REPORT

16-0128

July 24, 2017

Explorations and Geotechnical Engineering Services

Northeast Airmotive
Proposed Hangar
1011 Westbrook Street
Portland, Maine

Prepared For:
Northeast Airmotive
Attention: Mark Goodwin, General Manager
1011 Westbrook Street
Portland, ME 04102

Prepared By:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, ME 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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July 24, 2017

Northeast Airmotive
Attention: Mark Goodwin, General Manager
1011 Westbrook Street
Portland, ME 04102

Subject: Explorations and Geotechnical Engineering Services
Proposed Hangar
1011 Westbrook Street
Portland, Maine

Dear Mark:

In accordance with our Proposal, dated May 22, 2017, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

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

1.2 Site and Proposed Construction

The site is located on the easterly side of Westbrook Street, north of the existing Northeast Air Terminal building. The site is currently occupied by the existing North Hangar (Hangar 1101).

We understand development plans call for demolition of the existing North hangar and construction of a new hangar. Based on a site plan provided by Grant Hays Associates including proposed exploration locations by Sebago Technics (project civil engineer) and Allied Engineering (project structural engineer), we understand the new hangar will have a footprint on the order of 80 by 100 feet in plan dimensions and will be about 40 feet in height. Structural loading information is not available at this time, but we understand the east and west wall lines will be bearing walls, supporting an 80 foot clear span. We also understand column spacing may be on the order of 25 feet on center along the east and west wall lines. We anticipate the new concrete floor elevation will match the existing structure. We understand the building will be heated to approximately 55 degrees during the cold months. Existing and proposed grading is not available at this time.

The existing and proposed hangar locations are shown on the “Exploration Location Plan” attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Five test borings (B-1 through B-5) were made at the site on June 27, 2017. The test borings were made by S. W. Cole Explorations, LLC a subsidiary of S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected by others and established in the field by S.W.COLE using a proposed exploration location plan provided by Grant-Hays Associates and measurements from existing site features. Three backhoe-dug test pits were proposed along the westerly side of the existing hangar, but were eliminated due to potential conflict with subsurface utilities and were replaced with a test boring (B-5). Some of the proposed test boring exploration locations were shifted due to either on-site obstructions or subsurface utility conflicts. Logs of the test borings are attached in Appendix C. A key to the notes and symbols used on the logs is attached

in Appendix C. Elevations shown on the boring logs were estimated based on ground surface contours shown on a Concept Site Plan prepared by Sebago Technics, Inc.

2.2 Testing

The test borings were drilled using hollow-stem augers. The soils were sampled at 2 to 5 foot intervals using a split-spoon sampler and Standard Penetration Testing (SPT) techniques. SPT blow counts are shown on the logs. The results of field pocket penetrometer tests (PPT) are noted on the logs.

Soil samples obtained from the test boring explorations were returned to our laboratory for further classification and testing. The results of two laboratory gradations are attached in Appendix D. Soil moisture content test results are shown on the boring logs.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Surficial

The site of the proposed hangar is approximately the same footprint as the existing hangar. Paved areas exist adjacent to the north, east and south sides of the site. A grassed area exists adjacent to the west side of the site, between the proposed hangar and Westbrook Street. The ground surface elevation varies from about 62 to 64 feet on the west side and is about elevation 60 feet on the north, east and south sides.

3.2 Soil and Bedrock

The principal strata encountered in the proposed additions is summarized below. Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

Below the surficial pavement or topsoil, the explorations generally encountered loose to medium dense pavement base and mixed granular fill extending to depths of about 1 to 7 feet below the ground surface; deepest at boring B-5. Below the fills, borings B-1 through B-4 encountered very stiff to medium brown silty clay extending to depths of about 6 to 10.5 feet below the ground surface. Below the silty clay and the fill at boring B-5, the explorations encountered medium dense to loose silty sand with varying portions of clay and fine gravel which transitions to medium dense gray sand with varying portions of silt and gravel (till-like soil) at each exploration except B-4. Probable weathered bedrock surfaces were met at

depths varying from about 11.5 to 16.1 feet below the ground surface at the explorations. The hollow-stem augers were used to penetrate the probable weathered bedrock and were terminated (practical refusal) at depths varying from about 12.5 to 16.8 feet below the ground surface.

3.3 Groundwater

In general, the soils encountered at the test borings were moist from the ground surface. Saturated soils were generally encountered at depths of about 8 to 10 feet at the explorations at the time of drilling. Groundwater likely becomes seasonally perched on the relatively impermeable silty clay encountered in the explorations. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

3.4 Frost and Seismic

The 100-year Air Freezing Index for the Portland, Maine area is about 1,407-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the subsurface findings, in accordance with IBC 2009, we interpret the site soils to correspond to Seismic Soil Site Class D.

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:

- Spread footing foundations and on-grade floor slabs bearing on properly prepared subgrades appear appropriate for the proposed hangar construction. All spread footings should bear on at least 12 inches of compacted Crushed Stone wrapped in a non-woven geotextile fabric such as Mirafi 160N overlying native, undisturbed stiff silty clay.

- We recommend all existing fills be removed from beneath the proposed hangar footprint to expose undisturbed, native stiff silty clay.

- An exterior perimeter foundation underdrain should be provided within the Crushed Stone layer recommended below the footings, but outside the bearing splay of the footing.

- Imported Structural Fill, Crushed Stone and Gravel Borrow will be needed for construction. The existing fill and native silty clay soils are unsuitable for reuse as fill or backfill in building and pavement areas.

- Imported Structural Fill and Gravel Borrow can be used as granular backfill in the depression left after removal of the existing foundations and fills, where needed.

- Geotextile fabric may be needed on the exposed slab and paved area subgrades prior to placing new compacted fills, depending upon subgrade conditions at the time of construction.

- Consideration can be given to providing rigid subgrade insulation adjacent to the inside face of perimeter foundation walls and below the floor slab to help reduce thermal conductivity.

- A representative of S.W.COLE should observe subgrades prior to placing new fills and concrete.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

All topsoil, disturbed soils, pavements, fill soils, foundations, slabs and utilities must be completely removed from beneath the proposed building area to expose undisturbed, native stiff silty clay. Any over-excavation should occur downward and outward at a 1H:1V bearing splay from the edge of foundations. S.W.COLE should observe exposed subgrades prior to placement of geotextile fabric, new fills and footings.

All topsoil, foundations and any disturbed, unsuitable fill should be removed from below the

proposed paved areas. Pavement subgrades consisting of existing granular fills should be proof-rolled with 3 to 5 passes of a vibratory roller having a static weight of at least 5 tons. Areas which become soft or yielding should be over excavated and replaced with compacted Structural Fill or Gravel Borrow. S.W.COLE should observe the proof-rolling. Pavement subgrades which consist of native silty or clayey soil should be excavated with a smooth edged bucket and left undisturbed. Woven geotextile fabric may be needed over silty or clayey pavement subgrades.

4.3 Excavation and Dewatering

Excavation work will generally encounter pavement, topsoil, granular and mixed fill and silty clay. Saturated soils and groundwater will likely be encountered with depth and during periods of precipitation and/or snowmelt. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier Summer and Fall seasons. Construction equipment should not operate directly on the native subgrade soils. Final cuts to subgrade elevation in soil should be performed with a smooth-edged bucket to help reduce soil disturbance.

Sumping and pumping dewatering techniques should be adequate to control groundwater in shallower excavations. Controlling the water levels to at least 1 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.

4.4 Foundations

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

Geotechnical Parameters for Spread Footings and Foundations Walls	
Design Frost Depth	4.5 feet
Net Allowable Soil Bearing Pressure	3 ksf
Base Friction Factor	0.4 (Crushed Stone)
Seismic Soil Site Class	D (IBC 2009)
Total Unit Weight of Backfill	130 pcf (Structural Fill)
At-Rest Lateral Earth Pressure Coefficient	0.5 (Structural Fill)
Internal Friction Angle of Backfill	32° (Structural Fill)
Estimated Total Settlement	1 inch or less

Footings should be at least 24 inches in width regardless of bearing pressure.

4.5 Foundation Drainage

We recommend an underdrain system be installed within the outside edge of the geotextile fabric wrapped Crushed Stone layer recommended below perimeter footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe. The underdrain system must have positive gravity outlet(s) protected from freezing, clogging and backflow. Surface grades should be sloped away from the buildings for positive surface water drainage. A general underdrain detail is illustrated in Appendix B.

4.6 Slabs-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 120 pci (pounds per cubic inch) provided the slab is underlain by at least 18-inches of compacted Structural Fill overlying 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 buildings 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 shall 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. Rigid insulation can be considered beneath the vapor barrier for slab-on-grade areas to help reduce heat loss. 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 that non-frost susceptible Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width and length of the entrance slab, 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 in Appendix B.

4.8 Backfill and Compaction

Based on the findings at the explorations, the existing mixed fill and silty clay soils are not suitable for reuse as fill or backfill in building or paved areas. However, some of the existing granular fill encountered directly beneath the pavements is likely suitable for subgrade fill (Gravel Borrow). We recommend the following fill and backfill materials for use during construction:

Structural Fill: Clean, non-frost susceptible, sand and gravel, free of organics and other deleterious materials meeting the following gradation:

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

Structural Fill is recommended for:

- Subgrade fill to raise proposed building and paved areas
- Backfill for foundations
- Slab-on-grade base material
- Backfill within the frost-free transition zones for building entrances and sidewalks

Crushed Stone: Crushed Stone used around underdrains and beneath all footings should consist of crushed rock meeting the gradation requirements of the MDOT Standard Specifications 703.22 “Underdrain Backfill Type C”.

Gravel Borrow: Gravel Borrow should meet the gradation requirements for MDOT 703.20. Gravel Borrow can be used as subgrade fill beneath paved and landscaped areas (non-building areas), as needed.

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 be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted in loose lifts not exceeding 12-inches with 2 to 4 passes of a vibratory plate compactor with a static weight of at least 500 lbs.

4.9 Paved Areas

We anticipate that the paved parking lot will be subjected primarily to passenger car traffic. We offer the following pavement sections for your consideration. The materials are based on Maine Department of Transportation Specifications.

Standard Duty Pavement (Passenger Car and Light Delivery Truck Traffic)	
Maine DOT 9.5 mm Superpave 703.09 (50 gyration design)	1.25 Inches
Maine DOT 19.0 mm Superpave 703.09 (50 gyration design)	2.25 Inches
Maine DOT Crushed Aggregate Base 703.06 Type A	6 Inches
Maine DOT Aggregate Subbase 703.06 Type D	12 Inches

Bituminous pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. Tack coat is recommended between lifts of asphalt pavement. Base and subbase materials should be compacted according to Section 4.8. Paved areas should be graded to promote surface drainage away from structures. Geotextile fabric may be needed on silty clay subgrades if soft or wet areas exist.

Frost penetration can be on the order of 4.5 feet or more in this area. In the absence of full depth excavation of frost susceptible soils or use of insulation, frost will penetrate into the subgrade and some frost heaving and pavement distress must be anticipated.

4.10 Weather Considerations

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

4.11 Design Review and Construction Testing

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

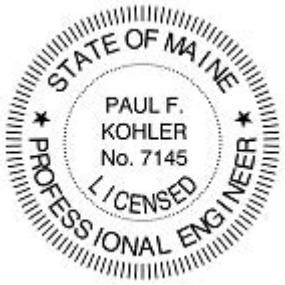
A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe preparation of subgrades for foundations and pavements as well as testing services for soils, concrete, asphalt, steel 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.



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

PFK:rec

C: Grant-Hays – Mike Hays
Sebago Technics, Inc. – Owens McCullough

Appendix A
Limitations

This report has been prepared for the exclusive use of Northeast Airmotive for specific application to the proposed Hangar at 1101 Westbrook 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.

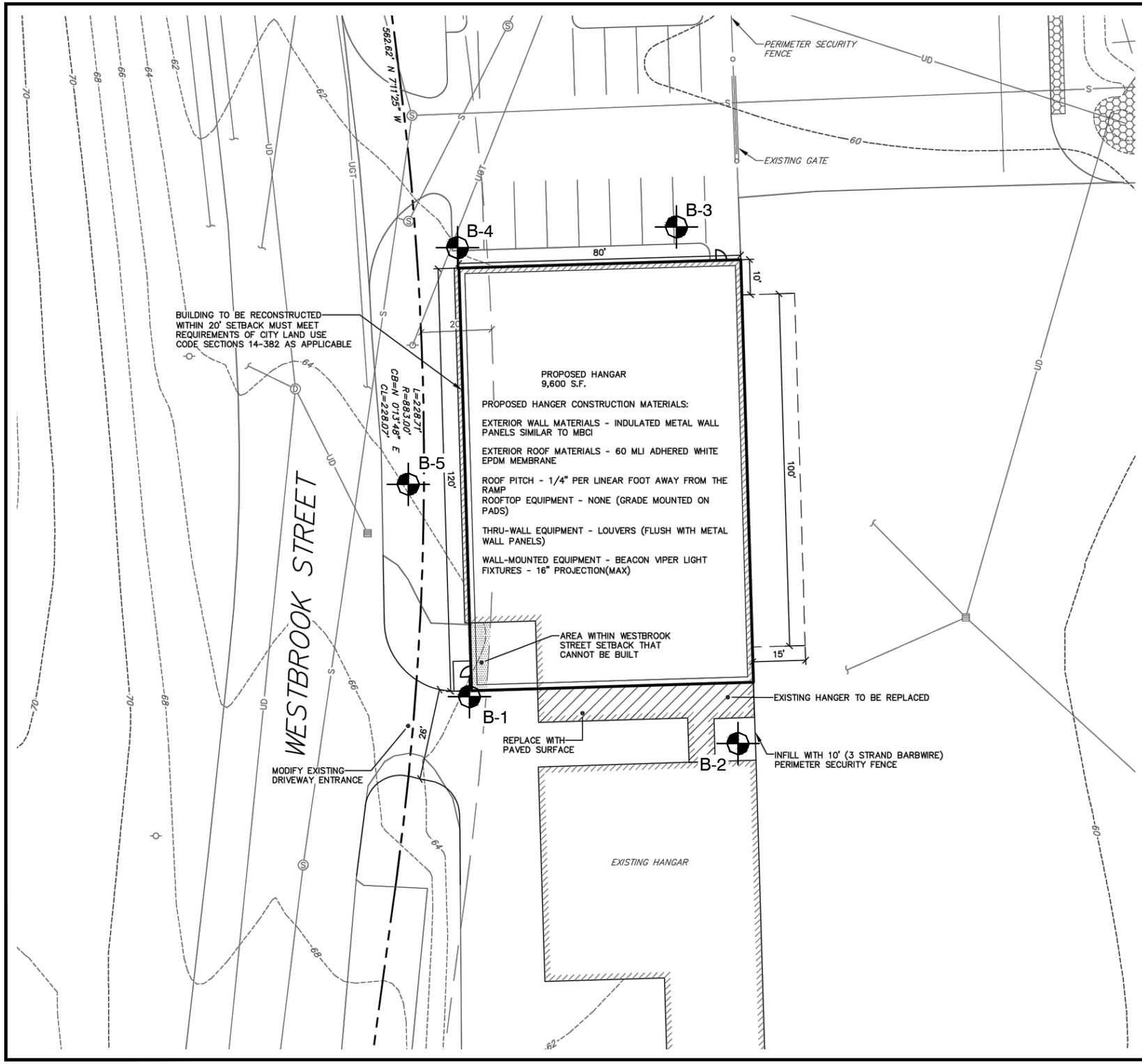
The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations 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.

APPENDIX B



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "CONCEPT SITE PLAN - HANGER," PREPARED BY SEBAGO TECHNICS, DATED 10/26/2016 AND PROVIDED AS A PORTABLE DOCUMENT FORMAT (PDF) FILE.
2. THE BORINGS WERE LOCATED IN THE FIELD BY 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 30 60 Feet

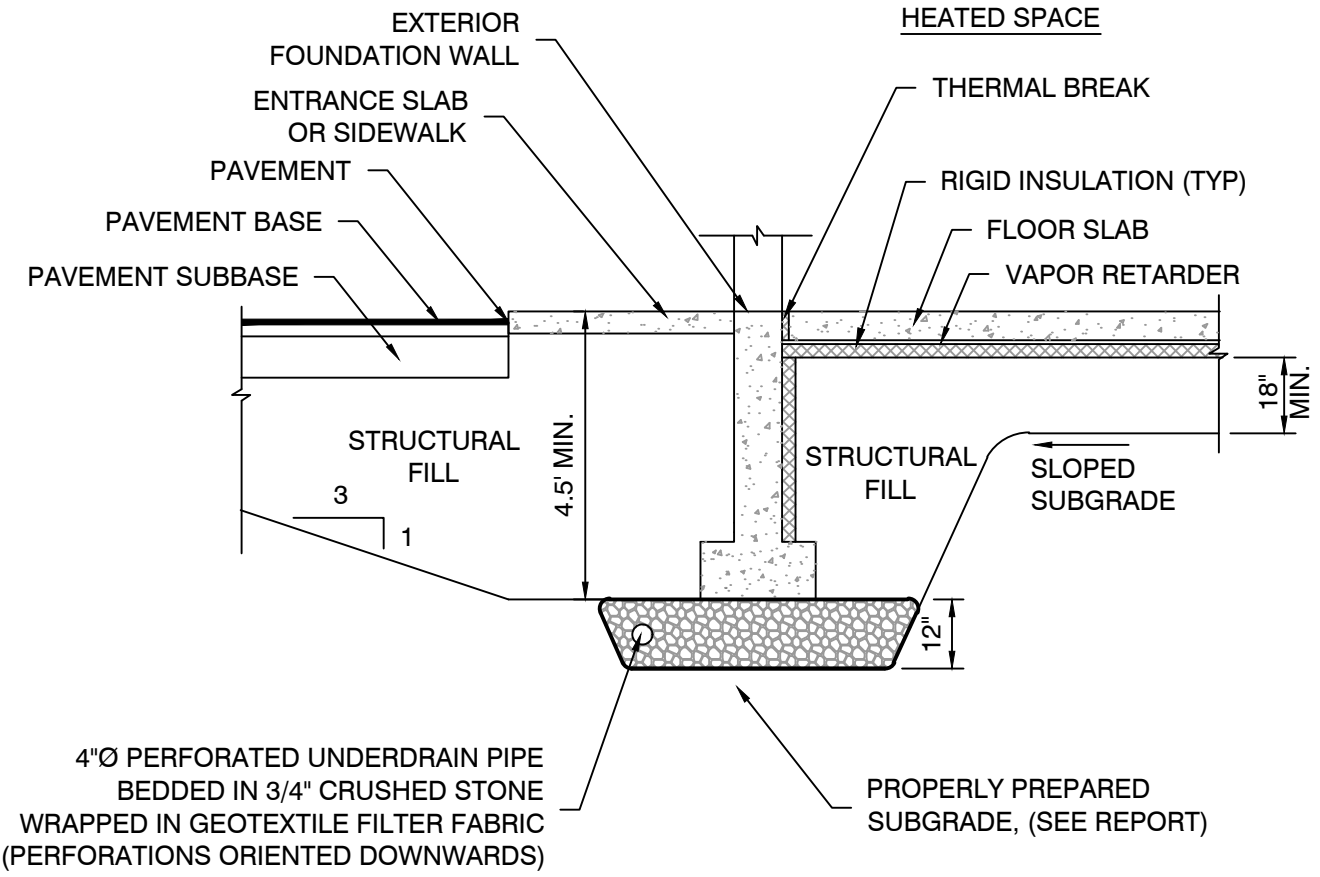
S.W.COLE ENGINEERING, INC.

NORTHEAST AIRMOTIVE

EXPLORATION LOCATION PLAN

PROPOSED HANGER
1101 WESTBROOK STREET
PORTLAND, MAINE

Job No.:	16-0128	Scale:	1" = 30'
Date :	07/20/2017	Sheet:	1



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.

NORTHEAST AIRMOTIVE

FOUNDATION DETAIL SKETCH

PROPOSED HANGER
1101 WESTBROOK STREET
PORTLAND, MAINE

Job No.:	16-0128	Scale:	Not to Scale
Date :	07/24/2017	Sheet:	2

APPENDIX C

S.W.COLE EXPLORATIONS, LLC

BORING LOG

CLIENT: Northeast Airmotive
PROJECT: Proposed Hangar
LOCATION: 1101 Weatbrook Street, Portland, Maine

BORING NO.: B- 1
SHEET: 1 of 1
PROJECT NO. 17-0128
DATE START: 6/27/2017
DATE FINISH: 6/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 64' +/- | **TOTAL DEPTH (FT):** 12.5 | **LOGGED BY:** Paul Kohler
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Kevin Hanscom | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL ELEVATIONS (ft): ▼ 54.60 6/27/2017 Caved at 10'
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0.5-2.5	24/6	6-5-3-5			0.4 Asphalt Pavement 0.8 Loose brown SAND, some gravel, trace silt (Fill) Loose dark brown gravelly silty SAND, some clayey silt (Mixed Fill)		
60										3.5 Very stiff brown silty CLAY with sand seams		
	5		2D		5-7	24/24	4-4-6-5	q_P=7 to 8 ksf w =24.8 %				
55										9.0 Medium grayish brown sandy silty CLAY	▼	
	10		3D		10-11.9	23/18	4-7-7-50/5"	q_P=2 ksf		10.5 Medium dense brownish gray silty SAND, some fine gravel (Till-Like) 11.5 Auger into probable weathered bedrock 11.5' to 12.5' 12.5 Refusal at 12.5 feet Auger Refusal - Probable Bedrock		

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

S.W.COLE EXPLORATIONS, LLC

BORING LOG

CLIENT: Northeast Airmotive
PROJECT: Proposed Hangar
LOCATION: 1101 Weatbrook Street, Portland, Maine

BORING NO.: B- 2
SHEET: 1 of 1
PROJECT NO. 17-0128
DATE START: 6/27/2017
DATE FINISH: 6/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 60' +/- | **TOTAL DEPTH (FT):** 16.2 | **LOGGED BY:** Paul Kohler
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Kevin Hanscom | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL ELEVATIONS (ft): ▼ 50.50 6/27/2017 Caved at 11.4'
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0.5-2.5	24/18	4-3-3-5			0.4 Asphalt Pavement Medium dense brown silty SAND, some gravel, some clayey silt (Mixed Fill) 1.5 Loose gray clayey silty SAND (Fill) 2.0 Very stiff brown silty CLAY with sand seams		
55	5		2D		5-7	24/24	4-4-6-6	q_P=6 to 8 ksf				
										8.0 Medium dense brown silty SAND, some fine gravel	▼	
50	10		3D		10-12	24/20	6-6-7-6			10.5 Medium dense brown-gray silty SAND, some fine gravel (Till-Like)		
45	15		4D		15-15.8	9/6	11-50/3"			15.8 16.2 Auger into probable weathered bedrock 15.8' to 16.2'		

Refusal at 16.2 feet
Auger Refusal - Probable Bedrock

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

S.W.COLE EXPLORATIONS, LLC

BORING LOG

CLIENT: Northeast Airmotive
PROJECT: Proposed Hangar
LOCATION: 1101 Weatbrook Street, Portland, Maine

BORING NO.: B- 3
SHEET: 1 of 1
PROJECT NO. 17-0128
DATE START: 6/27/2017
DATE FINISH: 6/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 60' +/- | **TOTAL DEPTH (FT):** 16.8 | **LOGGED BY:** Paul Kohler
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Kevin Hanscom | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL ELEVATIONS (ft): ▽ 51.00 6/27/2017 Soils appeared Saturated. Caved at 9.7'
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0.6-2.6	24/16	4-4-5-6			0.4 Asphalt Pavement Loose brown silty gravelly SAND (Fill) 1.2 Very stiff brown silty CLAY with some sand seams		
			2D		2.6-4.6	24/24	5-5-7-10	q_P=7 to 8 ksf w =7.9 %				
55	5		3D		5-7	24/24	4-5-8-10	q_P=8 ksf w =25.6 %			▽	
50	10		4D		10-12	24/20	3-4-4-4	q_P=2 ksf w =15 %		10.5 Medium dense brown clayey silty SAND, trace fine gravel		
45	15		5D		15-16.6	19/14	8-5-7-50/1"			14.0 Medium dense gray SAND and silt, some clay, trace fine gravel (Till-Like) 16.1 Auger into probable weathered bedrock 16.1' to 16.8' 16.8 Refusal at 16.8 feet Auger Refusal - Probable Bedrock		

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

S.W.COLE EXPLORATIONS, LLC

BORING LOG

CLIENT: Northeast Airmotive
PROJECT: Proposed Hangar
LOCATION: 1101 Weatbrook Street, Portland, Maine

BORING NO.: B- 4
SHEET: 1 of 1
PROJECT NO. 17-0128
DATE START: 6/27/2017
DATE FINISH: 6/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 62' +/- | **TOTAL DEPTH (FT):** 13.4 | **LOGGED BY:** Paul Kohler
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Kevin Hanscom | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL ELEVATIONS (ft): ▼ 53.50 6/27/2017 Caved at 8.8'
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
										0.4 Asphalt Pavement		
			1D		0.5-2.5	24/15	3-4-4-4			1.0 Loose brown gravelly SAND, trace silt (Fill)		
60										Very stiff brown silty CLAY		
			2D		2.5-4.5	24/24	4-5-8-10	q_P=6 to 8 ksf				
	5		3D		5-7	24/24	3-4-6-6	q_P=5 to 7 ksf				
										6.0 Medium dense grayish brown clayey silty SAND, some fine gravel	▼	
55												
	10		4D		10-12	24/18	4-6-7-6					
50										12.1 Auger into probable weathered bedrock 12.1' to 13.4'		
										13.4 Refusal at 13.4 feet Auger Refusal - Probable Bedrock		

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

BORING LOG

S.W.COLE EXPLORATIONS, LLC

CLIENT: Northeast Airmotive
PROJECT: Proposed Hangar
LOCATION: 1101 Weatbrook Street, Portland, Maine

BORING NO.: B- 5
SHEET: 1 of 1
PROJECT NO. 17-0128
DATE START: 6/27/2017
DATE FINISH: 6/27/2017

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 64' +/- | **TOTAL DEPTH (FT):** 14.4 | **LOGGED BY:** Paul Kohler
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Kevin Hanscom | **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 | **AUGER ID/OD:** 2 1/4 in / 5 5/8 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic | **HAMMER WEIGHT (lbs):** 140 / 300 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL ELEVATIONS (ft): ▼ 55.50 6/27/2017 Caved at 9'
GENERAL NOTES:

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

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/15	4-8-8-9			0.5 Topsoil Medium dense brown clayey silty SAND and silty gravelly SAND (Mixed Fill)		
			2D		2-4	24/14	6-4-6-6			2.0 Loose to medium dense brown silty SAND, some fine gravel, some cobbles (Fill)		
60	5		3D		5-6.3	15/10	3-2-50/3"	w =11.6 %		7.0 Loose brown clayey SILT and sand, some coarse sand	▼	
55	10		4D		10-12	24/24	3-3-6-9			11.5 Grayish brown medium dense silty SAND, some fine gravel (Till-Like)		
50										13.9 Auger into probable weathered bedrock 13.9' to 14.4' 14.4 Refusal at 14.4 feet Auger Refusal - Probable Bedrock		

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

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. - based on laboratory unconfined compressive 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. based on 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. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

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.

APPENDIX D

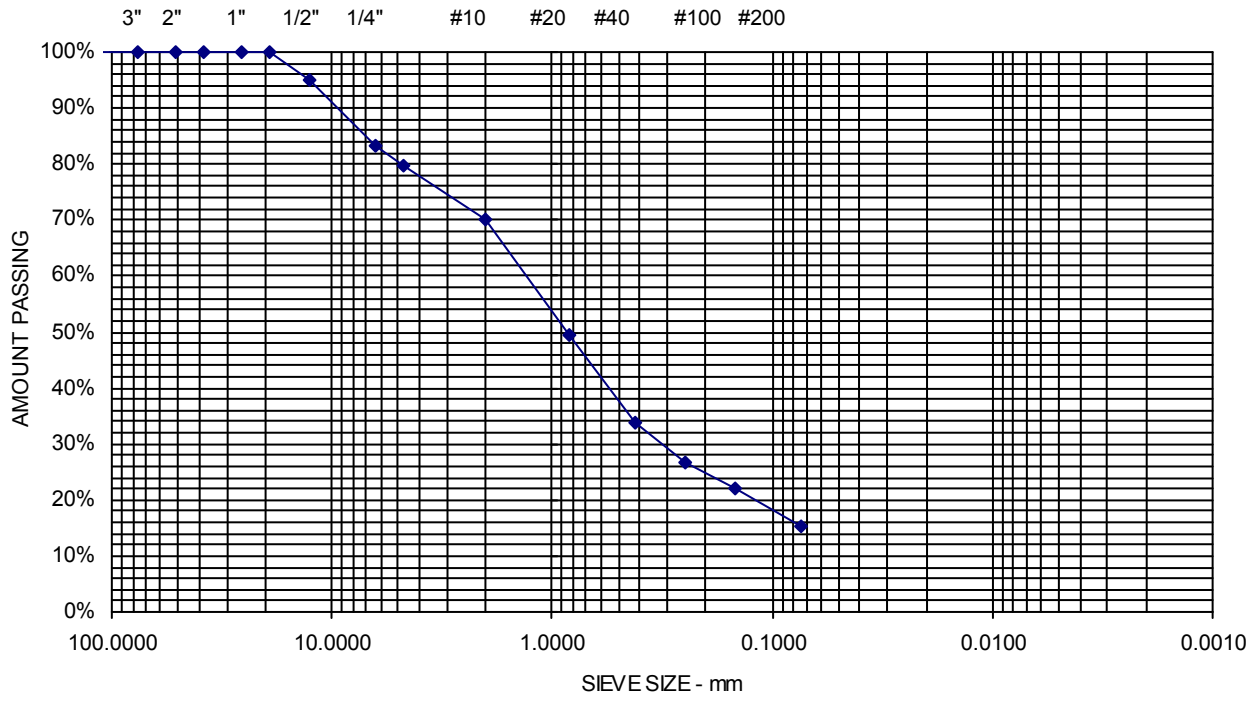
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 1127 WESTBROOK STREET NORTHEAST AIR HANGAR - GEOTECHNICAL ENGINERERING SERVICES	Project Number	16-0128
Client	NORTHEAST AIR	Lab ID	22556G
		Date Received	6/28/2017
		Date Completed	7/3/2017
Material Source	**B-3, 1D (.6-2.6')**	Tested By	PAUL SHAFFER

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**95**	
6.3 mm	**1/4"**	**83**	
4.75 mm	**No. 4**	**80**	20.2% Gravel
2.00 mm	**No. 10**	**70**	
850 um	**No. 20**	**50**	
425 um	**No. 40**	**34**	64.4% Sand
250 um	**No. 60**	**27**	
150 um	**No. 100**	**22**	
75 um	**No. 200**	**15.4**	15.4% Fines



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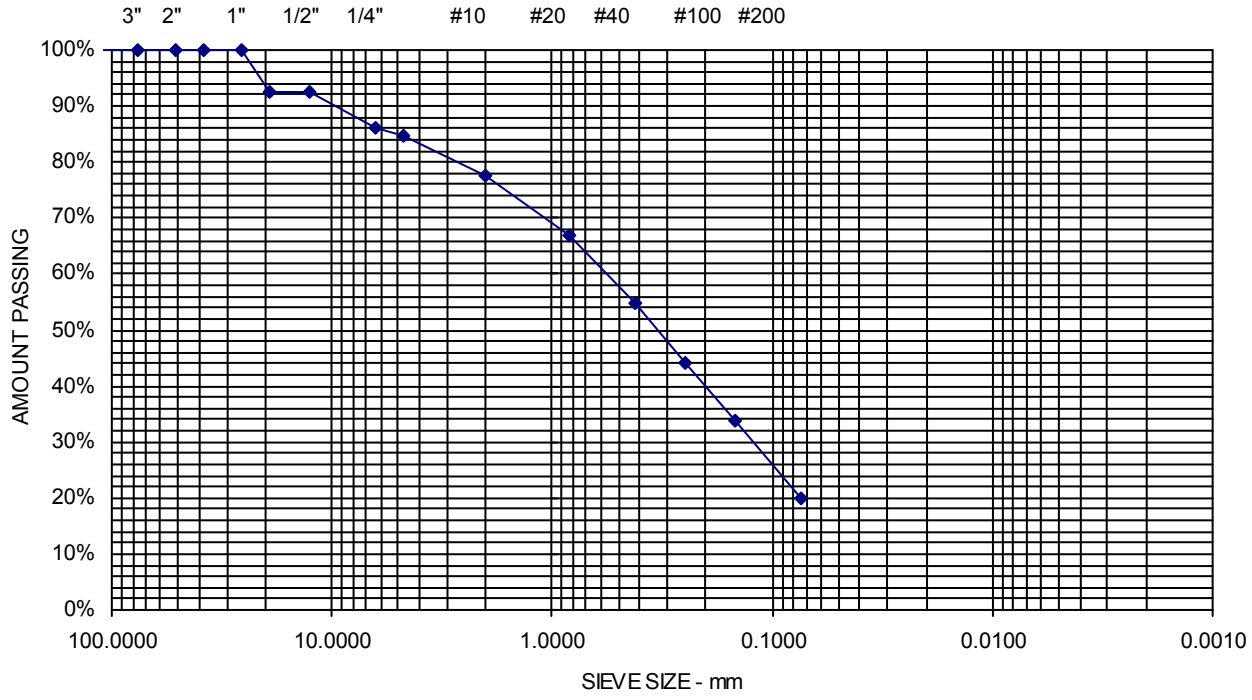
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name	PORTLAND ME - 1127 WESTBROOK STREET NORTHEAST AIR HANGAR - GEOTECHNICAL ENGINERERING SERVICES	Project Number	16-0128
Client	NORTHEAST AIR	Lab ID	22559G
		Date Received	6/28/2017
		Date Completed	7/3/2017
Material Source	**B-5, 3D (5-6.3')**	Tested By	PAUL SHAFFER

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**92**	
12.5 mm	**1/2"**	**92**	
6.3 mm	**1/4"**	**86**	
4.75 mm	**No. 4**	**85**	15.4% Gravel
2.00 mm	**No. 10**	**78**	
850 um	**No. 20**	**67**	
425 um	**No. 40**	**55**	64.7% Sand
250 um	**No. 60**	**44**	
150 um	**No. 100**	**34**	
75 um	**No. 200**	**20.0**	20% Fines



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