feet of foundation walls, and in areas where self-propelled compaction equipment should not be used based on vibration considerations, fill shall be placed in lifts not exceeding 6-inches in uncompacted thickness and be compacted with hand-operated compaction equipment. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

   Place backfill and fill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

   Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

C. Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including dampproofing, and/or waterproofing.

Inspection, approval and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with suitable materials.

Removal of trash and debris from excavation.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

Backfill cast-in-place concrete structures when the concrete has developed adequate strength.

Use care in backfilling to avoid damage or displacement of underground structures and pipe.

D. Backfilling Trenches: See Trench Detail on the Drawings.

Bed pipe in 3/4-inch crushed stone, unless otherwise indicated. Limits of bedding and requirements for remaining trench backfill shown on Drawings. Backfill under all existing utility pipes crossed by new utility pipes or work with ¾" crushed stone. The crushed stone backfill shall extend continuously from the bedding of the new pipe to the utility pipe crossed, including a 6" thick envelope of crushed stone all around the existing utility pipe(s). The ¾" crushed stone backfill shall stand at its own angle of repose. No "haunching" or "forming" with common fill will be allowed.

E. Replacement of Unsuitable Materials:

Below normal grade: See paragraph 3.01J.

Above normal grade: Replace unsuitable material with suitable material from on-site. All excess suitable material must be used before additional material from off-site is used.

3.06 COMPACTION:

A. Methods: Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the ENGINEER. In the parking lot and other open areas, compact with self-propelled compaction equipment. Within the building, utility trenches, and other confined areas, compact with hand-operated compaction equipment. Adjust moisture content of soil as required. Remove and replace material that is too wet to compact to required density. Compact each horizontal layer of fill and slope as Work progresses.

B. Degree of Compaction: Compact to the following minimum densities:

FILL AND BACKFILL LOCATION	DENSITY	TESTING FREQUENCY ONE TEST PER LIFT PER:
Building and pavement subgrade (top 18")	100% of max.	1,000 SF
Pavement below 18" of subgrade	95%	5,000 SF

Structures and walkways	95%	2,000 SF
Trenches	95%	150 LF
Lawn or Unimproved Areas	92%	20,000 SF

Maximum density: ASTM D1557.
Field density tests: ASTM D1556 (sand cone) or ASTM D6938 (nuclear methods).

C. Testing: In-place densities using field tests will be determined by the ENGINEER or the OWNER's Representative. Perform additional work to obtain proper compaction if in-place densities do not meet specified densities at no additional cast to the OWNER.

D. Protection of Fill

1. The CONTRACTOR shall take the necessary steps to avoid disturbance of subgrade and underlying soils during excavation and backfilling operations. Procedures for excavating and backfilling shall be revised as necessary to avoid disturbance of subgrade and underlying soils, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering, and other acceptable control measures. Disturbance shall include the deterioration of backfill (after placement and satisfactory compaction) due to the Contractor's operations, such as moving equipment, hauling trucks, etc. All excavated or backfilled areas or subgrades that become disturbed during construction shall be removed and replaced with acceptable materials.

2. Prevent materials below constructed foundations from freezing. Materials that become frozen shall be removed and replaced, including foundations, at no additional cost to the OWNER.

3. At the completion of Work, all ground surfaces shall be left in a firm, stable, unyielding, reasonably uniform condition, free of ruts and surface irregularities, in accordance with grading requirements shown on the Drawings.

3.07 GRADING:

A. Grading: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Structure Lines: Grade areas adjacent to structure to drain away from structures and to prevent ponding.

C. Finish surfaces free from irregular surface changes and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

Pavements: Shape areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required top of base gravel elevation.

Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces as required.

3.08 EROSION CONTROL: Provide erosion control measures as specified in Section 31 25 13 and as shown on Drawings.

3.09 MAINTENANCE:

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during warranty period; remove surface, base gravel, fill material, and add required backfill material, compact, and replace surface. Restore appearance, quality, and condition of surface to match adjacent work, and eliminate evidence of restoration work to greatest extent possible.

3.12 DISPOSAL OF EXCESS MATERIALS: Remove excess excavated material and dispose of it off-site in a lawful manner, unless otherwise directed by ENGINEER.

END OF SECTION 312000

R E P O R T

February 25, 2016

15-1382

Explorations and Geotechnical Engineering Services

Proposed Canal Plaza
Middle Street and Union Street
Portland, Maine

Prepared For:
Canal Plaza One, LLC
c/o East Brown Cow Management
Attention: Denine Leeman
100 Commercial Street
Portland, Maine 04101

Prepared By:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, Maine 04039
T: (207) 657-2866

S.W.COLE ENGINEERING, INC.

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February 25, 2016

Canal Plaza One, LLC
c/o East Brown Cow Management
Attention: Denine Leeman
100 Commercial Street
Portland, Maine 04101

Subject: Explorations and Geotechnical Engineering Services
Proposed Canal Plaza
Middle Street & Union Street
Portland, Maine

Dear Denine:

In accordance with our Agreement, dated January 4, 2016, 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 Attachment 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 geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included six test boring explorations, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The site is located at the intersection of Middle Street and Union Street in Portland, Maine and consists of an open plaza area centered between three multi-story office towers. We understand development plans call for construction of a heated, single-story building in the northern portion of the plaza. Additionally, we understand proposed

plaza improvements will include a rectangular canopy attached to the building, repaving of the plaza area with stone pavers, reconstruction of steps, retaining walls and drainage upgrades. Existing and proposed site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Six test borings (B-1 through B-6) were made at the site on January 12, 2016 by S. W. Cole Explorations, LLC, a subsidiary of S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected by the design team and established in the field by S.W.COLE adjusting to avoid subsurface conflicts as needed. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the test borings are attached as Sheets 2 through 7. A key to the notes and symbols used on the logs is attached as Sheet 8.

Woodard & Curran personnel were also present during exploration work to observe and environmentally screen soil samples.

2.2 Testing

The explorations were made using hollow-stem auger drilling techniques. Soil samples were obtained at 2 to 5 foot intervals using a split-spoon sampler and Standard Penetration Testing (SPT) methods. SPT blow counts results are shown on the logs. Soil samples obtained from the explorations were returned to our laboratory for further classification.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site consists of an open plaza area surrounded by office buildings to the south, east and west, and Middle Street to the north. The plaza is relatively flat and level at approximately elevation 53 feet (project datum) and is surfaced with brick pavers and concrete slabs. Several raised landscape planters are present in the plaza. Subsurface utilities including drainage, electrical and communications cross the plaza area.

Based on available historical mapping, we understand the site was within the burnt area of the 1866 Great Fire of Portland. Additionally, we understand the site was previously occupied by a large hotel structure which was razed in the mid 1900's in favor of the current site development.

3.2 Soil and Bedrock

Underlying surficial brick pavers and concrete slabs, the borings generally encountered a soils profile consisting of uncontrolled fill overlying glacial till and refusal surfaces (probable bedrock). The principal strata encountered are summarized below; refer to the attached logs for more detailed subsurface information. Not all the strata were encountered at each exploration.

Uncontrolled Fill: The borings encountered uncontrolled fill extending to depths varying from about 9 to 16 feet. The uncontrolled fill consists of loose to medium dense, brown, gray-brown, and black sand with varying portions of silt, gravel, black ash/slag, concrete and bricks. The ash appeared more concentrated in the upper 5 feet of fill. Rubble (probable concrete or relic foundations) was encountered in the fill at boring B-3 at a depth of about 5 to 9 feet. Boring B-4 encountered loose, reworked glacial till at a depth of about 10 to 13 feet.

Glacial Till: Underlying the uncontrolled fill, borings B-4, B-5 and B-6 encountered glacial till at depths of 13 to 16 feet. The glacial till consists of medium dense, brown to gray-brown silty sand with varying portions of gravel. Boring B-6 was terminated in the glacial till at a depth of 17 feet.

Bedrock: Underlying the uncontrolled fill and glacial till, borings B-1 through B-5 encountered bedrock at depths varying from 9 to 20 feet. A surficial layer of weathered bedrock was penetrated by as much as 4 feet before encountering refusal on probable sound bedrock.

3.3 Groundwater

The soils encountered at the test borings were damp to moist below depths of 3 to 5 feet. Saturated soils and free water were not encountered in the test borings. Groundwater likely become seasonally perched on the relatively impervious glacial till and bedrock encountered in the test borings. Long term groundwater information is not available. It

should be anticipated that seasonal groundwater levels will fluctuate, particularly in response to snowmelt, precipitation, and changes in site use.

3.4 Frost and Seismic

The 100-year Air Freezing Index for the Portland, Maine area is about 1,290-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the subsurface findings, we interpret the site soils to correspond to Seismic Soil Site Class D according to 2012 IBC/ASCE 7.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations are:

- The site is underlain by a layer of uncontrolled fill which extended to depths varying from about 9 to 16 feet at the borings. The uncontrolled fill is unsuitable for support of the proposed foundations. Options to mitigate the uncontrolled fill include overexcavation and replacement or use of a deep foundation system, such as micropiles.

- The uncontrolled fill should be densified below the interior on-grade floor slab, any new exterior slabs and the exterior plaza areas receiving new pavers. The interior slab-on-grade should bear on at least 12-inches of properly compacted Structural Fill overlying the densified subgrade.

- Excavation will encounter uncontrolled fill containing ash, brick, rubble, and potentially relic foundations. Handling and disposing of ash and excavation spoils must follow appropriate environmental regulations and recommendations from the project environmental consultant.

- Imported Structural Fill and Crushed Stone are recommended for fill and backfill. Flowable fill may be used to backfill deeper overexcavations.

4.2 Site and Subgrade Preparation

We recommend site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Existing pavements, drainage structures, and subsurface utilities should be completely removed from below the proposed building. Uncontrolled fills should be removed from beneath proposed footings supporting the new building and canopy, unless deep foundations are used. Excavations resulting from demolition and overexcavations should be backfilled with compacted Structural Fill or Flowable Fill.

Footing Subgrades: As discussed, one option to mitigate the existing uncontrolled fill below the proposed building is overexcavation and replacement. If this option is selected, we recommend that the uncontrolled fill be completely removed from beneath the proposed foundations until undisturbed native soils or bedrock are encountered. The overexcavation should be oversized 0.5 foot laterally away from footing edges for each vertical foot of overexcavation. The overexcavation should be backfilled with compacted Structural Fill or Flowable Fill. Alternatively, a deep foundation system such as micropiles or drilled shafts extending to undisturbed glacial till or bedrock may be used for foundation support, which would not require removal of uncontrolled fills.

Slab and Paver Subgrades: The uncontrolled fill should be proof-rolled and densified below on-grade slabs and pavers with 3 to 5 passes of a vibratory roller having a static weight of at least 5 tons. Areas of subgrade that yield or become soft after proof-rolling or are observed to have voided rubble should be overexcavated and replaced with compacted Structural Fill.

4.3 Excavation and Dewatering

Excavation work will generally encounter existing pavements, uncontrolled fill with ash and rubble, glacial till and bedrock. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should ideally occur during drier, non-freezing weather of Spring, Summer and Fall. Final cuts to subgrade in soils should be performed with a smooth-edged bucket to help minimize soil disturbance. Excavation in weathered bedrock may require hoe-ramming and a toothed bucket.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. Controlling the water levels to at least one foot below planned excavation

depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways.

The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor. Handling and disposal of on-site soils must follow all regulations and recommendations set forth by the project environmental consultant.

4.4 Foundations

Foundation options for the proposed structure include spread footings bearing on compacted Structural Fill or Flowable Fill following removal and replacement of uncontrolled fill, or a deep foundation system such as micropiles or drilled shafts.

4.4.1 Spread Footings

For spread footing foundations bearing in properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

Geotechnical Parameters for Spread Footings and Foundation Walls	
Design Frost Depth	4.5 feet
Net Allowable Bearing Pressure	3.0 ksf
Base Friction Factor	0.35
Total Unit Weight of Backfill	125 pcf
Internal Friction Angle of Backfill	30°
At-Rest Lateral Earth Pressure Coefficient	0.5
Seismic Soil Site Class (2012 IBC/ASCE 7)	D

Considering the uncontrolled fill will be removed and replaced below spread footings, we recommend design consider ½-inch total and differential settlement across the building pad.

4.4.2 Deep Foundations

The proposed structure may derive support from micropiles or drilled shafts extending to dense glacial till or bedrock. The contractor should be aware that rubble and relic foundations are present within the uncontrolled fill layer which likely precludes the use of helical screw piles or resistance piers. A deep foundation option could also be integrated with an insulated foundation to reduce the volume of ash removal from the

site. S.W.COLE is available to provide detailed recommendations for micropiles, drilled shafts and insulated foundations as deemed necessary by the design team.

4.5 Foundation Drainage

We recommend an underdrain system be installed on the outside edge of perimeter footings. The underdrain should consist of a 4-inch slotted HDPE pipe enveloped in underdrain sand. The pipe may have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive drainage away from the building. General underdrain details are illustrated on Sheet 9.

4.6 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 100 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.

4.7 Entrance Slabs and Sidewalks

Entrance slabs and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend non-frost susceptible Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance and plaza slabs. This thickness of Structural Fill should extend the full width of the entrance slab and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope. General details of this frost transition zone are attached as Sheet 9.

4.8 Backfill and Compaction

The on-site soils are unsuitable for reuse in building and paved areas, but may be reused in landscape areas. For building and paved areas, we recommend the following fill and backfill materials:

Structural Fill: Backfill for overexcavations, backfill to repair soft areas, backfill for foundations, slab and paver base material and material below exterior entrances and sidewalks 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 5

Flowable Fill: Flowable fill, used to backfill overexcavations should be a sand-cement slurry with a maximum compressive strength of 150 psi (excavatable mix).

Underdrain Sand: Drainage aggregate for underdrains should be clean, free-draining sand meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Aggregate Type B.

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.

4.9 Weather Considerations

Earthwork and foundation construction should be limited during wet and freezing weather and the site soils may require drying 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 Paved Plaza Area

We understand stone pavers will replace the brick pavers installed in the plaza area. We anticipate pavement subgrade will consist of uncontrolled fill. The uncontrolled fill should be proof-rolled and densified with 3 to 5 passes of a vibratory roller having a static weight of at least 5 tons. Areas of subgrade that yield or become soft after proof-rolling or are observed to have voided rubble should be overexcavated and replaced with compacted Structural Fill. In order to help reduce potential frost action, we recommend installing Maine DOT 703.06 Type B below the pavers to a depth of 30 inches below finished grade. A leveling course of finer material may be provided directly under the pavers, as recommended by the product supplier.

4.11 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents 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 foundation bearing surfaces and earthwork activities, as well as testing services for soils, concrete, asphalt, steel and spray-applied fireproofing construction materials.

5.0 CLOSURE

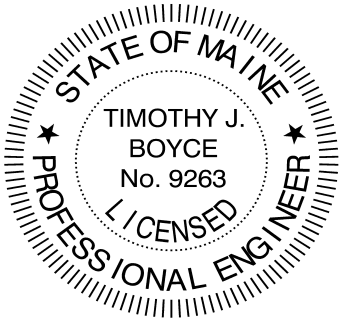
It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

Evan M. Walker Pierre, P.E.
Geotechnical Engineer

Timothy J. Boyce, P.E.
Senior Geotechnical Engineer



EMW:tjb

Attachment A
Limitations

This report has been prepared for the exclusive use of Canal Plaza One, LLC for specific application to the proposed Canal Plaza Café at Middle Street and Union Street in Portland, 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.

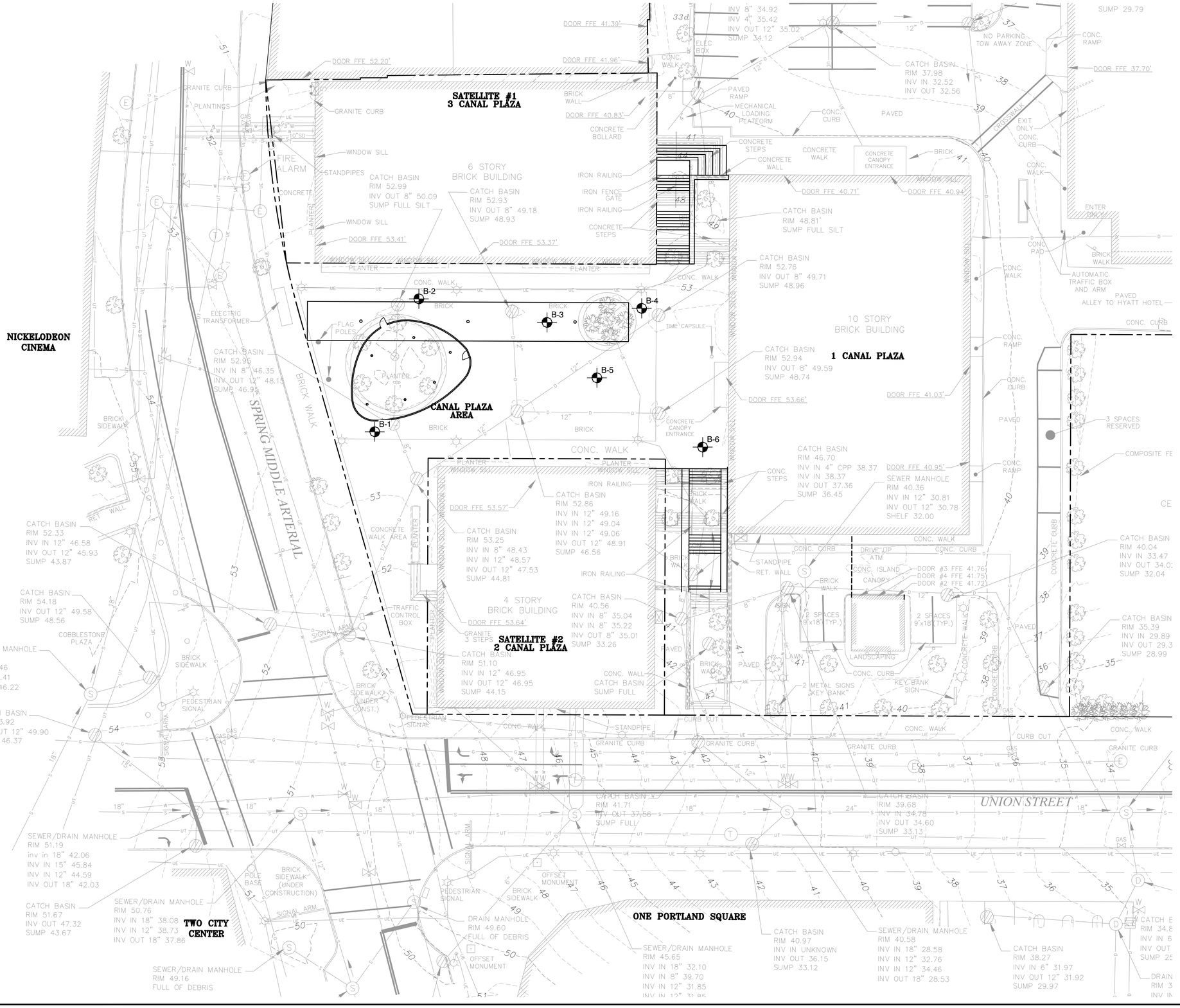
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

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.



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN PROVIDED BY WOODARD & CURRAN, RECEIVED VIA E-MAIL 1/13/2016.
2. THE BORING LOCATIONS WERE PROVIDED BY WOODARD & CURRAN AND ESTABLISHED IN THE FIELD BY S. W. COLE ENGINEERING, INC. BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
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 20 40 Feet

S.W.COLE ENGINEERING, INC.

CANAL 1 LLC

EXPLORATION LOCATION PLAN

PROPOSED CANAL PLAZA
MIDDLE STREET
PORTLAND, MAINE

Job No.:	15-1382	Scale:	1" = 20'
Date :	01/15/2016	Sheet:	1

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-1**
SHEET: 1 OF 1
PROJECT NO.: 15-1382

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST BELOW 5' +/-
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									10"	BRICK / CONCRETE
									1.5'	GRAY-BROWN SILTY SAND, SOME GRAVEL (FILL) ~ MEDIUM DENSE ~
	1D	24"	16"	3.0'	4	7	10	10		
										BROWN SILTY SAND AND BLACK ASH, WITH RED BRICK (FILL)
	2D	24"	8"	5.0'	10	11	12	14	5.0'	~ MEDIUM DENSE ~
	3D	24"	18"	7.0'	3	3	5	8		BROWN SILT AND SAND, SOME GRAVEL, WITH RED BRICK (FILL)
										~ LOOSE ~
									9.2'	
									10.2'	PROBABLE WEATHERED BEDROCK - ADVANCE BY AUGER
										REFUSAL @ 10.2'
										PROBABLE BEDROCK

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-1**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-2**
SHEET: 1 OF 1
PROJECT NO.: 15-1382
DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS DAMP BELOW 5' +/-
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									6"	BRICK / CONCRETE
									1.5'	BROWN SAND, SOME SILT (FILL) ~ MEDIUM DENSE ~
	1D	24"	20"	2.6'	7	6	12	9		DARK BROWN SILTY SAND AND BLACK ASH WITH RED BRICK (FILL)
	2D	24"	16"	4.6'	7	6	8	25	5.0'	~ MEDIUM DENSE ~
	3D	24"	16"	7.0'	6	4	4	8		BROWN TO DARK BROWN SILTY SAND, SOME GRAVEL, WITH RED BRICK (FILL) ~ LOOSE ~
									10.0'	
	4D	9"	9"	10.8'	17	50-3"				PROBABLE WEATHERED BEDROCK - ADVANCE BY AUGER
									13.9'	
										REFUSAL @ 13.9' PROBABLE BEDROCK

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-2**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-3**
SHEET: 1 OF 1
PROJECT NO.: 15-1382

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST BELOW 4' +/-
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									2"	BRICK PAVERS
									1.5'	GRAY-BROWN TO BROWN SAND, SOME SILT (FILL) ~ MEDIUM DENSE ~
	1D	24"	18"	2.5'	6	8	8	10		
										LAYERED BROWN SILTY SAND AND BLACK ASH WITH RED BRICK (FILL)
	2D	24"	18"	4.5'	9	9	19	14	5.0'	~ MEDIUM DENSE ~
	3D	15"	14"	7.0'	14	14	50-3"			
										PROBABLE CONCRETE / RUBBLE TO 9' : PENETRATE WITH SOLID STEM AUGER
										GRAY-BROWN GRAVELLY SILTY SAND WITH BRICK AND CONCRETE (FILL)
	4D	24"	18"	12.0'	25	26	32	24		<BLOWS OVERSTATED DUE TO RUBBLE>
										~ MEDIUM DENSE ~
									15.0'	
	5D	24"	16"	17.0'	27	38	32	52	17.0'	WEATHERED BEDROCK
										BOTTOM OF EXPLORATION @ 17.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-3**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-4**
SHEET: 1 OF 1
PROJECT NO.: 15-1382
DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS DAMP BELOW 3' +/-
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									7"	BRICK / CONCRETE
									1.0'	BROWN SAND, SOME SILT, SOME GRAVEL (FILL) ~ LOOSE ~
	1D	24"	16"	2.6'	3	3	2	5		
										BROWN SAND, SOME SILT, SOME GRAVEL,
	2D	24"	12"	4.6'	6	5	4	4	5.0'	WITH BLACK ASH AND RED BRICK (FILL) ~ LOOSE ~
	3D	24"	15"	7.0'	5	4	4	4		BROWN SILTY SAND, SOME GRAVEL, WITH RED BRICK (FILL)
										~ LOOSE ~
									10.0'	
	4D	24"	16"	12.0'	2	1	2	2		BROWN SILTY SAND, TRACE GRAVEL (REWORKED GLACIAL TILL - FILL) ~ LOOSE ~
									13.0'	INCREASED AUGER RESISTANCE @ 13'
	5D	24"	18"	17.0'	9	11	12	14		GRAY-BROWN SILTY SAND, SOME GRAVEL, WITH WEATHERED BEDROCK FRAGMENTS (GLACIAL TILL)
										~ MEDIUM DENSE ~
									20.0'	
										PROBABLE WEATHERED BEDROCK
	6D	24"	5"	22.0'	29	22	31	34	22.0'	
										BOTTOM OF EXPLORATION @ 22.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-4**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-5**
SHEET: 1 OF 1
PROJECT NO.: 15-1382
DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									9"	BRICK / CONCRETE
									1.6'	BROWN SAND, SOME SILT, SOME GRAVEL (FILL)
	1D	24"	20"	2.5'	14	16	24	18		BLACK ASH/SLAG AND RED BRICK (FILL)
	2D	24"	16"	4.5'	10	8	15	13	4.5'	~ MEDIUM DENSE ~
									6.0'	BROWN FINE TO MEDIUM SAND, SOME SILT ~ LOOSE ~ (FILL)
	3D	24"	18"	7.0'	4	3	2	5		GRAY-BROWN AND DARK BROWN GRAVELLY SILTY SAND WITH CONCRETE, BRICK, AND ASH (FILL)
	4D	24"	4"	12.0'	7	4	2	4		~ LOOSE ~
									14.0'	
										BROWN SAND, TRACE SILT (PROBABLE FILL)
									15.8'	~ LOOSE ~
	5D	24"	20"	17.0'	2	2	10	26	16.5'	GRAY-BROWN GRAVELLY SILTY SAND (GLACIAL TILL)
									17.0'	WEATHERED BEDROCK
										BOTTOM OF EXPLORATION @ 17.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-5**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-6**
SHEET: 1 OF 1
PROJECT NO.: 15-1382
DATE START: 1/12/2016
DATE FINISH: 1/12/2016
ELEVATION: 53' +/-
SWC REP.: E. WALKER

PROJECT: PROPOSED CANAL PLAZA
CLIENT : CANAL PLAZA 1 LLC
LOCATION: MIDDLE STREET AND UNION STREET, PORTLAND, MAINE
DRILLING FIRM: S.W. COLE EXPLORATIONS, LLC DRILLER: KEVIN HANSCOM

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	2 1/4"		
SAMPLER:	SS	1 3/8"	140 LBS.	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS DAMP BELOW 3' +/-

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4.25"	CONCRETE
									1.5'	BROWN SAND, TRACE SILT, TRACE GRAVEL (FILL)
	1D	24"	16"	2.5'	2	3	4	7		
										DARK BROWN TO BROWN SILTY SAND, TRACE GRAVEL
	2D	24"	16"	4.5'	9	8	6	4	5.0'	WITH BLACK ASH AND RED BRICK (FILL) ~ MEDIUM DENSE ~
	3D	24"	16"	7.0'	3	3	5	8		BROWN TO DARK BROWN SILTY SAND WITH RED BRICK (FILL)
										~ LOOSE TO MEDIUM DENSE ~
	4D	24"	0"	12.0'	10	13	12	12		<NO RECOVERY @ SAMPLE 4D - PUSHING BRICK OR RUBBLE>
									15.0'	
	5D	24"	20"	17.0'	13	14	15	19	17.0'	BROWN SILTY SAND, SOME GRAVEL, WITH WEATHERED BEDROCK FRAGMENTS (GLACIAL TILL) ~ MEDIUM DENSE ~
										BOTTOM OF EXPLORATION @ 17.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

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BORING NO.: **B-6**

KEY TO THE 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+%

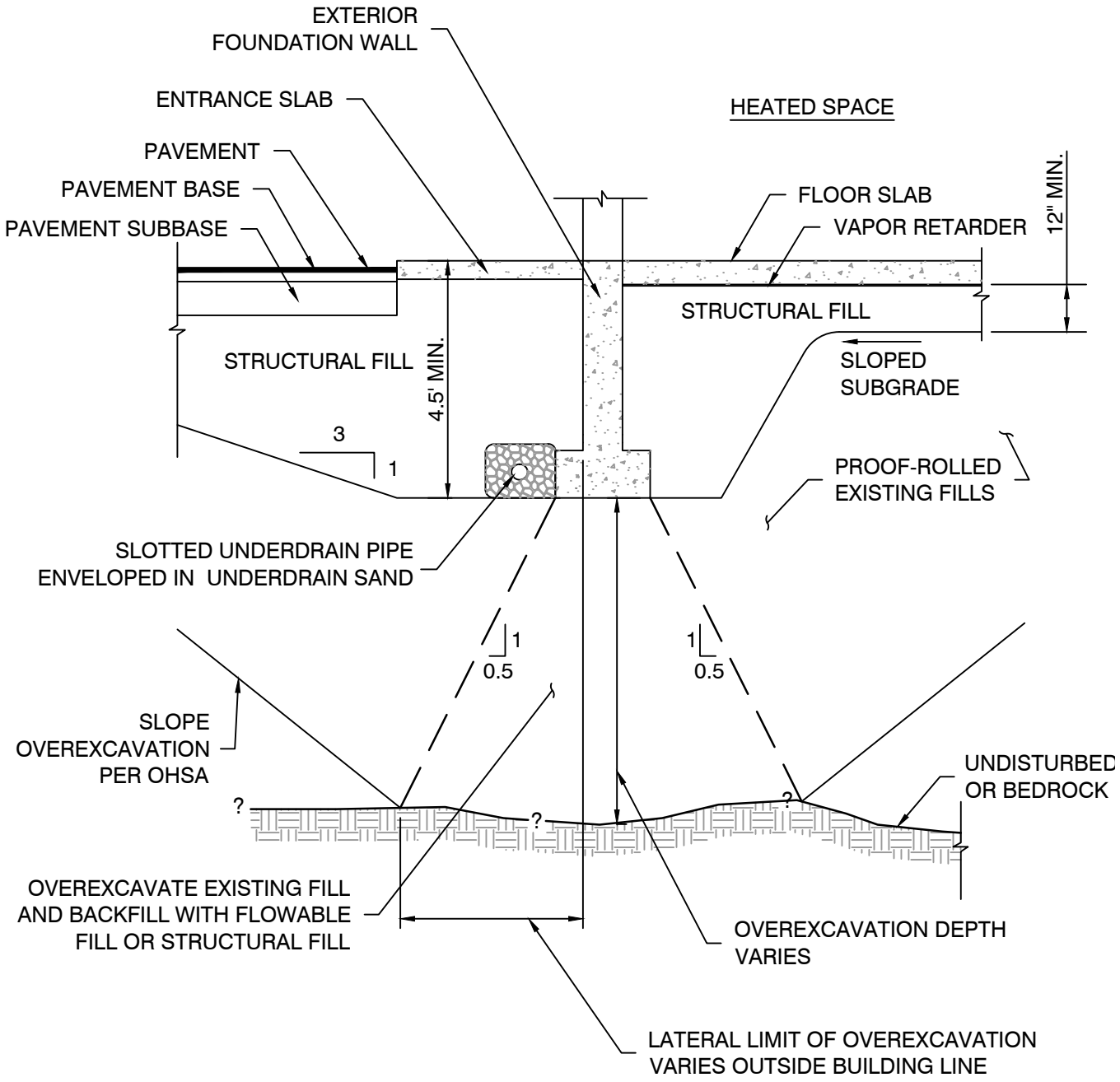
Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to ½" 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.



NOTE:

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.

2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.

S.W.COLE ENGINEERING, INC.

CANAL PLAZA 1 LLC

UNDERDRAIN DETAIL

PROPOSED CANAL PLAZA
MIDDLE STREET
PORTLAND, MAINE

Job No.:	15-1382	Scale:	Not to Scale
Date :	02/12/2016	Sheet:	9