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.

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

www.swcole.com

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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

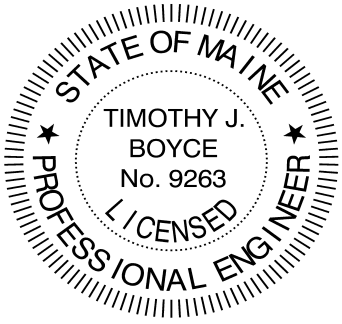
It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

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.

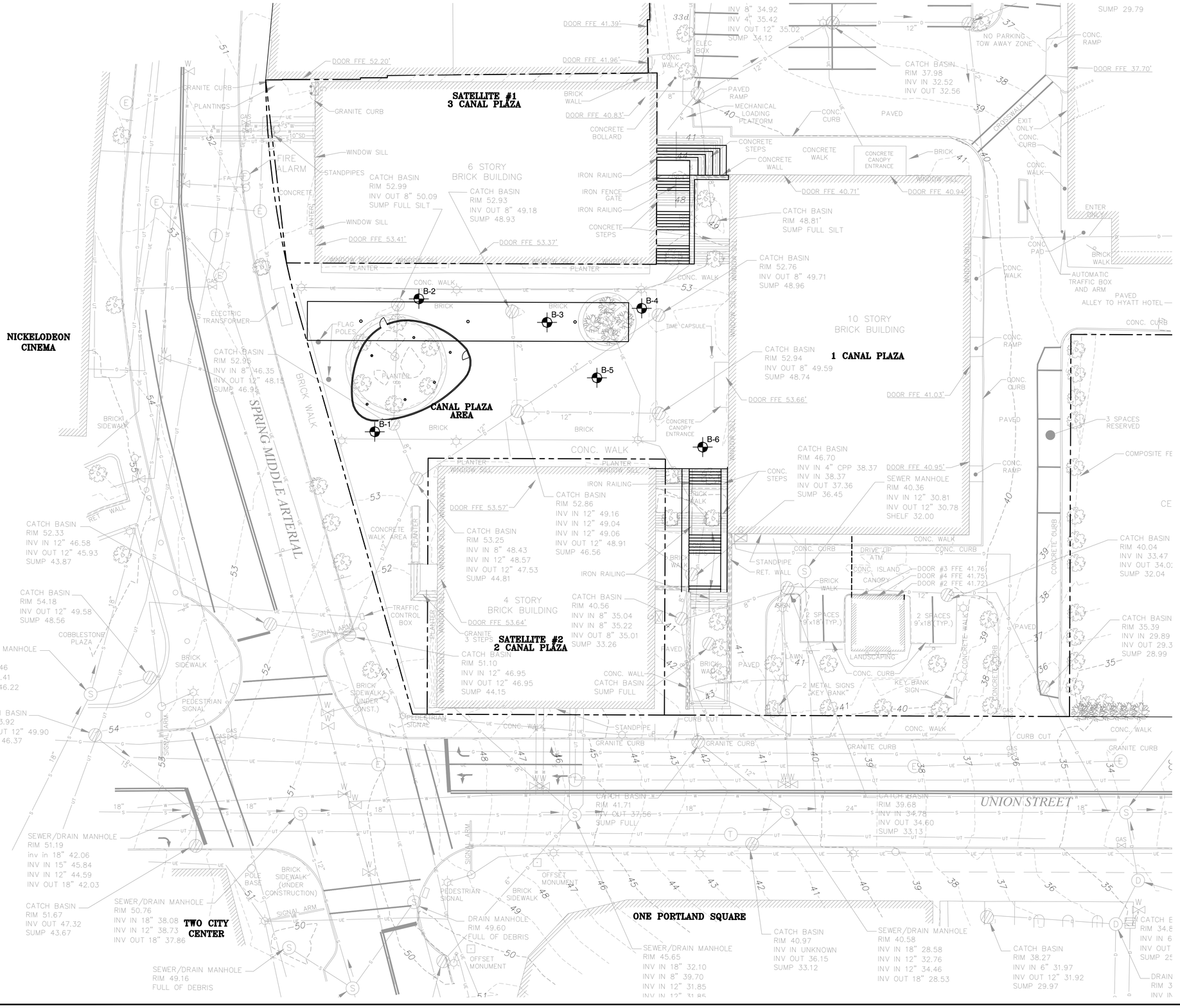
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

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

K:\2015\15-1382\CAD\Drawings\15-1382 EXP.dwg, 1/15/2016 3:15:54 PM, 1:1, CEM, S. W. Cole Engineering, Inc.

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

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

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+%

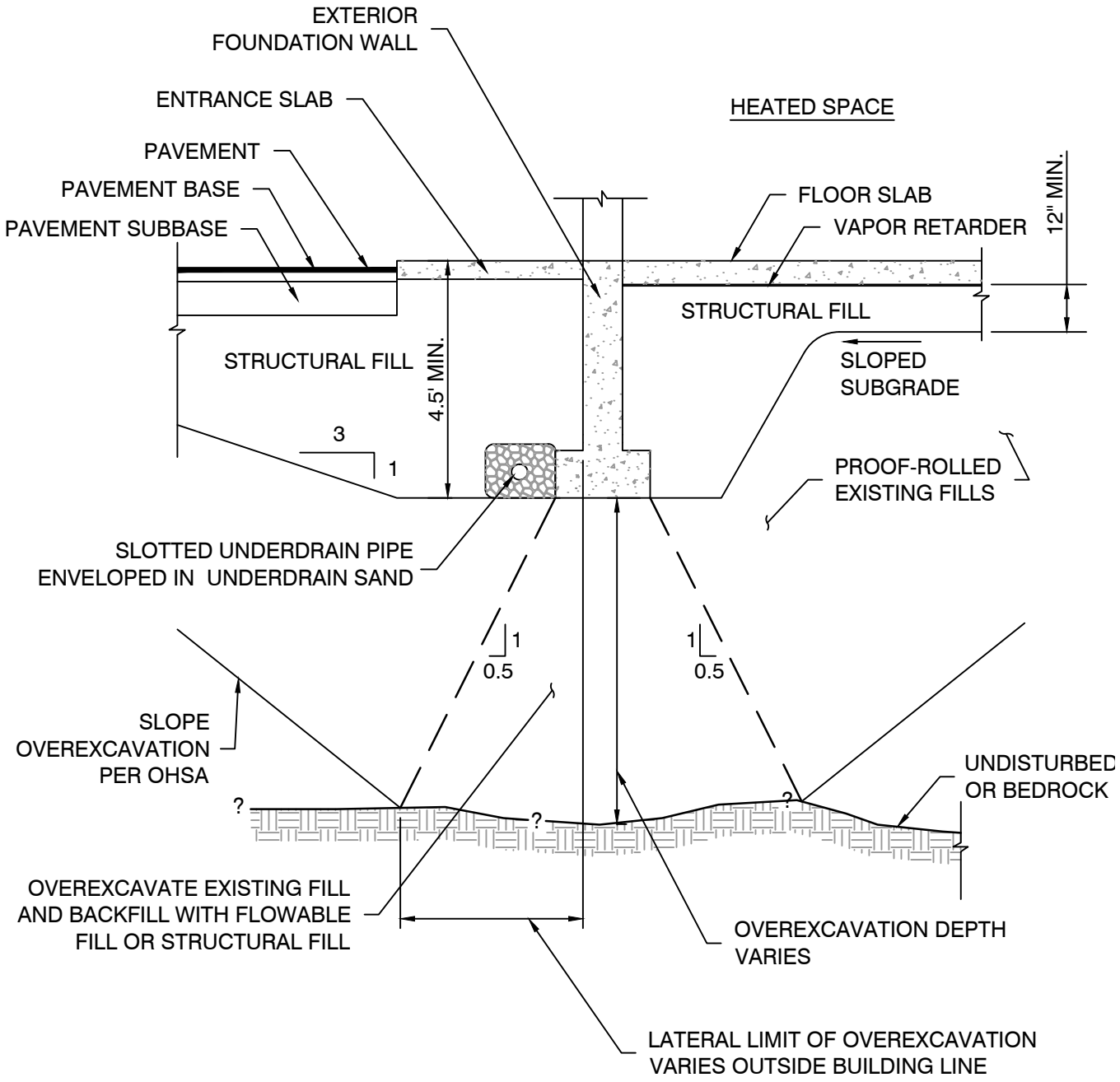
Description of Stratified Soils

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

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