GEOTECHNICAL ENGINEERING SERVICES
PROPOSED BUILDING ADDITION AND PARKING LOT EXPANSION
WOODARD & CURRAN OFFICES
41 HUTCHINS DRIVE
PORTLAND, MAINE

05-1126 **February 8, 2006**

PREPARED FOR:
Woodard & Curran, Inc.
Attention: Kenneth Volock
41 Hutchins Drive
Portland, Maine 04102

PREPARED BY:

S.W.COLE ENGINEERING, INC.

286 Portland Road
Gray, Maine 04039

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

05-1126

February 8, 2006

Woodard & Curran
Attention: Kenneth Volock
41 Hutchins Drive
Portland, Maine 04102

Subject: Geotechnical Engineering Services
Proposed Building Addition and Parking Lot Expansion
Woodard & Curran Offices
41 Hutchins Drive
Portland, Maine

Dear Kenny:

In accordance with our Agreement dated October 17, 2005, we have made a subsurface investigation for the proposed building addition and parking lot expansion at the Woodard & Curran Offices at 41 Hutchins Drive in Portland, Maine. The purpose of our work was to obtain subsurface information in order to provide geotechnical recommendations for foundations and earthwork associated with the proposed construction. A draft report was provided to Woodard & Curran on January 5, 2006 for review and comment. This report presents our findings and recommendations. The contents of this report are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope of Work

Our scope of work included a review of previous explorations coordinated by Woodard & Curran in 1995 for a previous building addition, six test boring explorations, geotechnical laboratory testing, a geotechnical evaluation of the subsurface findings relative to the proposed construction and preparation of this report. It should be noted that our scope of work was modified and expanded to include additional explorations, testing and analysis, as requested by Woodard & Curran, to accommodate a change in the site plan which included a new location for the building addition that was made after our initial explorations and laboratory testing had been completed.

GRAY, ME OFFICE
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Other offices in Augusta, Bangor, and Caribou, Maine & Somersworth, New Hampshire

1.2 Proposed Construction

At the time of our agreement and during our first phase of drilling in October, 2005, we understand development plans called for construction a 7,500 SF, three-story office wing on the northeast side of the existing Woodard & Curran Office building and expansion of the northern satellite parking lot at the facility. The ground floor of the building addition was to be an unheated car parking level at a finished floor elevation of 45.67 feet (project datum) and the upper two floors of the building addition were to be heated office space.

Based on the revised site plans provided, we understand the proposed building addition will be a 7,560 SF, three-story structure situated on the northwest side of the existing building. We anticipate the proposed building will be steel-framed with a brick veneer. All three stories will be enclosed office space and the ground floor has a proposed slab-on-grade at an elevation of about 45.7 feet. Based on the site plans, we understand existing grades within the proposed building addition range from about elevation 45 to 51 feet, requiring a tapered cut approaching 6 feet to establish finished slab grade.

A paved access drive will be constructed along the northerly edge of the proposed building to access an expanded parking area on the northeast side of the existing structures. The new access drive will be situated over an existing slope requiring tapered fills approaching 9 feet in height. We understand that a retaining wall approaching 9 feet in height and approximately 360 feet in total length will be placed along the northerly edge of the new access drive. Based on the topographic information provided, we anticipate that this retaining wall will have negative foreslopes approaching 6 feet in height at an inclination as steep as 1H:1V.

The proposed northern parking lot expansion includes construction of new parking spaces, two stormwater filter basins, cuts approaching 9 feet and fills approaching 11 feet. A new site retaining wall approaching 8 feet in height will retain the fill soils on the southerly edge of the proposed parking area expansion. According to the site plans, the new retaining wall with have a negative foreslope approaching 6 feet in height at inclinations as steep as 2H:1V. The northerly side of the proposed parking expansion will have a cut slope approaching 8 feet in height with a slope of 2H:1V.

2.0 EXPLORATION AND TESTING

2.1 Exploration

On October 24, 2005 four test borings (B-101 through B-103 and B-106) were conducted by Great Works Test Borings, Inc. of Rollinsford New Hampshire working under subcontract to S. W. COLE ENGINEERING, INC. These test borings were made for the original proposed building layout. After the site layout was changed, test borings B-104 and B-105 were added to obtain subsurface information beneath the new building location and added access road. Test borings B-104 and B-105 were made on December 5 and 6, 2005 by Great Works Test Boring working under subcontract to S. W. COLE ENGINEERING, INC. The approximate locations of B-101 through B-106 are shown on the "Exploration Location Plan," attached as Sheet 1. Logs of these 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. The elevation shown on the logs was estimated based on topographic information shown on Sheet 1.

In 1995, Woodard & Curran coordinated four test borings (B-1 through B-4) for the existing "North Wing" of the office building. The approximate location of these test borings are shown on Sheet 1. Logs of these test borings are attached in Appendix A.

2.2 Laboratory Testing

The test borings were made using cased wash boring drilling and rod probing techniques. Soil samples were obtained within the test borings at intervals of 2 and 5 feet using spilt spoon and Standard Penetration Test (SPT) methods. Field Vane Shear Tests were made in the test borings where softer cohesive soil deposits were encountered in order to assess in-situ soil strength properties. The results of Standard Penetration Tests and Field Vane Shear Tests are noted on the logs. Thin-wall Shelby Tube soil samples were obtained within softer cohesive soil deposits within certain test borings.

Laboratory testing was performed on selected samples recovered from the test borings. The results of Moisture Content (ASTM D-2216), Atterberg Limits (ASTM D-4318), and Unconfined Compressive Strength testing are also noted on the logs. The results of one Gradation Test (ASTM C-117) are shown on Sheet 9. The results of two One-Dimensional Consolidation Tests (ASTM D-2435) performed on samples of compressible gray silty clay obtained from test borings B-102 and B-105 are shown on Sheets 10 and 11. A third consolidation test was unsuccessful due to sample disturbance, therefore the results of this test are not included in this report. Based upon our laboratory testing, the glaciomarine clays are overconsolidated lean clays.

3.0 SUBSURFACE CONDITIONS

3.1 Site Conditions

The site of the proposed structure is on the northwesterly side of the existing north wing in an existing paved parking area. The proposed parking expansion to the east of the proposed building overlies a portion of the existing parking area and also extends to the northeast onto a gently sloping, tree-covered peninsula of land that is surrounded on three sides by a drainage feature. The proposed northerly parking expansion and stormwater filter basins overly a moderately-steep, wooded slope with grades varying from about 64 feet to 38 feet sloping downward from north to south. A stream separates the northerly parking area from the proposed building area. The stream flows from west to east and exists at about elevation 30 feet.

It should be noted an existing sanitary sewer currently traverses beneath the northerly edge of the proposed building addition footprint and will be relocated. A sanitary sewer lateral from the "South Wing" of the existing office building traverses the west portion of the proposed building.

3.2 Subsurface Conditions

In general, test borings B-101 through B-106 encountered a thin surficial layer of silty topsoil overlying stiff to hard brown silty clay which gradually becomes medium stiff with depth. The brown silty clay overlies soft to medium gray silty clay at depths of 9 to 14 feet from the ground surface overlying gray glacial till at depths of about 25 to 32 feet from the ground surface. The clay strata varied in thickness from about 11 to 20 feet, being thickest under the easterly portion of the proposed addition. Refusal surfaces (probable boulders in till) were encountered at borings B-102 and B-104 at depths of 40 and 44 feet, respectively. Borings B-101, and B-105 were extended to depths of about 55 and 40 feet, respectively, without encountering refusal surfaces. Borings B-103 and B-106 were terminated at depths of 12 feet in gray silty clay.

Not all the strata were encountered within each exploration. For more detail of the subsurface findings at the explorations, refer to the attached exploration logs.

S. W. COLE ENGINEERING, INC. also reviewed previous boring logs (B-1 through B-4) conducted by Woodard & Curran, Inc. It appears that the results of the current explorations (B-101 through B-106) are generally consistent with the results of the previous explorations (B-1 through B-4).

3.3 Groundwater Conditions

In general, the native underlying brown silty clay soils appeared to be wet below about elevation 35 feet (5 to 15 feet below the existing ground surface) at the time of drilling. The existing silty clay soils are poor draining and it should be anticipated that they become wet to saturated seasonally. It should be anticipated that groundwater will fluctuate seasonally and in response to precipitation and snow melt.

3.4 Seismic and Frost Conditions

According to the 2003 International Building Code, utilizing the results of field and laboratory testing, we interpret the subsurface conditions to correspond to a seismic soil Site Class E. The design-freezing index for the Portland area is about 1,250-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings and our understanding of the proposed construction, it appears that the proposed addition can be supported on spread footing foundations. The main geotechnical concerns for the proposed construction are long term settlement due to the underlying compressible clay soils, and sensitive subgrade soils. In general, oversized footings will be needed to help reduce the effective stress increase in the underlying soils and subgrade soils must be overexcavated by about 12 inches and replaced with geotextile fabric wrapped mats of crushed stone (fabric wrapped stone mats) in order to protect the subgrades from disturbance during construction.

4.2 Excavation Work

An erosion control system should be in place prior to construction activity at the site to help protect adjacent drainage ways and properties. Topsoil, organics, stumps and roots must be stripped and grubbed from areas of proposed construction prior to placing fills and foundations. Additionally, existing pavements should be removed prior to fill placement. Vegetation and existing pavement should remain in areas of inactive construction as long as practical to help reduce surface erosion.

Below the topsoil and organics, excavation will encounter moist to wet silty clay. The silty clay is very sensitive to strength loss when disturbed. All excavations should be made with a smooth edged bucket. Heavy equipment should not operate on exposed subgrades. We recommend that excavation equipment operate on existing soils at an elevation above subgrade elevation such that the subgrade soils are not disturbed by the equipment. If subgrade soils become soft or disturbed during construction, the disturbed soil should be removed and replaced with compacted Structural Fill (below slab areas) or compacted crushed stone overlying geotextile fabric (below foundation areas). Excavations must be properly shored and/or sloped consistent with the OSHA trenching regulations to prevent sloughing and caving of the sidewalls during construction.

The silty clays are poor draining and will pond water if left exposed to precipitation. Based on the limited groundwater information available, it appears sumping and pumping dewatering techniques should be adequate to control water within foundation excavations during construction. Controlling the water levels to at least one foot below soil subgrade elevations will help stabilize the subgrade and provide a more suitable working surface during construction.

4.3 Site and Subgrade Preparation

As discussed, we recommend excavation and removal of the existing sanitary sewer and lateral from beneath the proposed building. The existing trench backfill soils should be completely removed and backfilled with compacted Structural Fill or Granular Borrow.

Foundations should be placed on 12-inch thick fabric wrapped crushed stone mats overlying stiff, undisturbed, native brown clay. The woven geotextile fabric, such as Mirafi 500X, should wrap around and over the top of the crushed stone such that the fabric extends beneath the footing edges. Slab-on-grade floors should be placed on at least 12 inches of compacted Structural fill overlying a woven geotextile fabric, such as Mirafi 500X, overlying stiff, undisturbed, native brown clay.

Considering the subsurface findings and our understanding of the proposed construction, we anticipate pavement subgrades will likely consist of principally stiff brown clay, compacted granular borrow or common borrow (re-used native brown clay). As such, we recommend pavement subbase gravels be underlain with woven geotextile fabric, such as Mirafi 500X.

We recommend utilities with soft gray clay subgrades be underlain with at least 12 inches of crushed stone over a non-woven filter fabric, such as Mirafi 160N, placed over the undisturbed gray clay trench bottom. The depth of crushed stone should be increased to 2 feet below structures, such as manholes and vaults.

4.4 Foundation Design

4.4.1 Spread Footings and Basement Walls

To protect spread footings and foundation underdrains from freezing temperatures, perimeter footings should be cast at least 4.5 feet below exterior finish grades. Since finish grades will be as high as 4.5 feet above finish floor elevations on the westerly side of the building, we recommend placing these foundations as high in elevation as possible to help improve both the bearing capacity and settlement characteristics of the foundation system. All footings should be underlain with a minimum of 12 inches of compacted crushed stone wrapped in woven geotextile fabric. For spread footings bearing on properly prepared subgrades we recommend the following geotechnical parameters for design consideration:

Recommended Geotechnical Parameters For Spread Footings	
Net Allowable Bearing Pressure	1.5 ksf or less
Base Friction Factor (tan δ)	0.4 (crushed stone)
Passive Lateral Earth Pressure Coeff. (K_p)	3.0 (Structural Fill)
At-Rest Lateral Earth Pressure Coeff. (K_o)	0.5 (Structural Fill)
Total Unit Weight of Backfill (γ_t)	130 pcf (Structural Fill))
Internal Friction Angle (Φ)	30 degrees (Structural Fill)

These design parameters assume that a clean, compacted, non-frost susceptible, free-draining sand and gravel (Structural Fill) with an internal friction angle of at least 30° is utilized as backfill. These design values do not account for lateral surcharge loads from construction related activities such as compaction equipment or lateral loads due to wedging of backfill soils. The structural engineer should assess lateral loading both during construction and long term.

Further, we recommend that all perimeter frost walls be damp-proofed and insulated using a 2-inch thickness of rigid insulation to help reduce heat loss through the concrete. On the west, south and north wall lines, where finish floor elevations are planned below proposed exterior grades, the insulation should be placed on the exterior side of the walls. On the east and north wall lines, where the frost walls are planned below the finish floor and exterior grade, the insulation should be placed on the interior side of the frost wall.

4.4.2 Settlement and Seismic Considerations

In general, less settlement is anticipated in the western and southern portions of the addition because this portion of the building will have a finish floor elevation approaching 4.5 feet below existing grades and the compressible soils in this area were not as thick. The eastern portion of the building will have a finish floor elevation approaching 1-foot above existing grades and the compressible soils are thicker in this area; however, it appears that the soils were cut to achieve proposed grades during construction of the north wing. Within the northern portion of the building, the finish floor elevation will be close to existing grade and a tapered embankment fill approaching 9 feet thick will be placed adjacent to the northerly wall line to construct the access road. We anticipate settlement to be the greatest magnitude in the north portion of the building.

Based on the loading information you provided for the north wing addition, we have estimated the potential loads for the proposed new addition. Based on the anticipated loading, the proposed and existing grades and the results of our laboratory consolidation testing, we have estimated post-construction settlement may approach 1-inch total and ¾-inch differential. In our experience, the estimated post-construction settlement is generally within tolerable limits for the proposed construction. We recommend design include control joints in foundation concrete and any masonry or brick siding to control random cracking due to minor settlement as well as thermal expansion and contraction of the building.

According to the 2003 International Building Code, utilizing the results of field and laboratory testing, we interpret the subsurface conditions to correspond to a seismic soil Site Class E.

4.5 Foundation Drainage

We recommend that a perimeter underdrain be provided within the fabric wrapped crushed stone mats and outside the 1H:1V bearing splay of the perimeter footings. Rigid, 4-inch diameter, perforated foundation drain pipes with perforations of ¼ to ½ inch should be utilized. The foundation drains must have positive gravity outlets. Exterior foundation backfill should be sealed with a surficial layer of clayey or loamy soil in areas that are not to be paved or occupied by entrance slabs. This is to reduce direct surface water infiltration into the backfill. Ideally, surface grades should be sloped away from the building to shed surface water. Roof drains must be routed in separate non-perforated drain lines such that roof drainage is not introduced into the foundation drainage system. General underdrain details are shown on Sheet 12.

4.6 Slab-on-Grade Floors

Slab-on-grade floors in heated spaces may be designed using a subgrade reaction modulus of 150 pci provided the concrete slab is underlain by at least 12 inches of compacted Structural Fill overlying a woven geotextile fabric, such as Mirafi 500X, overlying properly prepared subgrades. In areas where the footing elevations are held as high as possible, as discussed in Section 4.4, we recommend at least 6 inches of Structural Fill be placed between the top of footings and bottom of floor slab.

For slab-on-grade floors, we recommend that a 15-mil vapor barrier be placed directly below the floor slab concrete. The vapor barrier should have a permeance that is less than the floor covering being applied on the slab and should be installed according to the manufacturer's recommended methods including taping all joints and wall connections. Flooring suppliers should be consulted relative to acceptable vapor barrier systems for use with their products. The vapor barrier must have sufficient durability to withstand direct contact with the sub-slab fill and construction activity.

We recommend that control joints be installed within floor slabs to accommodate shrinkage in the concrete as it cures. In general, control joints are usually installed at 10 to 15 foot spacing; however, the actual spacing of control joints should be determined by the structural engineer. We recommend that slabs be wet-cured for a period of at least 7 days after casting as a measure to reduce the potential for curling of the concrete and excessive drying/shrinkage. We further recommend that consideration be given to using a curing paper or curing compound after the wet-cure period to improve the quality of the completed floor.

4.7 Entrance Slabs and Sidewalks

Entrance slabs and sidewalks adjacent to the building should be designed to reduce the adverse effects of frost action between adjacent pavement, doorways, and entrances. We recommend that a frost control zone of Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs and sidewalks. The Structural Fill should extend horizontally outward from the building the full width and length of entrance slabs and then transition up to bottom of adjacent pavement or sidewalk sub-base at a 3H:1V or flatter slope. This is to help reduce differential movement due to frost. General details of this frost transition zone are shown on Sheet 12.

4.8 Site Retaining Walls

Based upon the subsurface findings and our understanding of the proposed construction, we anticipate that MSE walls and cast-in-place reinforced concrete retaining walls will be considered for construction adjacent to the access road and adjacent to the expanded northerly parking area. MSE walls can tolerate some settlement and generally perform better than rigid concrete walls when settlement is anticipated. In our opinion, MSE walls are more appropriate along the access road adjacent to the new building addition and cast-in-place reinforced concrete walls are feasible for construction adjacent to the expanded northerly parking area.

We understand that retaining wall design will be completed by others and that S. W. COLE ENGINEERING, INC. will be engaged to perform a global stability analysis during design and prior to construction.

4.8.1 MSE Walls

For a MSE Wall constructed along the proposed access road adjacent to the proposed building addition and founded on properly prepared subgrades, we recommend the following geotechnical parameters for design:

Geotechnical Parameters for MSE Wall along Access Road	
Net Allowable Bearing Pressure	1.5 ksf or less
Base Friction Factor	0.4 (crushed stone)
Reinforced Zone Backfill Unit Weight	130 pcf (Structural Fill)
Reinforced Zone Internal Friction Angle	30 degrees (Structural Fill)
Retained Soil Unit Weight	125 pcf (Granular or Common Borrow)
Retained Soil Internal Friction Angle	26 degrees (Granular or Common Borrow)

Design of the MSE Walls must consider increased embedment depth to account for the negative foreslope in front of the walls as well as surcharge loads from traffic loading. We recommend the MSE Wall be designed considering a minimum geogrid length of at least 70 percent of the overall wall height. Ideally, at least 4.5 feet (horizontal measure) of Structural Fill should be used as backfill behind the wall to control potentially adverse frost thrust on the wall.

We recommend the MSE Wall and reinforced zone be underlain by a 12-inch thick mat of crushed stone wrapped in a woven geotextile fabric with perforated 4-inch diameter underdrain pipe installed at the back of the reinforced zone. The underdrain must be provided with a positive gravity outlet. General MSE Wall details are shown schematically on Sheet 12.

4.8.2 Reinforced Concrete Retaining Walls

For a cast-in-place Reinforced Concrete Retaining Wall constructed adjacent to the proposed northern parking area and founded on properly prepared subgrades, we recommend the following geotechnical parameters for design:

Geotechnical Parameters for Reinforced Concrete Wall for North Parking Area	
Net Allowable Bearing Pressure	3.0 ksf or less
Base Friction Factor	0.4 (Structural Fill)
Passive Lateral Earth Pressure Coeff. (K_p)	3.0 (Structural Fill)
Active Lateral Earth Pressure Coeff. (K_a)	0.33 (Structural Fill)
Total Unit Weight of Backfill (γ_t)	130 pcf (Structural Fill)
Internal Friction Angle (Φ)	30 degrees (Structural fill)

We recommend the foundations for cast-in-place concrete retaining walls adjacent to the north parking lot be underlain with at least 8 inches of compacted Structural Fill. Cast-in-place reinforced concrete walls should be constructed with weepholes or underdrains to preclude the build-up of water and hydrostatic pressure behind the retaining wall.

4.9 Backfill and Compaction

The native soils are frost susceptible silty clay and are not suitable for reuse as backfill adjacent to foundations and retaining walls. We recommend foundation and wall backfill materials consist of clean sand and gravel meeting the gradation requirements for Structural Fill, as given below. Structural Fill should also be used as backfill for MSE Walls within the reinforced soil zone and Reinforced Concrete Walls, as well as backfill for the excavated trench after removal of the existing sanitary sewer.

Structural Fill	
Sieve Size	Percent Finer by Weight
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 5

Crushed Stone used under footings and as underdrain aggregate should meet the gradation given below. A nominal size ¾-inch crushed stone usually meets these gradation requirements.

Crushed Stone	
Sieve Size	Percent Finer by Weight
1 inch	100
¾ inch	90 to 100
3/8 inch	0 to 75
#4	0 to 25
#10	0 to 5

We understand that grades under the proposed access road and grades in the proposed northerly parking lot expansion area will require as much as 10 feet of compacted fill. Grades in paved areas can be raised using compacted Common Borrow or Granular Borrow. Common Borrow is generally a mixture of sand, silt and clay at a compactable moisture content that meets the requirements of MDOT Standard Specification 703.18. Granular Borrow is generally a mixture of sand, silt and gravel at a compactable moisture content meeting the gradation requirements of MDOT Standard Specification 703.19, as given below.

Granular Borrow	
Sieve Size	Percent Finer by Weight
6 inch	100
#40	0 to 70
#200	0 to 20

Based on the observations made at the explorations, it appears that the existing native brown clays that are to be excavated are at moisture contents that are too wet for reuse as Common Borrow without drying. The existing base and subbase fills in paved areas can likely be reused as compacted Granular Borrow.

Fill and backfill beneath building and paved areas should be compacted to 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed stone below footings should be compacted to 100 percent of its dry rodded unit weight as determined by ASTM C-29. Retaining wall and MSE Wall backfill should be compacted to between 92 to 95 percent of its maximum dry density as determined by ASTM D-1557. Lift thickness should be 6 to 12 inches such that desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment.

4.10 Pavements

Based on our understanding of the proposed construction, we anticipate pavements will be used for parking and access drives for passenger cars. Pavement subgrades should be sloped and subbase gravel daylighted to provide underdrain relief of the pavement gravels. Where daylighting of subbase gravel is not possible, we recommend MDOT Type B Underdrains be installed to provide underdrain relief for pavement gravels. It must be understood that without replacement of the native soil below pavements with non-frost susceptible soil for the full depth of frost penetration, some frost related movement of the pavements will occur.

Based on our experience with projects of similar size and scope, and considering the subsurface conditions encountered, we offer the following standard duty pavement structure for car parking and access drive areas:

Recommended Standard Duty Pavement (Car Parking)	
Pavement Layer	Thickness
MDOT 9.5 mm Superpave or Grade C Hot Mix Asphalt	1.25 inches
MDOT 12.5 mm Superpave or Grade B Hot Mix Asphalt	1.75 inches
MDOT Crushed Aggregate Base 703.06 Type A	3 inches
Maine DOT Aggregate Subbase 703.06 Type D	12 inches
Woven Subgrade Geotextile, Mirafi 500X	YES

The bituminous pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. Tack coat should be applied between successive lifts of asphalt, as necessary. The base and subbase materials should be compacted to at least 95 percent of their maximum dry densities as determined by ASTM D-1557. We recommend that all fill placed below the base and subbase materials to subgrade level be compacted to at least 95 percent of ASTM D-1557.

4.11 Weather Considerations

If foundation construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and pavement must not be placed on frozen soil and once placed, the soil beneath structures must be protected from freezing.

4.12 Design Review and Construction Testing

S. W. COLE ENGINEERING, INC. should be retained to review the final design and specifications to determine that our earthwork recommendations have been properly interpreted and implemented.

A soils, asphalt, and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans and specifications. S. W. COLE ENGINEERING, INC. is available to provide field and laboratory testing services for soil, concrete, masonry, steel, fireproofing and asphalt construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. If you have any questions, please do not hesitate to contact us.

Sincerely,

S. W. COLE ENGINEERING, INC.

Andrew R. Simmons, P.E.
Geotechnical Engineer

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

STATE OF MAINE
TIMOTHY J.
BOYCE
No. 9263
REGISTERED
PROFESSIONAL ENGINEER

ARS-TJB:pfb

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ATTACHMENT A - LIMITATIONS

This report has been prepared for the exclusive use of Woodard & Curran Inc. for specific application to the proposed office addition and parking lot expansion at 41 Hutchins Drive in Portland, Maine. S. W. COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No other 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 ENGINEERING, INC.'s scope of work 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 ENGINEERING, INC. should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless S. W. COLE ENGINEERING, INC. reviews the changes.

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.:	B-101
SHEET:	1 OF 1
PROJECT NO.:	05-1126
DATE START:	10/24/2005
DATE FINISH:	10/24/2005
ELEVATION:	45' +/-
SWC REP.:	A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 7 FEET

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
									3"	BITUMINOUS ASPHALT
	1D	24"	12"	2.5'	10	16	5	4	2.0'	BROWN SILTY GRAVELLY SAND (FILL)
										BROWN SILTY CLAY
	2D	24"	24"	4.5'	5	5	6	6		w = 28.3% qp = 5 KSF
										~ VERY STIFF ~
	3D	24"	24"	7.0'	3	4	4	4		w = 29.7% qp = 5 KSF
										~ MEDIUM ~
	4D	24"	24"	9.0'	4	5	5	5	9.5'	w = 37.0% qp = 2 KSF
										qp = 0.5 KSF
	5D	24"	24"	12.0'	WOH					w = 43.3% qp < 0.25 KSF
										W_L = 39
	1U	24"	24"	17.0'	HYDRAULIC					W_P = 21
	Sv: 3.5x7			20.8'		58/8				Sv = 0.60 / 0.08 KSF
				21.6'		56/9				Sv = 0.58 / 0.09 KSF
									25.6'	w = 34.1%
	2U	24"	5"	27.0'	HYDRAULIC					
										GRAY SILTY FINE SAND, SOME GRAVEL (GLACIAL TILL) WITH COBBLES
	6D	24"	24"	32.0'	11	12	25	37		~ DENSE ~
										w = 10.7%
									55.0'	ADVANCE RODS TO 55 FEET
										BOTTOM OF EXPLORATION @ 55 FEET

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

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

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

2

BORING NO.: B-101

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-102
SHEET: 1 OF 1
PROJECT NO.: 05-1126
DATE START: 10/24/2005
DATE FINISH: 10/24/2005
ELEVATION: 42' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 7 FEET

CASING BLOWS PER FOOT	SAMPLE				SAMPLER BLOWS PER 6"				DEPTH	STRATA & TEST DATA
	NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24		
									2"	CLAYEY TOPSOIL
	1D	24"	14"	2.0'	1	2	5	8		
										BROWN SILTY CLAY
	2D	24"	20"	4.0'	6	15	17	18		qp = 9 KSF
										~ HARD ~
	3D	24"	24"	7.0'	4	5	7	9		qp = 6 KSF
	Sv: 2x4			10.5'		36/6				Sv = 2.0/0.33 KSF ~ STIFF ~
				11.0'		45/5			12.0'	Sv = 2.5/0.28 KSF
										GRAY SILTY CLAY
	Sv: 3.5x7			15.8'		55/8				Sv = 0.57/0.08 KSF ~ MEDIUM ~
				16.6'		55/8				Sv = 0.57/0.08 KSF
										qu = 1.2 KSF
	1U	24"	24"	22.0'	HYDRAULIC					w = 47.3%
										W_L = 44
										W_P = 25
	Sv: 3.5x7			25.8'		62/8				Sv = 0.64 / 0.08 KSF
				26.6'		60/8				Sv = 0.62 / 0.08 KSF
									31.5'	
	4D	24"	24"	32.0'	WOR/12"		1	5		
										GRAY SILTY FINE SAND, SOME GRAVEL (GLACIAL TILL) WITH COBBLES
									40.4'	
	5D	4"	4"	40.4'	50/4"					REFUSAL @ 40.4 FEET (PROBABLE BOULDER IN GLACIAL TILL)

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.

3

BORING NO.: B-102

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-103
SHEET: 1 OF 1
PROJECT NO.: 05-1126
DATE START: 10/24/2005
DATE FINISH: 10/24/2005
ELEVATION: 38' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO.: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 5 FEET

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"	FOREST DUFF
	1D	24"	14"	2.0'	3	2	4	8		BROWN SILTY CLAY ~ VERY STIFF ~ qp = 9 KSF
	2D	24"	18"	4.0'	6	10	14	13		qp = 6 KSF
	3D	24"	20"	7.0'	3	5	7	8		qp = 6 KSF
									10.0'	~ STIFF ~ qp = 1.5 KSF
	4D	24"	24"	12.0'	1	2	2	2	12.0'	GRAY SILTY CLAY ~ MEDIUM ~ qp = 0.5 KSF
										BOTTOM OF EXPLORATION @ 12.0 FEET

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.

4

BORING NO.: B-103

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-104
SHEET: 1 OF 1
PROJECT NO.: 05-1126
DATE START: 12/5/2005
DATE FINISH: 12/6/2005
ELEVATION: 42' +/-
SWC REP.: A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO.: GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 10 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										BROWN SILTY CLAY
										~ STIFF ~
	1D	24"	24"	7.0'	4	5	6	8		qp = 6 KSF
									10.0'	
	1U	24"	21"	12.0'	HYDRAULIC					GRAY SILTY CLAY
	Sv: 3.5x7			15.8'		50/9				Sv = 0.52/0.09 KSF ~ MEDIUM ~
				16.6'		58/18				Sv = 0.60/0.19 KSF
	2U	24"	24"	22.0'	HYDRAULIC					
	Sv: 3.5x7			25.8'		85/11			25.8'	Sv = 0.88/0.11 KSF
					NO PENETRATION					
										GRAY SILTY FINE SAND, SOME GRAVEL (GLACIAL TILL) WITH SOME COBBLES
	2D	24"	8"	32.0'	41	53	42	34		~ VERY DENSE ~
	3D	0"	0"	35.0'	HOLE CAVED IN					
									44.5'	
										REFUSAL @ 44.5 FEET (PROBABLE BOULDER IN GLACIAL TILL)

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.

5

BORING NO.: B-104

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.:	B-105
SHEET:	1 OF 1
PROJECT NO.:	05-1126
DATE START:	10/24/2005
DATE FINISH:	10/24/2005
ELEVATION:	51' +/-
SWC REP.:	A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 15 FEET

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									1.0'	BROWN SILT (FILL)
	1D	24"	8"	2.0'	3	3	4	4		BROWN SILTY CLAY
	2D	24"	24"	7.0'	7	10	12	18		~ VERY STIFF ~ qp = 6 KSF
	Sv: 2x4			10.5'		55/9				Sv = 3.1/0.5 KSF ~ VERY STIFF ~
				11.0'		48/9				Sv = 2.7/0.5 KSF
									14.5'	
	1U	24"	24"	17.0'	HYDRAULIC					GRAY SILTY CLAY w = 48.3 %
	Sv: 3.5x7			20.8'		58/8				Sv = 0.60/0.08 KSF
				21.6'		58/8				Sv = 0.60/0.08 KSF ~ MEDIUM ~
	Sv: 3.5x7			25.8'		82/10			25.8'	Sv = 0.85/0.10 KSF
					NO PENETRATION					GRAY SILTY FINE SAND, SOME GRAVEL (GLACIAL TILL) WITH SOME COBBLES
	3D	24"	12"	32.0'	6	7	8	10		~ MEDIUM DENSE ~
									40.0'	ADVANCE RODS TO 40 FEET
										BOTTOM OF EXPLORATION @ 40 FEET

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.

6

BORING NO.: B-105

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.:	B-106
SHEET:	1 OF 1
PROJECT NO.:	05-1126
DATE START:	10/24/2005
DATE FINISH:	10/24/2005
ELEVATION:	43' +/-
SWC REP.:	A. SIMMONS

PROJECT / CLIENT: PROPOSED WOODARD & CURRAN INC. OFFICE EXPANSION / WOODARD & CURRAN INC.
LOCATION: 41 HUTCHINS DRIVE, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED @ 6 FEET

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	
									2"	FOREST DUFF	
	1D	24"	12"	2.0'	1	1	2	4		BROWN SILT SOME CLAY	
									3.0'	~ LOOSE ~	
	2D	24"	20"	4.0'	4	14	16	20		BROWN SILTY CLAY	qp = 9 KSF
										~ HARD ~	
											qp = 6 KSF
	3D	24"	24"	7.0'	5	11	10	9			qp = 2 KSF
										~ MEDIUM ~	
									11.0'		qp = 2 KSF
	4D	24"	24"	12.0'	1	1	1	1	12.0'	GRAY SILTY CLAY ~ SOFT ~	qp < 0.25 KSF
										BOTTOM OF EXPLORATION @ 12.0 FEET	

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.

7

BORING NO.: B-106

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
HSA	-	Hollow Stem Auger
HW	-	4" Casing
NW	-	3" Casing
SS	-	split-spoon sampler

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.

S.W.COLE ENGINEERING, INC.

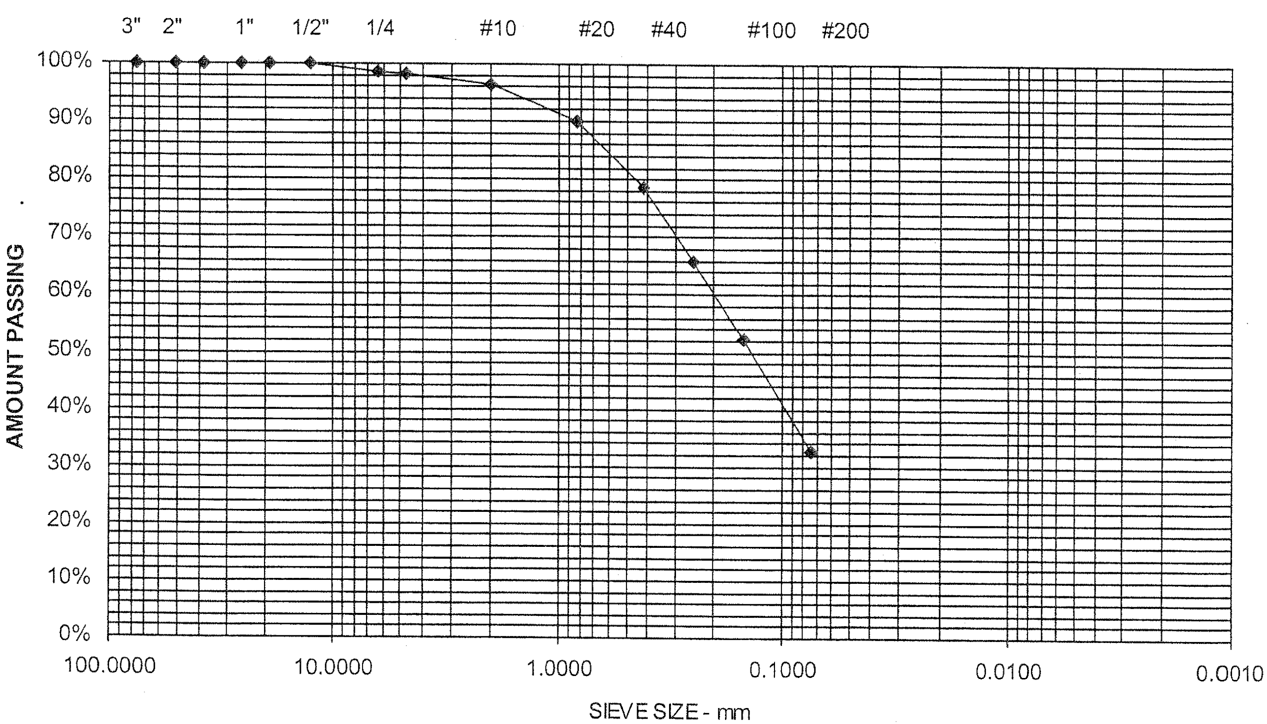
Report of Gradation

ASTM C-117 & C-136

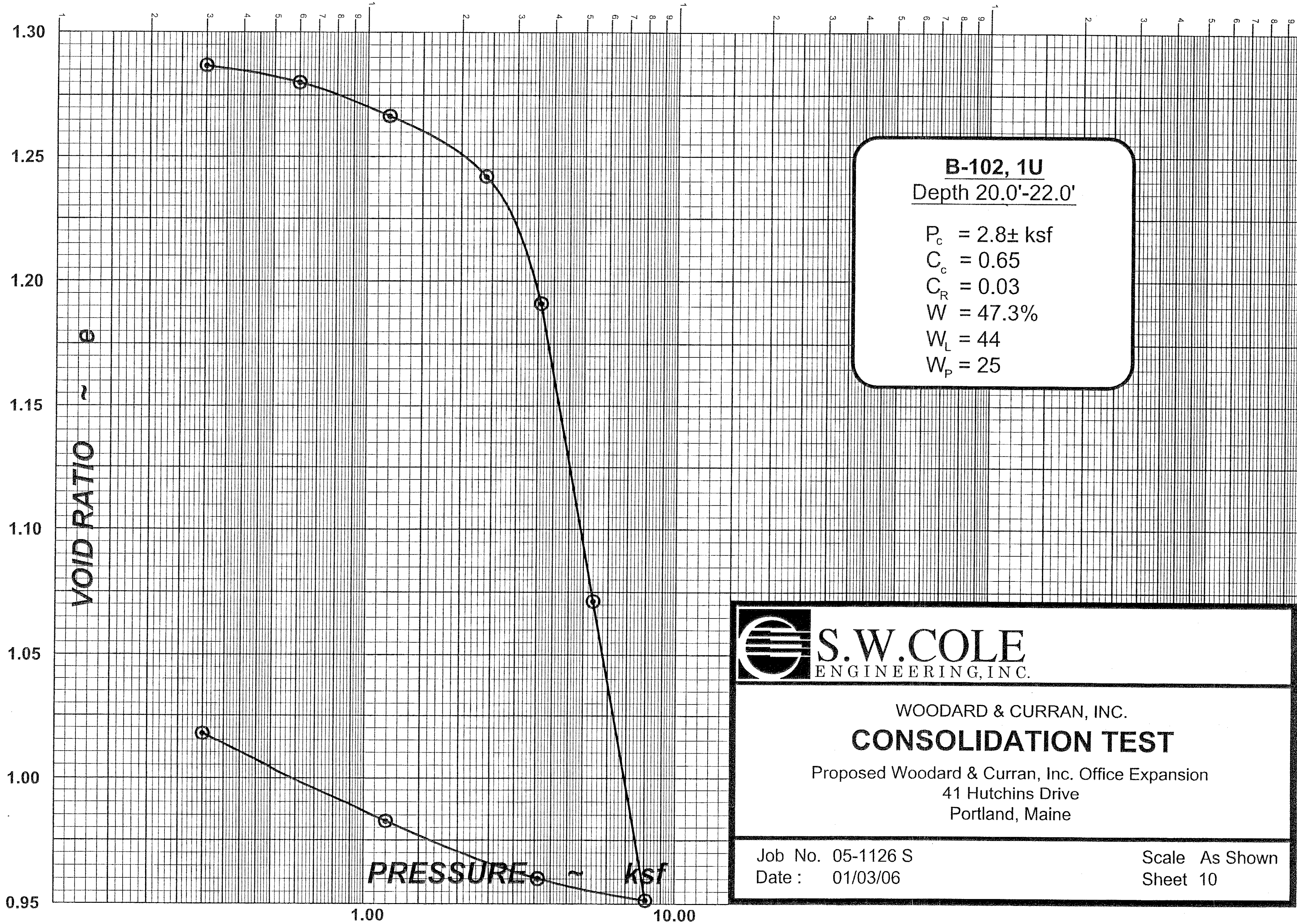
Project Name	PORTLAND - PROPOSED OFFICE ADDITION - GEOTECHNICAL SERVICES	Project Number	05-1126
Client	WOODARD & CURRAN, INC.	Lab ID	4366G
Exploration	**B-101 6D**	Date Received	11/1/2005
Material Source	**30'-32'**	Date Complete	11/7/2005
		Tested By	COLIN PATTERSON

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"**	**100**	
6.3 mm	**1/4"**	**99**	
4.75 mm	**No. 4**	**98**	1.6% Gravel
2.00 mm	**No. 10**	**96**	
850 um	**No. 20**	**90**	
425 um	**No. 40**	**79**	65.6% Sand
250 um	**No. 60**	**66**	
150 um	**No. 100**	**52**	
75 um	**No. 200**	**32.8**	32.8% Fines

GRAY SILTY FINE SAND SOME GRAVEL (TILL)



Comments: w = 10.7%



S.W.COLE
ENGINEERING, INC.

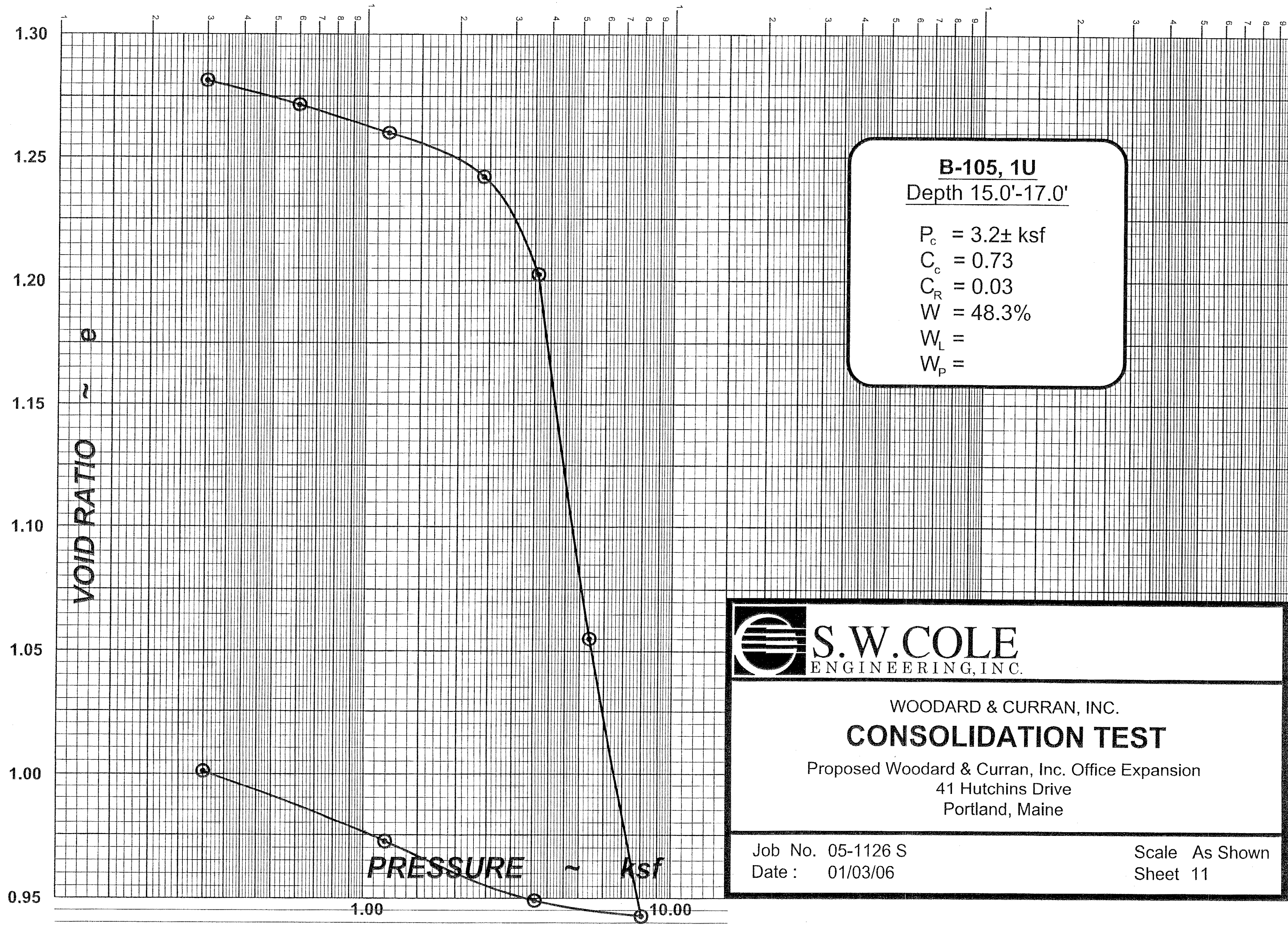
WOODARD & CURRAN, INC.

CONSOLIDATION TEST

Proposed Woodard & Curran, Inc. Office Expansion
41 Hutchins Drive
Portland, Maine

Job No. 05-1126 S
Date : 01/03/06

Scale As Shown
Sheet 10



S.W.COLE ENGINEERING, INC.

WOODARD & CURRAN, INC.

CONSOLIDATION TEST

Proposed Woodard & Curran, Inc. Office Expansion
41 Hutchins Drive
Portland, Maine

Job No. 05-1126 S
Date : 01/03/06

Scale As Shown
Sheet 11