FOUNDATION ENGINEERING REPORT

70 CRESCENT STREET

NEWTON, MASSACHUSETTS

JUNE 1, 2016

Prepared For:

KBA Architects
6 Thirteenth Street
Charlestown, MA 02129

2269 Massachusetts Avenue
Cambridge, MA 02140
www.mcphailgeo.com
(617) 868-1420

PROJECT NO. 6155.2.00

June 1, 2016

KBA Architects
6 Thirteenth Street
Charlestown, MA 02129

Attention: Mr. Dan Bradford

Reference: 70 Crescent Street; Newton, Massachusetts
Foundation Engineering Report

Ladies and Gentlemen:

Enclosed herein is our Foundation Engineering Report for the proposed residential development to be constructed at 70 Crescent Street in Newton, Massachusetts. Refer to the Project Location Plan (Figure 1) for the general site location.

This report was prepared in accordance with our proposal to KBA Architects for geotechnical engineering services dated April 6, 2016 and the subsequent authorization of Mr. Dan Bradford.

Purpose and Scope

The purposes of the subsurface exploration program and foundation design study are to assess the subsurface soil and groundwater conditions at the site as they relate to foundation design and construction and, based on this information, to provide safe and economic foundation design recommendations for the proposed building.

Foundation design includes foundation support of the proposed buildings, lateral earth pressures on foundation walls, and seismic design considerations in accordance with the provisions of the 8th Edition of the Massachusetts State Building Code (Code). Foundation construction considerations relating to excavation, backfilling, dewatering and other geotechnical aspects of the proposed construction are also presented herein.

Available Information

Information provided to McPhail Associates, LLC (McPhail) included a 20-scale site plan entitled “Existing Conditions Plan”, dated May 17, 2016 prepared by Feldman Land Surveyors.

Existing Site Conditions

Fronting onto the intersection of Crescent Street and Robinhood Street to the west, the 70 Crescent Street property is generally bounded by Interstate 90 to the north, wooded residential areas to the east, and an un-named access road to the south. Currently, the

property operates as a City of Newton Parks and Recreation Department facility and is occupied by a two-story brick building on the west of the site and a one-story warehouse building in the center of the site. The two buildings are surrounded by bituminous paved parking areas.

Proposed Construction

It is understood that proposed construction at the site consists of the construction of several two to three-story residential buildings. It is understood that the proposed buildings are planned to be constructed within the approximate location of the existing warehouse building and the directly adjacent bituminous paved areas. Furthermore, it is understood that the proposed buildings are not planned to occupy below-grade space.

Subsurface Explorations

A subsurface exploration program consisting of six (6) borings was completed at the site on April 27 and 28, 2016. The borings were performed by Carr-Dee Corp. of Medford, Massachusetts under contract to McPhail. The approximate locations of the boreholes are indicated on the enclosed Subsurface Exploration Plan, Figure 2. Logs of the borings are contained in Appendix B.

The borings were performed at accessible areas within the bituminous paved parking areas that surround the existing warehouse building. Field locations of the subsurface explorations and the existing ground surface at each exploration location were determined by a McPhail field representative by taping from existing site features identified on the referenced site drawings.

The explorations were monitored by personnel of McPhail who prepared field logs, obtained and visually classified soil samples, monitored groundwater conditions in the completed explorations, and determined the required depth of the explorations based upon actual subsurface conditions encountered.

The borings were generally advanced with NW casing using truck-mounted drilling equipment. Standard 1-3/8-inch I.D. split-spoon samples and standard penetration tests were obtained in general accordance with the standard procedures described in ASTM D1586. The depth of the explorations ranged from 17 to 22 feet below the existing ground surface.

Laboratory Testing

At the completion of the field work, the soil samples were transported to our laboratory for more detailed classification, analyses and testing. The laboratory testing consisted of sieve

analyses of representative samples of the fill and glacial outwash deposits recovered from the borings. Laboratory test procedures were in general accordance with applicable ASTM Standards. Results of the grain size analyses appear in Figures 3 and 4 attached to this report.

Subsurface Conditions

A description of the subsurface conditions encountered in the explorations is documented on the boring logs contained in Appendix B. Based on the explorations performed, the following is a generalized description of the subsurface conditions encountered from ground surface downward.

Directly underlying the existing bituminous asphalt site surface treatments, the borings encountered a layer of uncontrolled fill. The fill was observed to consist of a compact to very dense, gray-brown to black sand and gravel with trace to some silt. Also observed in the fill deposit were varying quantities of ash and cinders. The fill was observed to vary in thickness from approximately 1 to 4.7 feet. Grain size distributions of typical samples of the fill deposit are presented on the enclosed Figure 3.

Underlying the fill deposit, the borings encountered a stratified, natural glacial outwash deposit. The outwash deposit was observed to consist of a compact to very dense, tan to brown sand with trace silt varying to a sandy gravel with trace silt stratified with a compact, brown, silt with trace sand and gravel.

The surface of the natural glacial outwash deposit was encountered at depths between 1.5 to 5 feet below existing ground surface corresponding to levels between approximately Elevation +90.3 and Elevation +94.8. Grain size distributions of typical samples of the glacial outwash deposit are presented on the enclosed Figure 4. The borings were terminated within the natural glacial outwash deposit at depths between 17 and 22 feet below existing ground surface.

Groundwater was observed within the completed borings at depths ranging from 6.5 to 8 feet below existing ground surface, corresponding to levels ranging from Elevation +87.4 to Elevation +92.3. It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, periods of heavy precipitation, and alterations of existing drainage patterns.

Foundation Design Recommendations

Based on the scope of the proposed construction and the subsurface conditions encountered at the site, it is recommended that the proposed structures be founded on conventional footing foundations bearing directly on the undisturbed, natural outwash deposit or on compacted gravel fill placed directly on the undisturbed natural outwash deposit. It is

generally anticipated that across the footprint of the proposed addition, the surface of the natural outwash deposit will be encountered within two feet of the design bottom of footing.

Footings should be proportioned utilizing an allowable design bearing pressure of two (2) tons per square foot. The minimum footing width for perimeter footings and isolated footings should be 24 inches and 30 inches, respectively. All foundations should be designed in accordance with the Code.

Perimeter foundations and interior foundations below unheated areas should be provided with a minimum 4-foot thickness of soil cover as frost protection. Interior foundations below heated areas should be located such that the top of foundation concrete is a minimum of 12 inches below the underside of the lowest level slabs. All foundations should be located such that they are below a theoretical line drawn upward and outward at a 2 to 1 (horizontal to vertical) angle from the bottom exterior edge of all adjacent footings, structures and utilities. Proposed foundations located immediately adjacent to existing foundations should be founded at the same level as the existing foundation.

The lowest level slabs should be designed as an economical slab-on-grade underlain by a polyethylene vapor barrier. The vapor barrier should be underlain by a minimum 9-inch thickness of 3/4-inch crushed stone underlain by a layer of filter fabric, such as Mirafi 140N. Prior to the placement of any 3/4-inch crushed stone, the existing fill subgrade should be proof compacted with a minimum of six passes of a vibratory plate compactor. After proof compaction, all soft and/or weaving subgrade areas should be removed and replaced with compacted granular fill. Some cosmetic cracking and minor settlement of the slabs may occur over time due to the presence of the existing fill soil below the slabs.

Since the proposed lowest level slabs are understood to be constructed at or above the proposed finished grade, perimeter and underslab drainage are not considered necessary. All pits and depressions extending below the lowest level slabs (i.e. elevator pits, etc.) should be waterproofed and provided with properly tied continuous waterstops at all construction joints.

Lateral forces can be transmitted from the structure to the soil by passive pressure on the footings utilizing an equivalent fluid density of 120 pounds per cubic foot providing that these structural elements are designed to resist these pressures. Lateral forces can also be considered to be transmitted from the structure to the soil by friction on the base of the footings using a frictional coefficient of 0.4 to which a factor of safety of 1.5 should be applied.

Seismic Design Considerations

For the purposes of determining parameters for structural seismic design, this site is considered to be a Site Class D as defined in Section 1613 of the Code. Furthermore, the

bearing strata on the proposed site is not considered to be subject to liquefaction during an earthquake based on the criterion of Section 1806.4 of the Code.

Foundation Construction Considerations

The primary construction considerations include removal of existing foundations, excavation of existing fill from below the proposed footings, preparation of the foundation bearing surfaces, construction dewatering, placement and compaction of structural fill, overexcavation and replacement of structural fill for support of footings, reuse of onsite soils, and off-site disposal of excess excavated soil.

Following demolition of the existing buildings, it is recommended that all existing foundations within the footprints of the proposed buildings be removed in their entirety. Outside of the proposed building footprint, the existing foundations may be cut off and removed to a depth of at least 2 feet below finished grades.

Preparation of the footing subgrades should include removal of all fill materials to expose the surface of the natural undisturbed outwash deposit. The final excavation of the footing and slab subgrades should be accomplished using an excavator that is equipped with smooth-edged bucket to avoid disturbance of the bearing surface. Further, it is recommended that as soon as the outwash bearing surface is exposed, it should be immediately covered with a minimum 3-inch thickness of compacted 3/4-inch crushed stone to prevent disturbance of the subgrade during subsequent forming operations and construction traffic.

It is anticipated that across the footprint of the proposed structure, the surface of the natural outwash deposit will be generally encountered within 5 feet of the existing ground surface. If locations are encountered during excavation where the surface of the natural outwash deposit is below the design bottom of footing subgrade, compacted gravel fill should be used to replace the unsuitable existing fill material. The lateral limits of excavation and placement of compacted gravel fill at the surface of the natural outwash deposit should extend beyond the outside edge of the perimeter footings, in all plan directions, a distance equal the thickness of the gravel fill below the footing plus two feet.

It is anticipated that the dewatering of groundwater encountered during foundation excavation may be performed by means of localized sumping. In addition, trapped surface water is anticipated to accumulate within localized depressions in the ground surface across the site after periods of heavy precipitation and will most likely necessitate localized sumping. Therefore, groundwater interception and drainage by means of strategically located sump pumps are recommended to provide a workable excavation surface. It is recommended that surface water and groundwater accumulated on-site during foundation construction be recharged on-site.

It is anticipated that the excavated fill material and glacial outwash material may be re-used on-site for support of the proposed building foundations and slabs-on-grade and as ordinary fill outside the proposed building footprint provided it is excavated during non-freezing conditions in a relatively dry condition, is maintained in a dry condition, and can be properly compacted. Prior to reusing the fill material and glacial outwash material on-site as ordinary fill or as structural fill, it will be necessary to cull out all material in excess of 4 inches in largest dimension.

The results of our subsurface investigation indicate that the fill and glacial outwash deposit contain a moderately low silt content. However, it is emphasized that excavated fill and glacial outwash deposit will become unsuitable for re-use as structural fill if it becomes too wet. Hence, it is recommended that stockpiles of excavated fill and glacial outwash material intended for reuse be protected against increases in moisture content by securely covering the stockpiles prior to and during precipitation events. The placement and compaction of the fill and glacial outwash material should be completed during relatively dry and non-freezing conditions.

If, due to any of the above conditions, the excavated fill and glacial outwash material is unsuitable for reuse as structural fill, an off-site gravel fill consisting of a well-graded sand and gravel with a maximum of 8 percent by weight passing the No. 200 sieve should be used. Excavated organic material is considered unsuitable for re-use as ordinary fill or structural fill, and therefore would require off-site disposal.

The placement and compaction of gravel fill and structural fill should be monitored by a registered professional engineer or his designated representative in accordance with the provisions of the Code. The proposed paved areas of the subject site should be proof compacted. Soft spots identified during proof compaction should be excavated and replaced with compacted ordinary fill material.

Excess soil which is generated at the site and requires disposal is subject to current DEP policies and regulations pertaining to off-site re-use. In order to verify that the policies and guidance are being followed, it is typically necessary to perform chemical analysis on samples of the excess fill prior to disposal. If requested, McPhail Associates, LLC can provide these services should they be required for this project.

Final Comments

It is recommended that McPhail be retained to provide design assistance to the design team during the final design phase of this project. The purpose of this involvement would be to review the structural foundation drawings and foundation notes for conformance with the recommendations presented herein and to prepare the earthwork specification section for inclusion into the Contract Documents for construction.

It is further recommended that McPhail be retained during the construction period to observe final preparation of the foundation bearing surfaces and to monitor placement and compaction of fill materials in accordance with the provisions of the Code and the provisions of the Contract Documents. Our involvement during the construction phase of the work should minimize costly delays due to unanticipated field problems since our field engineer would be under the direct supervision of our project manager who was responsible for the subsurface exploration program and foundation design recommendations documented herein.

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the foundation design recommendations presented herein, please do not hesitate to call us.

Very truly yours,

McPHAIL ASSOCIATES, LLC

John A. Erikson

Ambrose J. Donovan, P.E., L.S.P.

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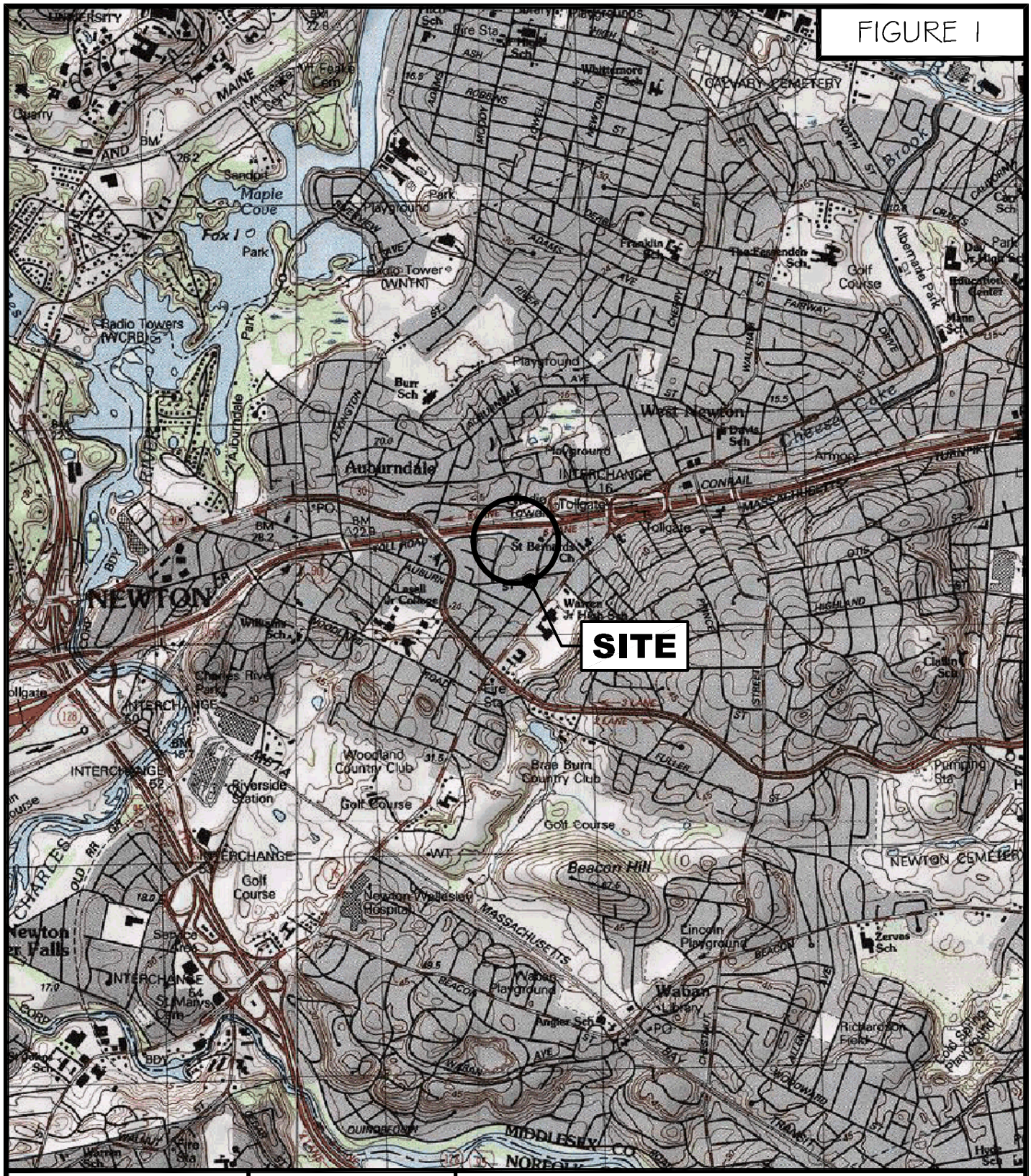
JAE/ajd

FIGURE 1



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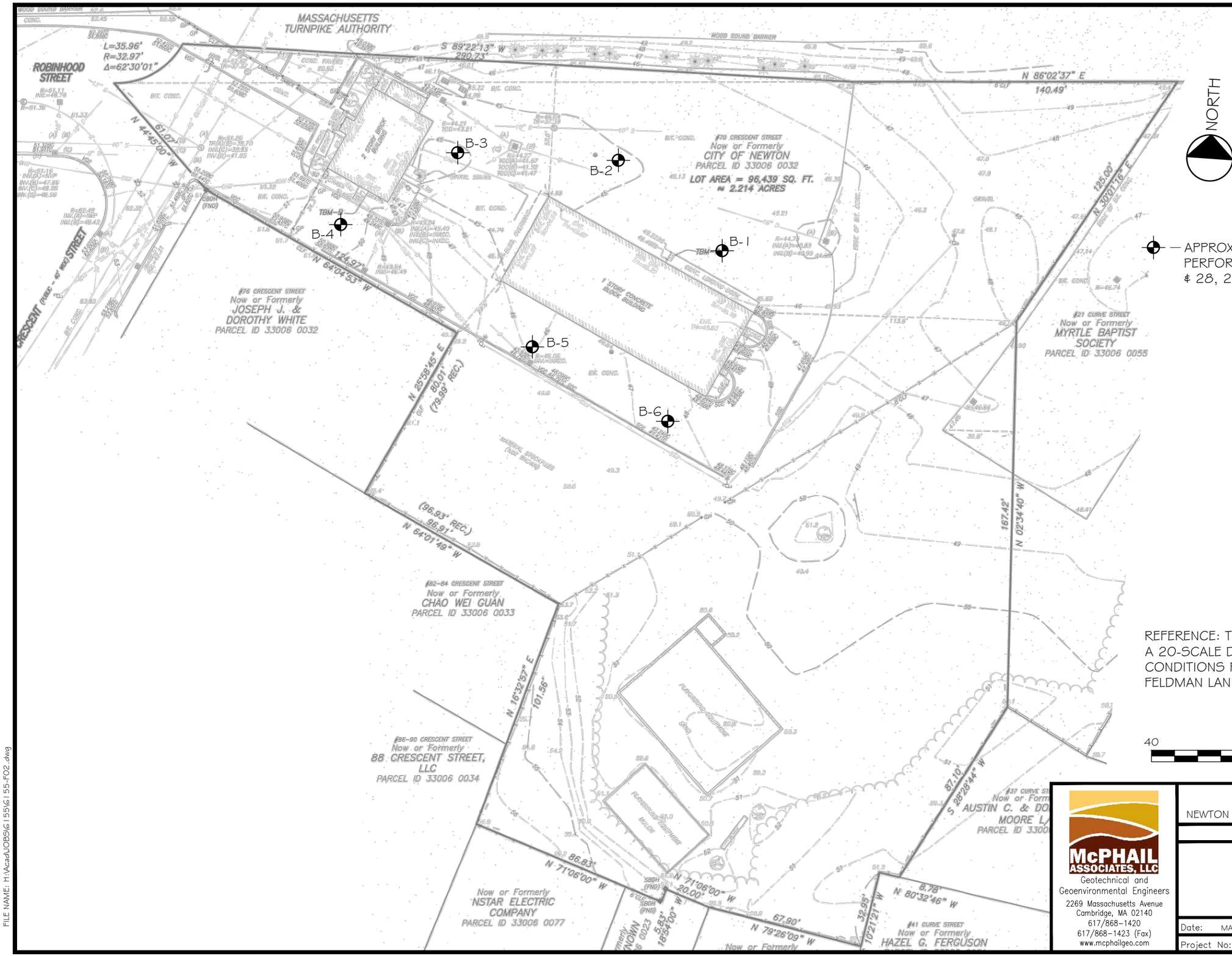
SCALE 1:25,000

PROJECT LOCATION PLAN

70 CRESCENT STREET

NEWTON MASSACHUSETTS

FIGURE 2



LEGEND

— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY CARR-DEE CORP. ON APRIL 27 & 28, 2016 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED "EXISTING CONDITIONS PLAN" DATED MAY 17, 2016 BY FELDMAN LAND SURVEYORS

GRAPHIC SCALE

40 0 40 80

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70 CRESCENT STREET

NEWTON MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

KBA ARCHITECTS

BY

McPHAIL ASSOCIATES, LLC

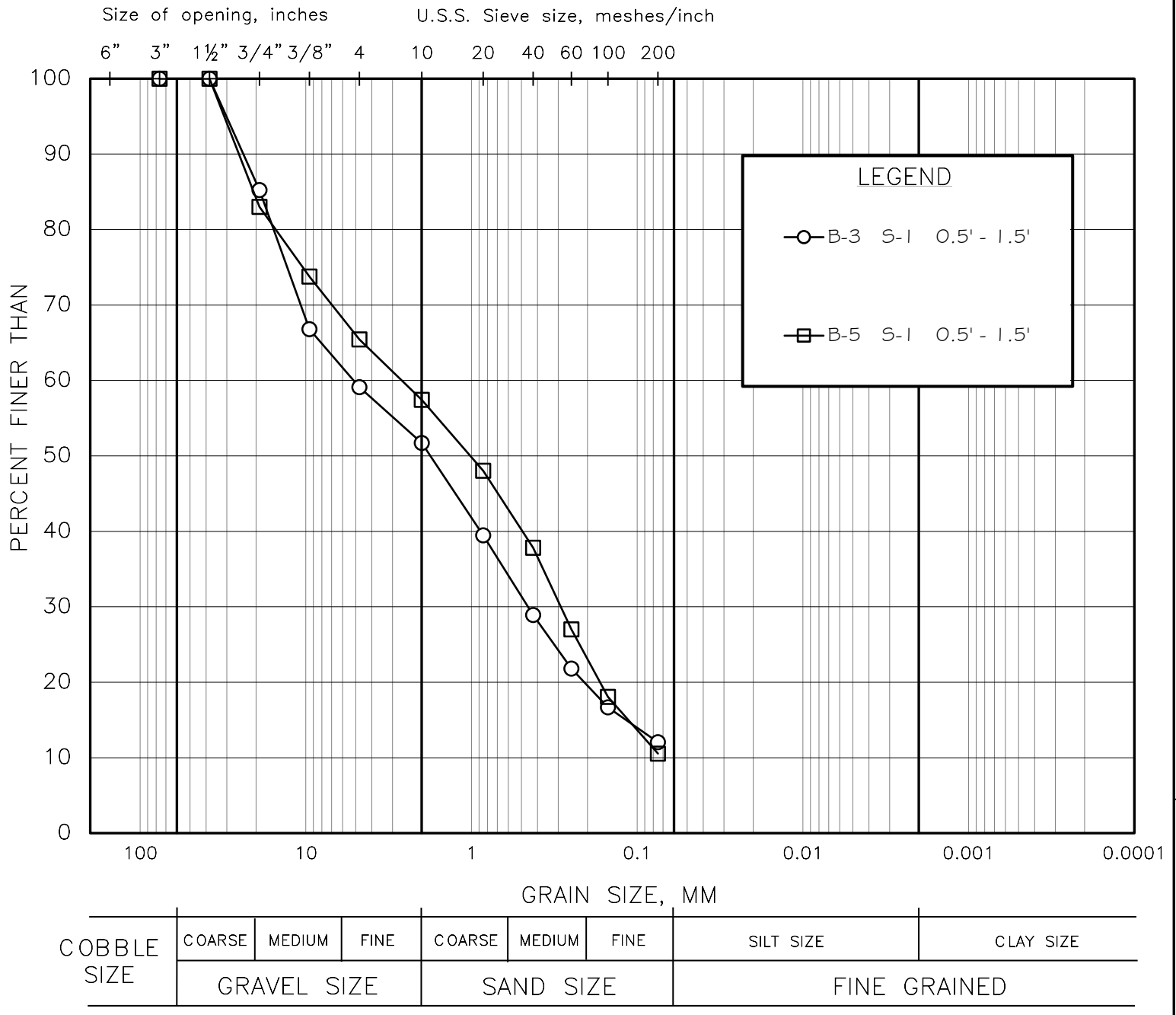
Date: MAY 2016	Dwn: I.J.M.	Chkd: J.A.E.	Scale: 1" = 40'
Project No: 6155			

FILE NAME: H:\Acad\JOBS\6155\55-F02.dwg

FILE NAME: F:\WP5\JOBS\6155 - 70 Crescent Street\Fill Sieve.xls

PROJECT No. 6155.2.00

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GRANULAR FILL

FIGURE 3

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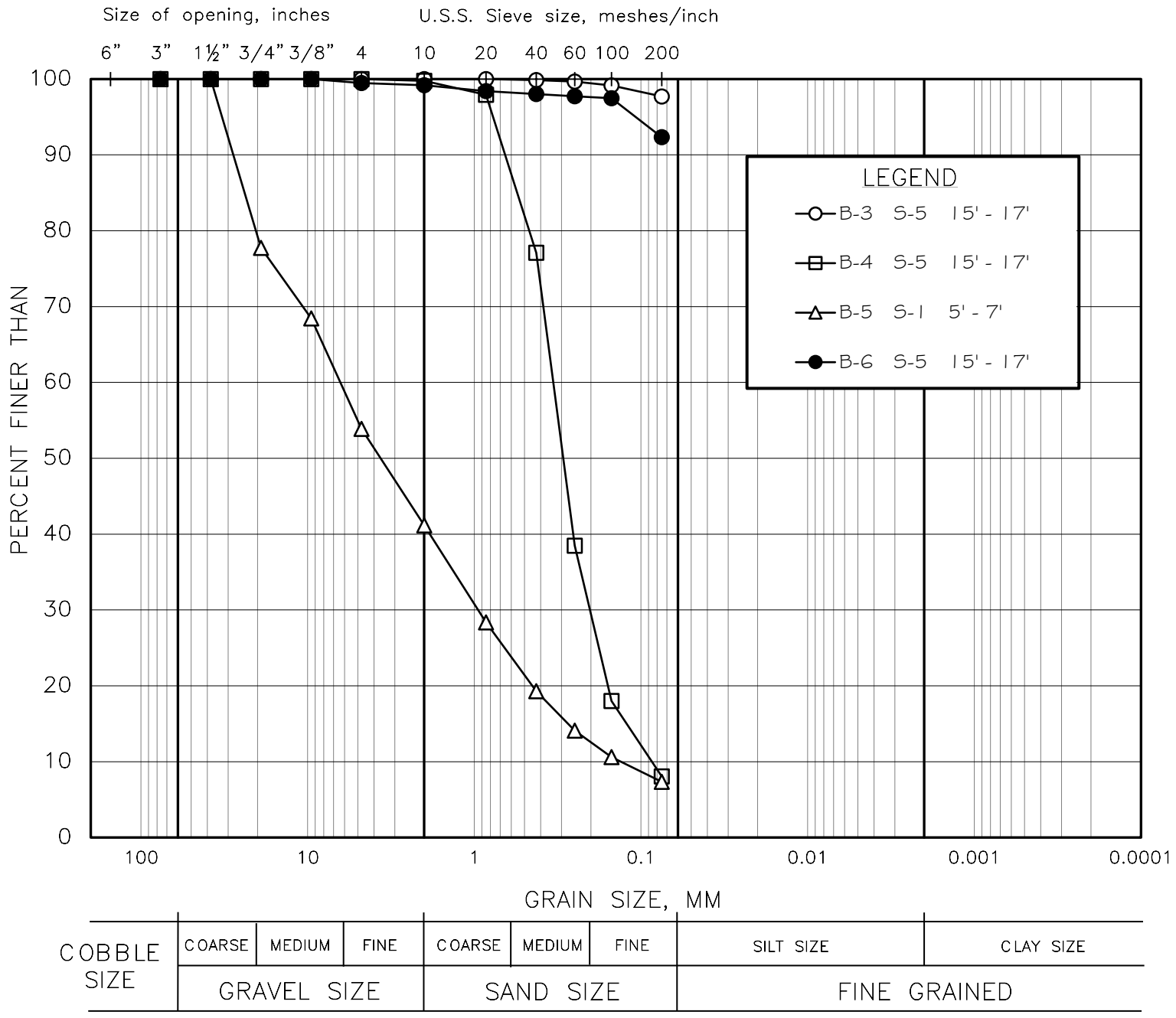
PROJECT No. 6155.2.00

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 4

APPENDIX A:

LIMITATIONS

LIMITATIONS

This report has been prepared on behalf of and for the exclusive use of KBA Architects for specific application to the proposed residential buildings to be constructed at 70 Crescent Street in Newton, Massachusetts in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made.

In the event that any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by McPhail Associates.

The analyses and recommendations presented in this report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

APPENDIX B:

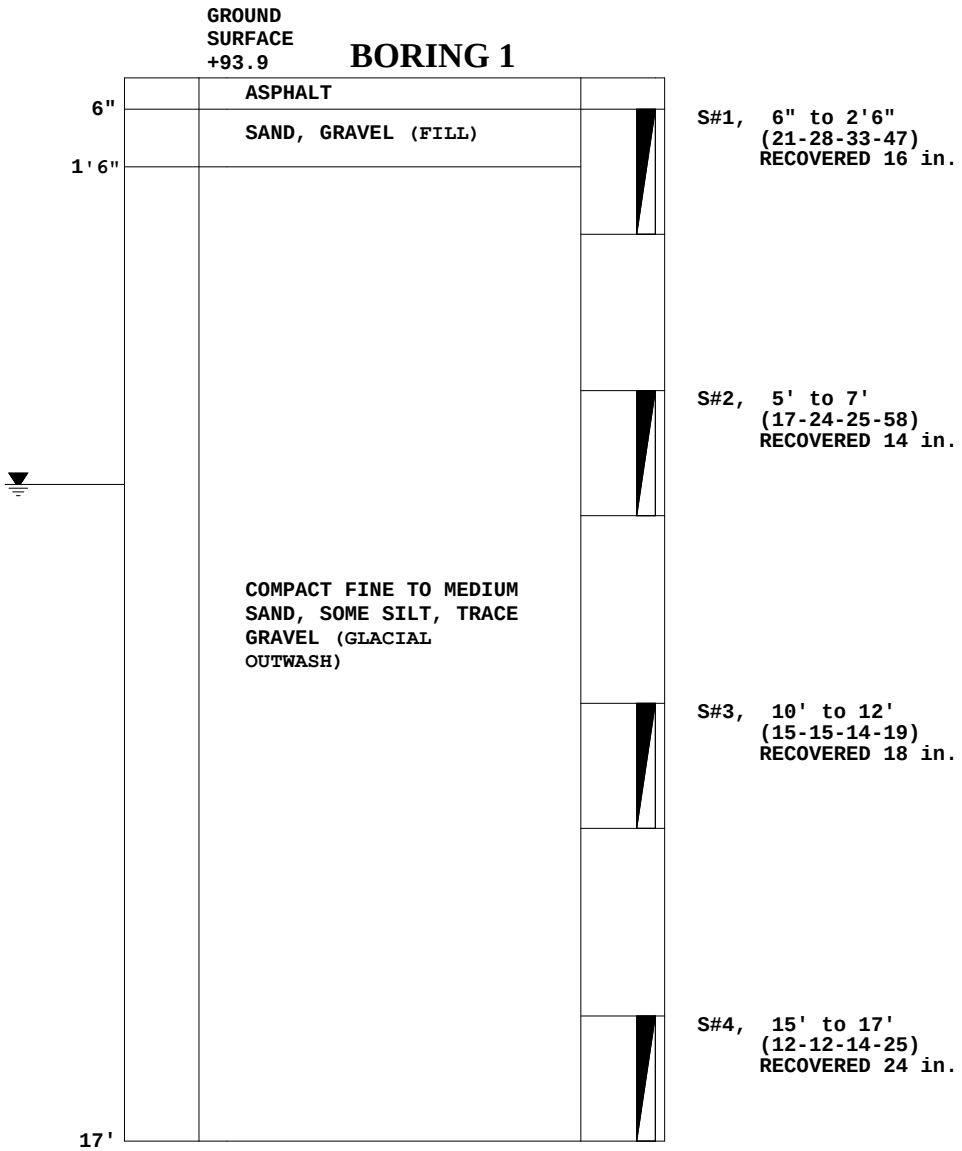
CARR DEE CORP. BORING LOGS
BORINGS B-1 TO B-6

CARR-DEE CORP.

37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: MCPHAIL ASSOC., LLC, 2269 MASS. AVE., CAMBRIDGE, MA Date: 5-2-2016 Job No.: 2016-88

Location: 70 CRESCENT STREET, NEWTON, MA Scale: 1 in.= 3 ft.



WATER LEVEL 6'6"
SIZE OF AUGERS: 2-1/4" I.D., LENGTH: 15'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-27-2015

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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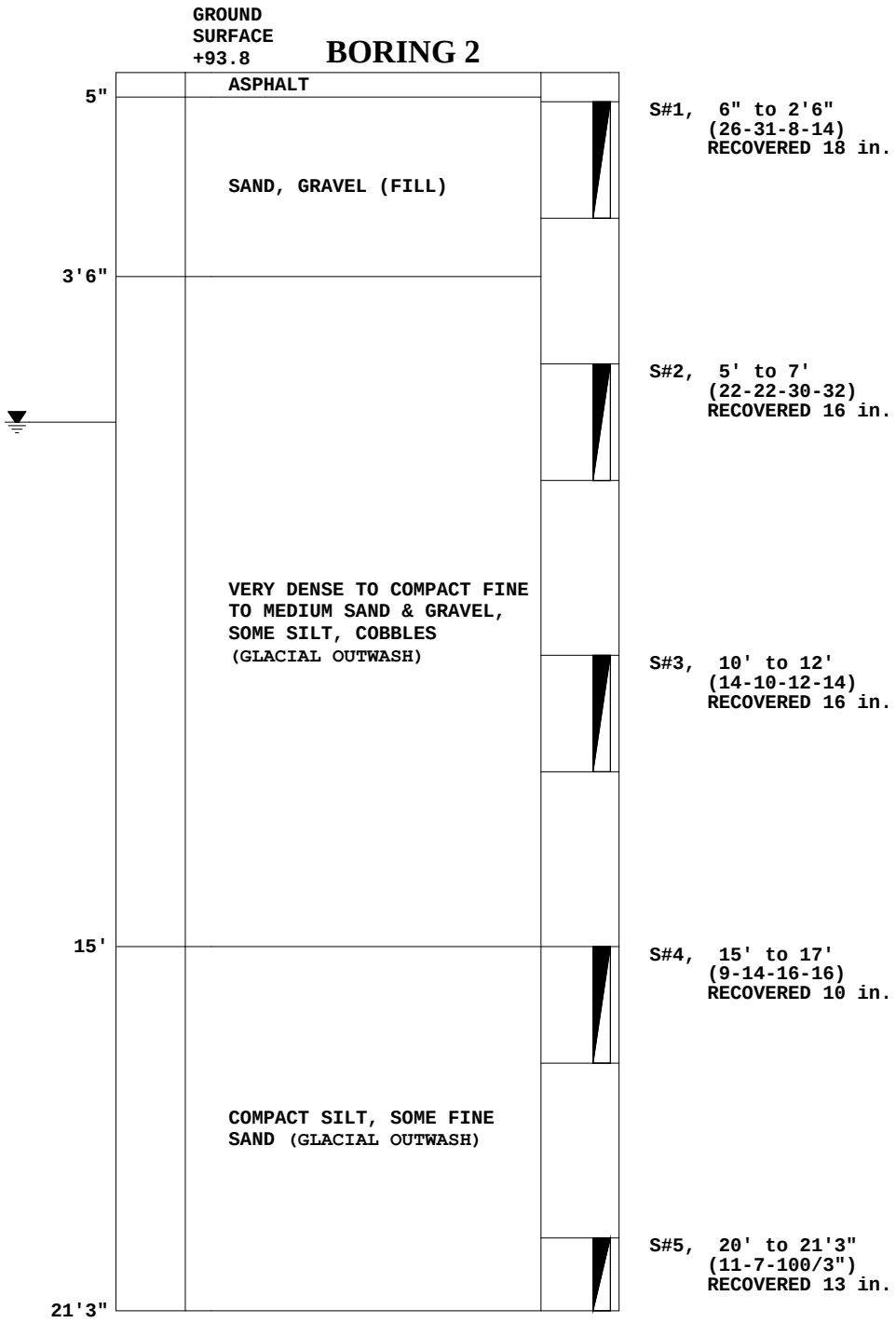

WATER LEVEL 6'
SIZE OF AUGERS: 2-1/4" I.D., LENGTH: 15'0"
SIZE OF CASING: NW, LENGTH: 20'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-27-2015

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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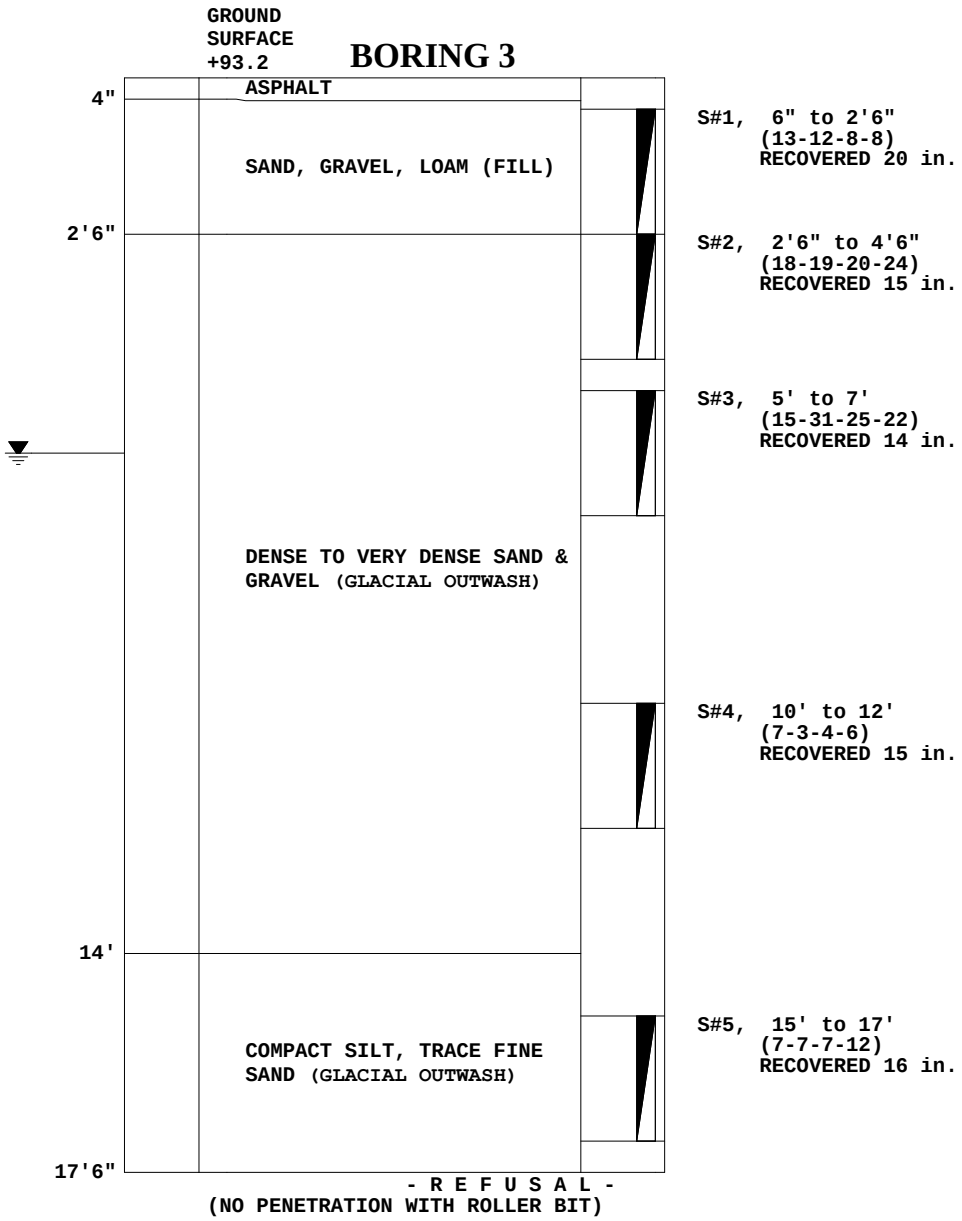

WATER LEVEL 6'
SIZE OF CASING: NW, LENGTH: 15'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-28-2015

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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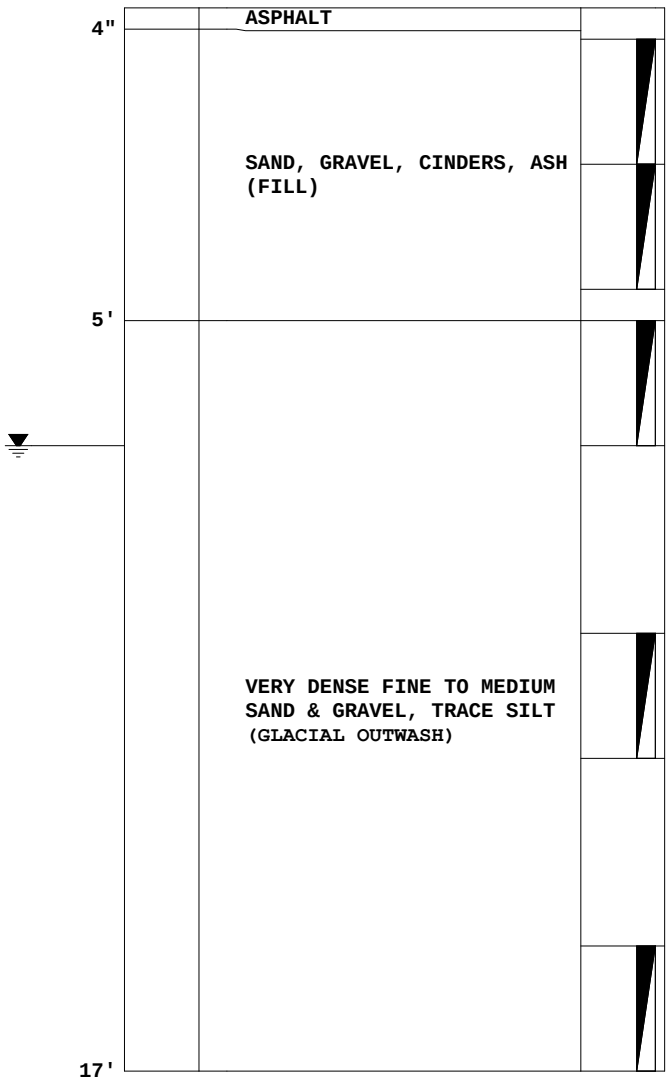
To: MCPHAIL ASSOC., LLC, 2269 MASS. AVE., CAMBRIDGE, MA Date: 5-2-2016 Job No.: 2016-88

Location: 70 CRESCENT STREET, NEWTON, MA Scale: 1 in.= 3 ft.

BORING 4



WATER LEVEL 7'
SIZE OF CASING: NW, LENGTH: 15'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-28-2015

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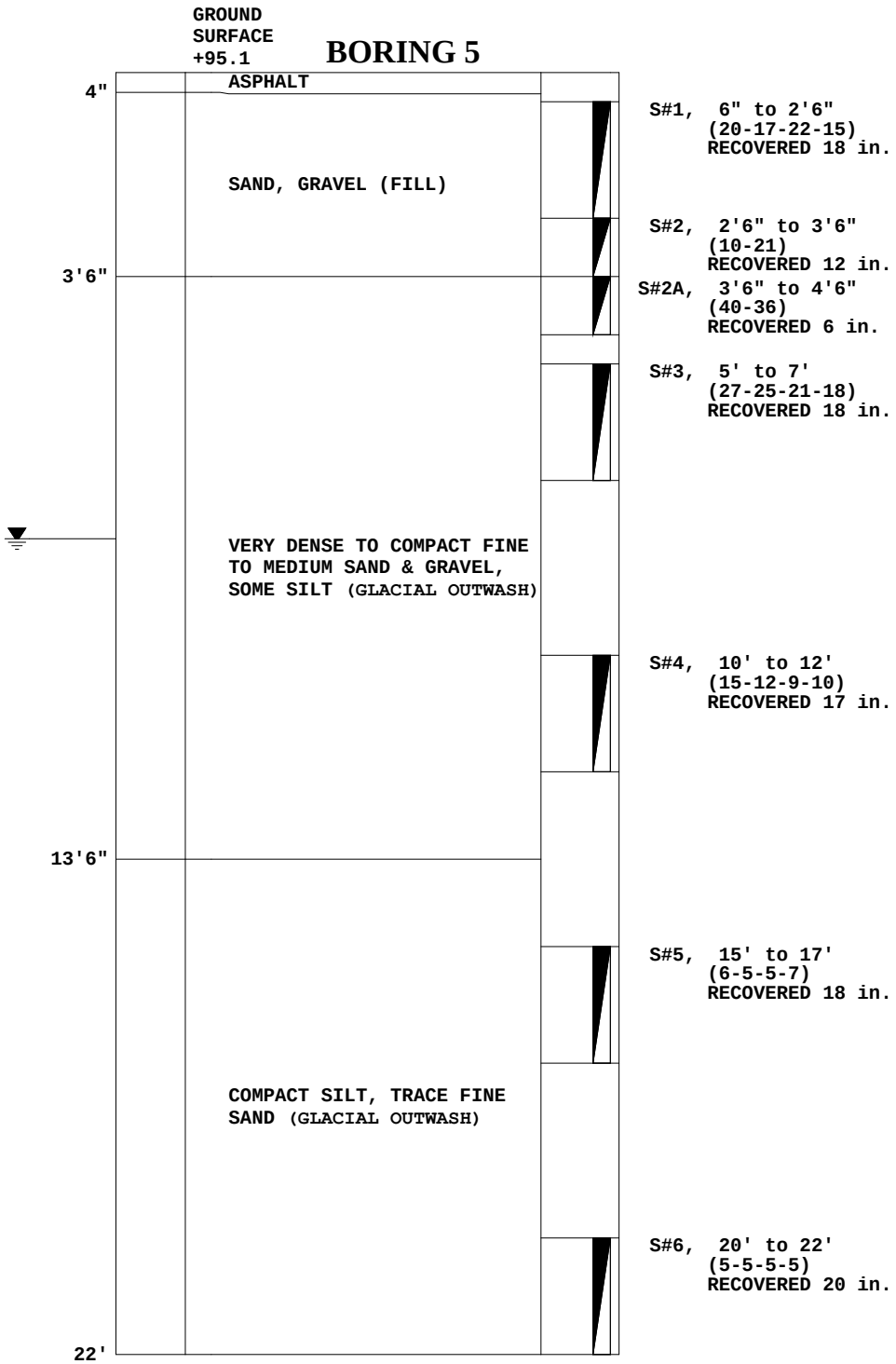

WATER LEVEL 8'
SIZE OF CASING: NW, LENGTH: 15'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-28-2015

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

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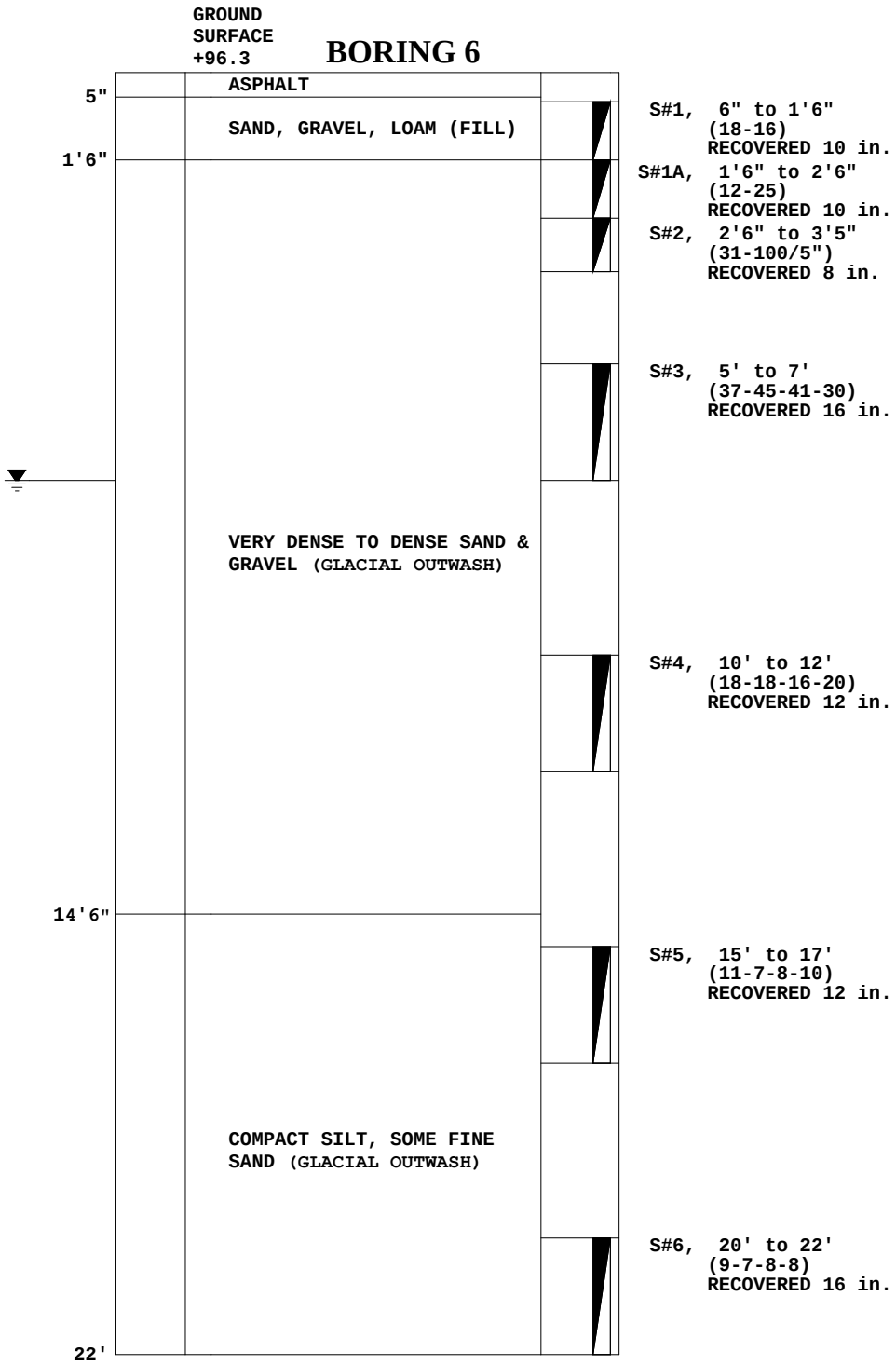

WATER LEVEL 7'
SIZE OF CASING: NW, LENGTH: 15'0"
DRILLER: G. SMITH, INSPECTOR: T. CORMICAN
DATE STARTED & COMPLETED: 4-27-2015

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