

Newton Highlands Park – Newton, Massachusetts
Weston & Sampson Project No. 2150258

July 9, 2015

City of Newton, Massachusetts
c/o Brandon Riley
Weston & Sampson
85 Devonshire Street, 3rd Floor
Boston, Massachusetts 02109

RE: Geotechnical Engineering Report
Newton Highlands Park Rehabilitation – Newton, Massachusetts

INTRODUCTION

Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to present our geotechnical engineering report for the proposed improvements at Newton Highlands Park in Newton, Massachusetts.

Based on review of concept design drawings prepared by Weston & Sampson (see attached ***Sheets L500 through L503***), we understand that proposed improvements include eight light poles at various locations around new natural turf football and baseball fields, a single story concession/restroom building, a paved parking area, new tennis courts, a new basketball court, a children's play area including small climbing structures, and drainage improvements including catch basins, manholes, pipes, and subsurface drainage at the football and baseball fields. The locations of the proposed site improvements are shown relative to existing site features on the attached concept drawings.

Proposed grades are within approximately 5 ft. of existing grades, with most areas being filled to proposed grades. The south corner of the football field and home plate area of the new baseball field will be raised up to approximately 4 ft. above existing grades. Proposed utility depths were not available at the time of this report but we anticipate that new drainage utilities will be less than 6 feet below existing grades.

Foundations for the new concession/restroom structure are expected to be lightly loaded shallow spread footings bearing approximately 4 ft. below proposed grades. A concrete floor slab on-grade is assumed. Light pole foundations are assumed to consist of cylindrical precast concrete bases installed in drilled (augered) shafts and backfilled with structural concrete.

SITE CONDITIONS

Geologic Conditions

Based on surficial geology information available from the Massachusetts Office of Geographic Information (MassGIS), the site is mapped in an area of sand and gravel deposits overlying till and bedrock at depths up to 50 ft. Bedrock geology is mapped as Roxbury Conglomerate.

Surface Conditions

In general, Newton Highlands Park is bordered by Dedham Street to the south, Upland Avenue to the west, Winchester Street to the northwest, residential properties along Wade Street to the northeast, and an undeveloped forested area to the southeast. The existing ground surface is relatively flat and covered with mowed grass in most areas north of the existing tennis and basketball courts. Based on an existing conditions survey provided by the City of Newton, surface grades at the site are relatively flat with elevations ranging from approximately El. 124 at the northwest end of the site to El. 111 near the center of the site. Elevations reference the North American Vertical Datum of 1988 (NAVD88). The asphalt concrete (AC) pavement at the existing tennis and basketball courts is generally in poor condition with frequent cracks.

Subsurface Explorations

Subsurface conditions were explored by advancing fourteen test borings labeled B1 through B14 to depths up to 24.0 ft. below the existing ground surface at the approximate locations shown on the attached **Boring Location Plan**. Borings B1 through B8 were advanced to depths between 22.0 to 24.0 ft. BGS in the immediate vicinity of the proposed light poles around the new football and baseball fields. Boring B9 was located at the proposed concession/restroom building and was terminated at a depth of 8.0 ft. due to poor sample recoveries. Boring B9A was advanced to a depth of 24.0 ft. approximately 3 ft. north of B9. Borings B10 through B14 were each advanced to a depth of 6.0 ft. in proposed tennis court, basketball, parking, and playground areas.

The borings were completed on June 15 through 17, 2015 by Crawford Drilling Services, LLC. of Westminister, MA using a track-mounted ATV drill rig and hollow stem auger drilling methods. Standard penetration tests (SPT) were completed in each boring using a standard 24-in. long by 1 $\frac{3}{8}$ -in. inside diameter (2-in. outside diameter) split spoon sampler driven 24 in. by blows from a 140-lb. automatic hammer falling 30-in. per blow. Sampling intervals generally ranged from continuous (every 2 ft.) in the topsoil and fill soils to every 5 ft. in the underlying native soils.

A Weston & Sampson representative observed drilling activities in the field. Subsurface conditions encountered in our explorations are described in the following sections and in the attached **Boring Logs**.

Subsurface Conditions

All borings encountered a surficial topsoil layer ranging in thickness from 1 to 9 inches underlain by SAND FILL to depths of 2 to 4 ft. BGS. Borings B3, B10, B11, and B12 encountered a 6- to 28-inch thick buried layer of TOPSOIL FILL underlying the sand fill. The sand and topsoil fill were underlain by native strata of SILT, SAND, and SILTY SAND to the depths explored. The

subsurface conditions encountered in our explorations are generally consistent with the site history and mapped surficial geology.

The SAND FILL was generally loose to medium dense and contained up to some gravel and up to some silt. The TOPSOIL FILL was generally dark brown, loose to medium dense, silty, and contained little organics. The native SAND (with little silt) and SILTY SAND were generally loose to medium dense. The native SILT was generally medium stiff to stiff and contained up to little fine sand.

Groundwater

Groundwater levels were estimated at approximately 6 ft. in B3, B13, and B14 and at approximately 10 ft. in B1, B2, and B4 through B9(A) based on observation of wet samples. Wet samples were not observed in B10 and B11 to the depth explored (6 ft.). We anticipate that groundwater levels will fluctuate with season, variations in precipitation, construction in the area, and other factors. Perched groundwater conditions could exist close to the ground surface, especially during and after extended periods of wet weather.

RECOMMENDATIONS

General

Based on the subsurface conditions encountered in our explorations and our engineering analyses, the proposed site improvements are feasible following the recommendations contained herein. The primary geotechnical consideration for the proposed light pole foundations is the presence of loose sandy soils beneath the groundwater table. Excavations for foundation construction will require temporary casing and/or use of a drilling fluid to maintain open excavations and support the surrounding ground.

Geotechnical considerations associated with the proposed site grading and shallow foundations include surficial undocumented (non-engineered) fill, a buried layer of topsoil fill encountered in several explorations (B3, B10, B11, and B12), and fine grained silty soils at proposed subgrade elevations. The existing sand fill and topsoil fill are not suitable for support of foundations and other site improvements that would be adversely affected by settlement. The existing fill should be removed from these areas and replaced with structural fill constructed as recommended herein.

It may be possible for the existing fill to remain in place in some areas, such as landscape and field areas and beneath flexible asphalt concrete pavements and walkways, but subgrade conditions in these areas should be evaluated by a Weston & Sampson geotechnical engineer following excavation to subgrade elevations and prior to placement of overlying fill and materials. This will allow us to evaluate the thickness and composition of the existing fill, identify potential risk(s) to the performance of the overlying site improvement(s), and provide recommendations for removal and/or stabilization as necessary. Additional recommendations are provided in the following sections.

Earthwork

Site Preparation - Prior to earthwork construction, the site should be prepared by removing vegetation, topsoil, debris, disturbed soil, and existing site features (to be removed) to expose undisturbed fills and subgrade materials. The borings generally encountered 1 to 9 inches of

topsoil at the ground surface. Deeper stripping depths may be required in areas of loose organic soil typically associated with areas of trees and undergrowth.

Existing fill should be completely removed to expose native undisturbed soils within the zone-of-influence beneath new foundations and other site improvements that could be adversely affected by differential settlement. The zone-of-influence is defined as planes extending horizontally away from the outside edge of foundations (and other features) for 2 ft. horizontally and then down and away at a 1H:1V slope. These areas should be brought back to grade with Structural Fill constructed as recommended below.

Root balls from trees may extend downward several feet and grubbing operations can cause considerable subgrade disturbance. All disturbed material should be removed to undisturbed subgrade and the resulting excavation backfilled with Structural Fill. Common Borrow may be used as backfill in landscape and non-structural areas. In general, the sides of these excavations should be sloped back flatter than 1.5H:1V to ensure that the interface between existing soil and new fill can be thoroughly compacted. Fill should be benched into slopes as described below.

Subgrade Preparation and Protection - Following stripping and site preparation, granular (sandy) subgrades should be recompacted until dense and stable with several passes of a minimum 12-ton smooth drum roller. We recommend that compaction be limited to static methods only; vibratory compaction methods could disturb underlying fine grained materials and should not be used unless recommended by the geotechnical engineer based on observations during construction.

Weston & Sampson should be contacted to evaluate exposed subgrades after recompaction and prior to placement of fill and overlying materials to determine if soft or yielding areas are present and require over-excavation and stabilization. Our evaluation may include visual observations and probing and/or observation of a proof roll using a fully loaded 10-yard dump truck or equipment of similar size and weight.

Soft, loose, or disturbed areas will require additional recompaction or over-excavation, stabilization, and backfill with compacted fill. Crushed stone could be used for stabilization and backfilling provided it is separated from surrounding soils by a non-woven geotextile filter fabric. A woven geosynthetic may also be required depending on the condition of the exposed subgrade and groundwater conditions encountered during the work. The recommended stabilization fabric is a woven geosynthetic with an AOS of #40 to #80 sieve, a minimum puncture resistance of 350 pounds, and a minimum grab tensile strength of 200 pounds (such as Mirafi FW700 or equivalent).

Fill should not be constructed over frozen subgrades. All frozen and frost penetrated materials should be removed prior to placement and compaction of overlying materials. If foundation construction occurs during freezing conditions, insulating blankets, heaters, or other suitable measures should be employed to prevent foundation subgrades from freezing until the foundations are backfilled sufficiently to prevent frost from reaching the footing subgrades.

Soils containing more than trace amounts of silt are highly susceptible to softening and disturbance by construction activity during wet weather. Construction traffic should not operate directly on subgrades if prone to loosening, disturbance, and softening.

Subgrade protection is the responsibility of the contractor and precautions and protective measures appropriate for the weather and traffic conditions during construction should be used during earthwork and foundation construction to preserve the integrity and condition of subgrades. To reduce disturbance due to foot traffic during construction, a few inches of crushed stone can be placed and compacted at the base of foundation excavations.

Fill - Imported well graded sand and gravel fill with less than approximately 10 percent fines (such as MassDOT M1.03.0-type B Gravel Borrow or M2.01.7 Dense-graded Crushed Stone) is recommended for use as Structural Fill beneath proposed structures and as a base course beneath proposed walkways, sidewalks, and slabs. Structural Fill should be placed in maximum 10 inch thick lifts (measured prior to compaction) with each lift compacted to at least 95 percent of its maximum dry density as determined by ASTM D1557 (modified proctor).

Based on the subsurface conditions encountered in our borings, the on-site fill will not be suitable for use as Structural Fill, however, on-site granular soils (sand and sand fill) will likely be suitable for use as Common Borrow in non-structural areas outside proposed structures, pavement, and hardscaped areas. Common Borrow fill material should contain less than approximately 20 percent fines and be free of organics (and organic debris), contamination, and other deleterious materials including cobbles and pieces of debris larger than approximately 6 inches.

Moisture conditioning (i.e. adding or removing moisture) may be required prior to compaction of on-site materials. Once moisture contents are within approximately three percent of optimum, the material should be compacted to at least 92 percent relative to ASTM D1557. Common Borrow fill material should be placed in lifts no greater than 10 inches in loose (uncompacted) thickness.

Fill should be placed in horizontal lifts benched into existing slopes. In confined areas and where only hand-guided compaction equipment can be used, lift thickness should be reduced to not more than six inches. In addition to density testing (and where feasible), we recommend that the fill lifts pass a proof roll using a fully loaded dump 10-wheel truck or equipment of similar size and weight and observed by a geotechnical engineer.

Excavation Considerations - Excavation will be required for site preparation, grading, and foundation construction. Recommendations for light pole foundation construction are provided in a following section. Groundwater and surface water should be controlled during construction and prevented from eroding slopes and disturbing excavation and subgrade materials. Moderate to severe caving of excavation sidewalls should be anticipated. Flowing sand conditions should be expected where seepage is present.

Temporary excavation support will likely be required for excavation depths greater than 4 feet and where groundwater seepage is present. Foundations and utilities should be designed and

constructed so that excavations do not extend into the zone-of-influence beneath existing utilities and other existing site improvements.

We recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. All excavations should be made in accordance with applicable OSHA and local safety regulations. Dewatering, if required, should also be the responsibility of the contractor.

Trenches - Open utility trench excavations should be completed as recommended above. Pipe bedding should be installed in accordance with the pipe manufacturers' recommendations. If groundwater seepage, standing water, or loose and/or disturbed soils are present at the base of utility trench excavations, we recommend over-excavating the trench by 12 to 18 inches and placing trench stabilization material in the base. Trench stabilization material should consist of well-graded, crushed stone with a maximum particle size of 4 inches and free of deleterious materials. The percent passing the U.S. Standard No. 200 Sieve shall be less than 5 percent by weight when tested in accordance with ASTM C 117.

Trench backfill above the pipe zone in structural areas should consist of well graded, angular crushed stone or sand fill with no more than 8 percent passing a #200 sieve. Common Borrow may be used in non-structural areas. Trench backfill should be compacted to 92 percent relative to ASTM D1557 and to 95 percent relative to ASTM D1557 within 2 feet of finished grades in structural areas. Construction of overlying hard surfaces, such as sidewalks or pavement, should not occur before at least one week after backfilling.

Light Pole Foundations

The light pole foundations should be designed in accordance with the provisions of the current edition of the Massachusetts State Building Code and the Technical Specifications provided by the light pole manufacturer. Based on the subsurface conditions encountered in our explorations, the proposed light poles at boring locations B-1 through B-8 can be supported by precast concrete bases installed in drilled shafts and backfilled with concrete.

Drilled shaft light pole foundation excavations will require use of temporary casing and/or drilling fluid to maintain open excavations and support the surrounding ground. All loose and disturbed materials should be removed from the base of the shaft prior to placement of the precast base. Backfill around the precast base should consist of Portland cement concrete with a minimum (28 day) compressive strength of 3,000 pounds per square inch. The concrete should be placed from the bottom of the shaft using a tremie pipe during extraction of the temporary casing.

An allowable (factored) bearing pressure of 2,000 psf can be used at the base of the pier to resist axial loads provided all loose material and slough is removed as recommended above. An allowable adhesion value of 75 pounds per square foot can be used to calculate resistance to axial loads due to skin friction between the soil and concrete backfill. Skin friction in fill soils should be neglected.

Resistance to lateral loads can be calculated using the soil parameters in the following table. Resistance in the top two feet of foundation embedment should be ignored. Groundwater at the ground surface should be assumed.

	SAND FILL	NATIVE SAND/ SILTY SAND/ SILT
Submerged Unit Weight, lb/ft ³	52.6	52.6
Soil Angle of Internal Friction, ϕ	30	28
Coefficient of Passive Earth Pressure, K_p (Rankine)	3	2.8

Shallow Foundations

General - Based on the subsurface conditions encountered in our explorations, the proposed lightly loaded concession/restroom building and playground structures can be supported by conventional spread footings or piers bearing on proof compacted native sand, undisturbed native medium stiff (or stiffer) silt, or properly constructed structural fill over these materials. A Weston & Sampson geotechnical engineer should observe all foundation subgrades prior to placement of forms and rebar.

Footings bearing on the recommended subgrades should be designed using an allowable bearing pressure of 2,000 psf. The allowable bearing pressure can be increased to 4,000 psf to resist temporary wind and seismic loads provided load eccentricities are within the middle third of the footing. Resistance to lateral loads can be obtained by a passive equivalent fluid pressure of 250 pcf, ignoring the top 12 inches of embedment, and by a footing base friction coefficient of 0.45.

Foundations for proposed structures should be designed in accordance with the provisions of the current edition of the Massachusetts State Building Code (MSBC). Footings should be embedded at least 4 ft. below the nearest proposed adjacent ground surface exposed to freezing.

Shallow foundations constructed as recommended herein are anticipated to undergo total and differential settlements of less than 1-inch and ½-inch, respectively.

Seismic Site Class

In accordance with the International Building Code (IBC) as adapted by the State of Massachusetts State Building Code and based on our explorations and analyses, the subject project should be evaluated using parameters associated with Site Class D.

Slabs

A minimum of 12 inches of clean, angular crushed stone with no more than 6 percent passing a #200 sieve is recommended for underslab stone. We should be contacted to evaluate the subgrade prior to placement of the underslab stone. Underslab stone should be compacted until dense and well-keyed by at least four complete passes of a minimum 10-ton vibratory smooth drum roller. Any areas contaminated with fines or debris should be removed and replaced with

clean stone. If the underslab stone is saturated or trapping water, the water should be removed prior to slab placement.

LIMITATIONS

We have prepared this report for use by the City of Newton and the design and construction teams for this project and this site, only. The information herein could be used for bidding or estimating purposes but should not be construed as a warranty of subsurface conditions. We have made observations only at the aforementioned locations and only to the stated depths. These observations do not reflect soil types, strata thicknesses, water levels or seepage that may exist between observation locations. We should be consulted to observe site and subgrade preparation. We should be consulted to review final design and specifications in order to see that our recommendations are suitably followed. If any changes are made to the proposed improvements, structures, grading, configurations, or construction timing, our recommendations may not be applicable, and we should be consulted.

The preceding recommendations should be considered preliminary, as actual soil conditions may vary. In order for our recommendations to be final, we should be retained to observe actual subsurface conditions encountered. Our observations will allow us to interpret actual conditions and adapt our recommendations if needed.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, expressed or implied, is given.

It has been a pleasure assisting you with this project and we look forward to our continued involvement. Please call if you have any questions.

Very truly yours,

WESTON & SAMPSON, INC.



Christopher J. Palmer, PE
Team Leader



Mark P. Mitsch, PE
Senior Associate

Attachments:

- Figure 1 - Boring Location Plan
- Boring Logs (14 pages)
- Conceptual Design Drawings L500 through L503 (4 pages)

O:\Newton MA\Highland Park Geotech\Report\Geotech Letter Report - Newton Highland Park.doc

C:\Newton MA\Highland Park Geotech\CAD\FIGURE 1 - BORING LOCATION PLAN.dwg



NOTES:

1. TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES, LLC OF GARDNER, MASSACHUSETTS ON JUNE 15 THROUGH 17, 2015.
2. WESTON & SAMPSON ENGINEERS, INC. OBSERVED DRILLING ACTIVITIES IN THE FIELD.
3. EXPLORATION LOCATIONS WERE MEASURED RELATIVE TO EXISTING SITE FEATURES. LOCATIONS SHOWN ARE THEREFORE APPROXIMATE.
4. THE VERTICAL DATUM REFERENCES THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. THIS PLAN IS BASED ON AN EXISTING CONDITIONS SURVEY PLAN PROVIDED BY THE CITY OF NEWTON AND COMPLETED BY CHAPPELL ENGINEERING ASSOCIATES, LLC. ON APRIL 6, 2007.

LEGEND


B-1  TEST BORING NUMBER AND APPROXIMATE LOCATION



FIGURE 1		
NEWTON HIGHLANDS PARK NEWTON, MA		
BORING LOCATION PLAN		
DESIGNED BY: TJB	CHECKED BY: CJP	DATE: JULY 2015
Weston & Sampson [®]		

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 120.5 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/15/15 **DATE END** 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	10/24	0-2	4-8-9-12		2" topsoil over medium dense, fine to medium SAND FILL, some gravel, trace silt; moist.		2" TOPSOIL
									SAND FILL
		S2	12/24	2-4	9-7-8-9				Medium dense, brown, fine to medium SAND, little silt; moist.
5		S3	10/24	4-6	3-7-7-6		Medium dense, brown, fine to medium SAND, little silt; moist.		
10		S4	8/24	10-12	3-2-3-4		Loose, brown, fine to medium SAND, little silt; wet.		
15		S5	8/24	15-17	2-3-3-4		Loose, brown, fine to medium SAND, little silt; wet.		
20		S6	8/24	20-22	2-4-5-7		Loose, brown, fine to medium SAND, little silt; wet.		
25								Terminated at 22 ft.	
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 117 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/15/15 **DATE END** 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	18/24	0-2	1-3-4-6		9" topsoil over loose, brown, silty fine SAND FILL, little organic silt; trace gravel; moist.		9" TOPSOIL
		S2	10/24	2-4	8-9-12-11				SAND FILL
		S3	10/24	4-6	3-5-5-6				Medium dense, gray-brown, silty fine SAND; moist.
5							Medium dense, brown, silty fine SAND; moist.		
10		S4	8/24	10-12	WOH-2-2-3		Loose, brown, silty fine SAND; wet.		SAND/SILTY SAND
15		S5	20/24	15-17	3-3-5-4		Loose, orange-brown, fine to medium SAND, some silt; wet.		
20		S6	18/24	20-22	1-2-3-3		Loose, orange-brown, silty fine to medium SAND, wet.		Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 116.5 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/15/15 **DATE END** 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 6 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	6/24	0-2	2-2-5-8		6" topsoil; moist. Poor sample recovery.		6" TOPSOIL
		S2	18/24	2-4	8-8-9-8		Medium dense, brown, fine to medium SAND FILL, little silt; moist.		SAND FILL
		S3	4/24	4-6	4-6-7-8		Medium dense, dark brown, silty SAND FILL, little organics; moist. (TOPSOIL)		TOPSOIL/FILL
5		S4	22/24	6-8	6-5-5-5		Top 4": Loose, dark brown, silty SAND FILL, little organics; wet. (TOPSOIL) Bot. 18": Medium dense, brown, fine to medium SAND, little silt; wet.		SAND
10		S5	10/24	10-12	2-5-4-3		Loose, brown, fine to medium SAND, little silt; moist.		SAND
		S6	8/24	12-14	2-3-2-3		Loose, brown, fine to medium SAND, little silt; moist.		
15		S7	8/24	15-17	3-5-6-7		Medium dense, brown, fine to medium SAND, little silt; moist.		SAND
20		S8	6/24	20-22	4-3-4-5		Loose, brown, fine to medium SAND, little silt; moist.		Terminated at 22 ft.
25								Terminated at 22 ft.	
30								Terminated at 22 ft.	

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 113 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/15/15 **DATE END** 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	5/24	0-2	3-3-5-8		1" topsoil over loose, brown, fine to medium SAND FILL, some silt, trace gravel; moist. Medium dense, gray-brown, silty fine to medium SAND, little gravel; moist. Stiff, brown, SILT; moist.		1" TOPSOIL
		S2	14/24	2-4	7-7-8-9				SAND FILL
		S3	7/24	4-6	2-4-5-4				SILTY SAND
5									
10		S4	10/24	10-12	2-2-3-4		Loose, brown, fine sandy SILT; wet.		SILT
15		S5	0/24	15-17	3-4-5-6		No sample recovery.		
		S6	20/24	17-18	3-4-5-4		Medium stiff, brown, SILT; wet.		
20		S7	24/24	20-22	2-3-5-7		Medium stiff, brown, SILT; wet.		
25									
30									
									Terminated at 22 ft.

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 114 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/16/15 **DATE END** 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	10/24	0-2	1-1-1-1		4" topsoil over loose, dark brown, silty fine to medium SAND FILL, trace organics; moist. Loose, gray, silty fine to medium SAND, little fine gravel; moist. No sample recovery.		4" TOPSOIL
		S2	8/24	2-4	2-4-4-4				SAND FILL
		S3	0/24	4-6	7-14-9-9				SILTY SAND
5		S4	20/24	6-8	5-6-9-13		Stiff, brown, SILT; moist.		SILT
10		S5	20/24	10-12	2-6-6-5		Stiff, brown, SILT; wet.		
15		S6	20/24	15-17	3-4-4-6		Loose, brown, silty fine to medium SAND; wet.		SILTY SAND
20		S7	15/24	20-22	3-3-4-8		Loose, brown, silty fine to medium SAND; wet.		Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 111.5 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/16/15 **DATE END** 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION	
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"					
0		S1	12/24	0-2	1-1-4-2		5" topsoil over loose, fine to medium SAND FILL, little fine gravel, little silt; moist.	1	5" TOPSOIL	
		S2	15/24	2-4	4-9-11-9				SAND FILL	
		S3	22/24	4-6	5-6-4-5				SILTY SAND	
5							Medium dense, gray-brown, silty fine to medium SAND; moist.		SILT	
10		S4	15/24	10-12	3-6-7-7		Medium dense, brown, fine SAND, some silt; wet.		SAND	
15		S5	22/24	15-17	1-7-7-9		Medium dense, brown, fine to medium SAND, some silt; wet.		SAND	
20		S6	15/24	20-22	WOR/12"-6-7		Loose, brown, fine to medium SAND, some silt; wet.		Terminated at 24 ft.	
		S7	15/24	22-24	2-4-8-7					Medium dense, brown, fine to medium SAND, little silt; wet.
25										
30										

GRANULAR SOILS		COHESIVE SOILS		NOTES: 1. Augers at 15 ft. - observed auger flights settle approximately 3 inches into borehole under self weight. WOR = weight of rods
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 111 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/16/15 **DATE END** 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	8/24	0-2	1-3-1-1		4" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist. Medium dense, gray-brown, silty fine to medium SAND, trace fine gravel; moist. Stiff, brown, SILT; moist.		4" TOPSOIL
		S2	20/24	2-4	2-6-9-8				SAND FILL
		S3	20/24	4-6	4-4-5-6				SILTY SAND
5									
10		S4	20/24	10-12	3-5-5-10		Stiff, brown, SILT, little fine sand; wet.		SILT
15		S5	24/24	15-17	4-5-8-8		Stiff, brown, SILT, little fine sand; wet.		
20		S6	24/24	20-22	1-3-6-7		Stiff, brown, SILT, little fine sand; wet.		
		S7	22/24	22-24	5-5-6-8		Stiff, brown, SILT, little fine sand; wet.		
25									Terminated at 24 ft.
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 111 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION	
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"					
0		S1	10/24	0-2	1-1-2-2		6" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist. Medium dense, gray-brown, silty fine to medium SAND, trace fine gravel; moist. Stiff, brown, SILT; moist.		6" TOPSOIL	
		S2	12/24	2-4	3-8-14-9				SAND FILL	
		S3	15/24	4-6	3-4-5-7				SILTY SAND	
5									SILT	
10		S4	22/24	10-12	4-6-7-7		Stiff, brown, SILT, little fine sand; wet.			
15		S5	24/24	15-17	3-5-6-6		Medium dense, brown, fine to medium SAND, little silt; wet.		SAND	
20		S6	24/24	20-22	3-3-8-8		Stiff, brown, SILT, little fine sand; wet. Stiff, brown, SILT, little fine sand; wet.		SILT	
		S7	15/24	22-24	10-10-10-8					
25										
30										

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

planning, permitting,
design, construction,
operation, maintenance



PROJECT
Newton Highlands
Park
Newton, MA

REPORT OF BORING No. B-9
SHEET 1 OF 1
Project No. 2150258
CHKD BY Christopher J. Palmer, P.E.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 114 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
No groundwater observed.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	4/24	0-2	1-1-5-10		2" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist. No sample recovery	1	2" TOPSOIL
		S2	0/24	2-4	10-21-19-11				SAND FILL
		S3	0/24	4-6	15-16-14-16				(See Boring B-9A)
5		S4	1/24	6-8	15-16-14-14		Stiff, brown, SILT; moist. Relocated boring to B-9A due to low sample recoveries.	2	Terminated at 8 ft.
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	1 - Sampler likely pushing a gravel or cobble. 2 - Boring B-9 terminated at 8.0 ft. and moved approximately 3 ft. north to B-9A due to poor sample recovery.
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES:

- 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
- 2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-9

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 114 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet samples observed below 10 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0								(See Boring B-9)	
5		S1	15/24	4-6	2-3-5-7		Stiff, brown, SILT; moist.	SILT	
10		S2	8/24	10-12	1-1-4-4		Medium dense, brown, fine to medium SAND, little silt; wet.	SAND	
15		S3	7/24	15-17	4-4-7-6		Medium dense, brown, fine to medium SAND, little silt; wet.		
20		S4	12/24	20-22	4-3-7-7		Medium dense, brown, fine to medium SAND, some silt; wet.		
		S5	15/24	22-24	4-7-7-7		Medium dense, brown, fine to medium SAND, some silt; wet.		
25								Terminated at 24 ft.	
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG.
FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME
MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 111 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/16/15 **DATE END** 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
No groundwater observed.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	6/24	0-2	1-1-3-4		5" topsoil over loose, brown, fine to medium SAND FILL, some silt, little fine gravel; moist. Loose, dark brown, silty SAND FILL, little organics, trace fine gravel; moist. (TOPSOIL) Loose, brown, fine to coarse SAND, little fine gravel, trace to little silt; wet.		5" TOPSOIL
		S2	8/24	2-4	1-1-3-3				SAND FILL
		S3	12/24	4-6	3-3-5-5				TOPSOIL/FILL
5								SAND	
								Terminated at 6 ft.	
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 112.5 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
No groundwater observed.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	7/24	0-2	1-3-4-3		2" topsoil over loose, brown, fine to medium SAND FILL, little fine gravel, trace silt; moist. Very loose, brown, fine to medium SAND FILL; little gravel, silt, and organics; moist. Top 4": Loose, dark brown, silty SAND FILL; moist. (TOPSOIL) Bot. 18": Medium dense, brown, fine to coarse SAND, little gravel, little silt; wet. End of sampling at 6 ft.		2" TOPSOIL
		S2	3/24	2-4	1-2-1-1				SAND FILL
		S3	22/24	4-6	4-6-9-11				TOPSOIL/FILL SAND
5								Terminated at 6 ft.	
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 111 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
No groundwater observed.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	6/24	0-2	3-7-6-5		3" topsoil over loose, brown, fine to medium SAND FILL, little fine gravel, trace silt; moist. Loose, dark brown, silty SAND, little organics; moist. (TOPSOIL)		3" TOPSOIL
		S2	5/24	2-4	2-4-1-3				SAND FILL
		S3	8/24	4-6	8-8-15-15				TOPSOIL/FILL
5						Medium dense, gray-brown, silty fine to medium SAND, little fine gravel; moist.		SAND	
10								Terminated at 6 ft.	
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 110.5 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/17/15 **DATE END** 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet sample observed at 6 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	15/24	0-2	1-1-3-2		4" topsoil over loose, brown, fine to medium SAND FILL, little silt, trace fine gravel; moist. Loose, brown, fine SAND, little silt, trace fine gravel; moist. Very loose, brown, fine to coarse SAND, some gravel, little to some silt; becomes wet at 6 ft.		4" TOPSOIL
		S2	5/24	2-4	1-2-2-2				SAND FILL
		S3	8/24	4-6	3-1-1-1				SAND
5								Terminated at 6 ft.	
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING Co. Crawford Drilling Services, LLC **BORING LOCATION** See attached plan.
FOREMAN Ryan **GROUND SURFACE ELEV.** 113 +/- **DAT.** NAVD88
WSE ENGINEER: Timothy Blair **DATE START** 6/16/15 **DATE END** 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES
USING A 140 lb. HAMMER. **GROUNDWATER READINGS / OBSERVATIONS**
Wet sample observed at 6 ft.
METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER
USING 4.25 IN. ID HOLLOW-STEM AUGERS

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE				PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
		No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"				
0		S1	7/24	0-2	1-1-3-7		4 " topsoil over loose, gray, silty fine to medium SAND FILL, trace fine gravel; moist. Medium dense, brown, fine to medium SAND FILL, some gravel, little silt; moist. Stiff, brown, SILT; wet.		4" TOPSOIL
		S2	14/24	2-4	8-9-10-9				SILTY SAND FILL
		S3	12/24	4-6	5-6-9-9				SAND
5									SILT
							End of sampling at 6 ft.		Terminated at 6 ft.
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS		NOTES:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	
0-4	V. LOOSE	0-2	V. SOFT	
4-10	LOOSE	2-4	SOFT	
10-30	M. DENSE	4-8	M. STIFF	
30-50	DENSE	8-15	STIFF	
> 50	V. DENSE	15-30	V. STIFF	
		> 30	HARD	

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Project:
**NEWTON HIGHLANDS
 PLAYGROUND
 REHABILITATION**



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 Boston, MA 02109
 (617) 412-4480 (800) Sampson
 www.westonandsampson.com

Consultants:

North:

Revisions:

Rev	Date	Description

Scale:

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Reviewed By:

Checked By:

Approved By:

Drawing Title:
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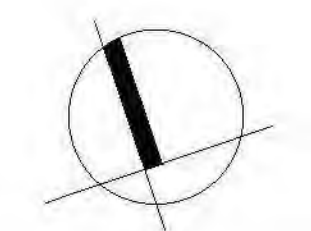
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