Kalorama erosion project

Conditions of the Site

Kalorama erosion project

Conditions of the Site

Kalorama erosion project

Looking Forward

Holistic and Comprehensive Remediation

SHORT TERM

- Clean gutters and add downspouts, possibly add rain barrels in short term.
- Repair trench drain
- Fix existing grates and trench drains
- Aerate and amend soil

LONG TERM

- Development of an RFP for design services, including:
- Park-wide arborist services (pruning, insect & disease mgt, soil management, growth injections, etc.)
- Widespread soil percolation tests and Geotechnical reports
- Landscaping where needed
- Permeable pavers at plaza and potentially walkway
- Long term solution for capturing roof runoff (buried catchment area/underground cistern?)
- New crowned park walkway (perhaps permeable?)

COMMUNITY IDEAS/INPUT

Kalorama erosion project

Next Steps

- After gathering all comments, DGS will put together an RFP for design services
- DPR/DGS will come back to community with 50% set to discuss with community to ensure we're on the right track.
- DPR/DGS will come back at 100% and inform community of upcoming construction.
- DPR/DGS will provide periodic updates to the community during the construction process.

Aerial Map
Kalorama Recreation Center
1875 Columbia Rd., NW

Ward 1

N
W E
S

0 37.5 75 150 Feet

Public Schools

DC Parks

Map: ORTHO DPR 0655
Date: Jan 26, 2011
Data Source: OCTO GIS DPR
Photo Imagery: 2010 Orthophoto
Coordinate System: NAD 1983 StatePlane MD
Prepared by: DC Dept of Parks and Recreaction

REPORT OF

SUBSURFACE EXPLORATION
AND INFILTRATION TESTING

KALORAMA PARK
1875 COLUMBIA ROAD, NW
WASHINGTON, DC

ECS PROJECT NO: 37:1341

FOR

MARCIS, HENDRICKS AND GLASCOCK, P.A.

AUGUST 15, 2014

August 15, 2014

Mr. Patrick G. La Vay, P.E.
Marcis, Hendricks and Glascock, P.A.
9220 Wightman Road
Suite 120
Montgomery Village, Maryland 20886-1279

ECS Project No. 37:1341

Reference: Report of Subsurface Exploration and Infiltration Testing, Kalorama Park, 1875 Columbia Road, NW, Washington, DC

Dear Mr. La Vay:

As authorized by your acceptance of ECS Proposal No. 37:586-GP, dated April 15, 2014, ECS Capitol Services, PLLC (ECS) has completed the subsurface exploration and infiltration testing for the proposed improvements/upgrades to the stormwater management system at the Kalorama Park, located at the physical addresses of 1875 Columbia Road, NW, Washington, DC.

A report, including the results of our subsurface exploration, infiltration testing, boring data, laboratory testing, engineering recommendations, and a Boring Location Diagram are enclosed herein. The recommendations presented are intended for use by your office and for use by other professionals involved in the design and construction stages of the project described herein. It should be noted the recommendations contained within this report are based on our understanding of the current preliminary design.

We appreciate the opportunity to be of service to Marcis, Hendricks and Glascock, P.A. on this project. If you have any questions with regard to the information and recommendations contained in this report, or if we may be of further service to you during the planning and/or construction phase of this project, please do not hesitate to contact the undersigned.

Respectfully,

ECS CAPITOL SERVICES, PLLC

Stephen F. Patt, P.E.
Senior Project Engineer

Karl A. Higgins, III, P.E.
Consultant – Senior Principal Engineer

SFPblm A:\Geotechnical_e-projects\1300-1399\1341 - Kalorama Park\e-Report Prep\37-1341.doc

REPORT

PROJECT

Subsurface Exploration and
Infiltration Testing
Kalorama Park
1875 Columbia Road, NW
Washington, DC

CLIENT

Marcis, Hendricks, and Glascock, P.A.
9220 Wightman Road
Suite 120
Montgomery Village, Maryland 20886-1279

PROJECT NO. 37:1341

DATE August 15, 2014

TABLE OF CONTENTS

PROJECT OVERVIEW

Introduction

This report presents the results of our subsurface exploration and infiltration testing performed for the proposed improvements/upgrades to the stormwater management system at the Kalorama Park located at the physical address of 1875 Columbia Road, NW, Washington, DC. The geotechnical exploration was conducted in general accordance with ECS Proposal No. 37:586-GP, dated April 15, 2014, and authorized by your office. In preparing this report, we have utilized information from our current subsurface exploration, as well as information from nearby sites.

Site Location and Existing Site Conditions

The site is located at the physical address of 1875 Columbia Road, NW, Washington, DC. The subject site is bound to the north by existing residential and commercial buildings, to the east by Columbia Road, NW, to the south by Kalorama Road, NW and to the west by 19th Street, NW. The current property consists of the existing park which includes play areas, walking trials and a one story recreation center in the northeastern corner of the site. The site generally slopes upward from west to east with site grades of approximately EL. 158 feet along 19th Street, NW and approximately EL. 182 feet along Columbia Road, NW. Please note our exploration was primarily limited to the northern portion of the site in the areas selected by Marcis, Hendricks, and Glascock, P.A. (MHG).

Proposed Construction

Limited information regarding the proposed project and design were provided at this time; however, we understand the park has insufficient stormwater management and is prone to erosion and problems during storm events. At this time additional details regarding the proposed construction/design were unavailable. We understand the purpose of this exploration is to provide the civil engineer with data to consider stormwater management alternatives.

The description of the proposed project, as given above, is based on information provided to us by you. If this information is in error, either due to our misunderstanding or due to any design changes which may occur later, we recommend that ECS be contacted so that we may review our recommendations and provide alternate or additional recommendations considered warranted at that time.

Purpose and Scope of Work

The purpose of the exploration was to explore the subsurface conditions at the site and to develop engineering recommendations to guide the design and construction of the project. We accomplished these purposes by performing the following scope of services:

1. Reviewing the geotechnical reports prepared for adjacent project sites by ECS;
2. Drilling soil borings using a conventional drill rig;

3. Performing in-situ infiltration testing at the locations and elevations specified by MGH;
4. Performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties;
5. Analyzing the field and laboratory data to develop appropriate engineering recommendations; and
6. Preparing this geotechnical report of our findings and recommendations.

The conclusions and recommendations contained in this report are based on eight (8) soil borings (referenced as B-1 through B-8) and eight (8) infiltration auger probes performed adjacent to each of the eight soil borings, conducted by ECS at the locations provided by MGH. The borings were drilled to a depth of 10 feet below existing site grades. Each soil boring was offset and an infiltration auger probe advanced to the approximate invert elevation provided to us by you. The subsurface exploration included split spoon soil sampling, Standard Penetration Tests (SPT), groundwater level observations in the boreholes and in-situ infiltration testing. The results of the completed soil borings along with a Boring Location Diagram are included in the Appendix of this report.

The Boring Location Diagram was developed from the site plan provided to us by MGH. The boring elevations were also obtained from the site plan provided and are considered accurate to the nearest foot. The borings were located in the field by ECS personnel by referencing site features and are considered accurate to within five feet.

It should be noted the recommendations contained herein are based on our understanding of the current design. Once the project design is finalized, we recommend the design team engage ECS to re-evaluate our geotechnical engineering recommendations and determine if additional subsurface exploration and/or engineering analysis is required.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

Soil Borings

The soil borings were performed with an ATV-mounted auger drill rig, which utilizes continuous flight, hollow stem augers to advance the boreholes. In hollow stem auger drilling operations, drilling fluid is not used to maintain or advance the borings. After completion of the borings, the boreholes were grouted to the surface. Excess spoils were containerized as required by the DDOE and a soil sample was tested to determine to means and methods for disposal. At the time this report was prepared, the soils had not been removed from the site.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Standard D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. Sampling was typically performed continuously to the termination of the boreholes. The number of blows required to drive the sampler through the last 12-inch interval is termed the Standard Penetration Test (SPT) N-value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of granular soils.

A field log of the soils encountered in the boring was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and brought to our laboratory.

In-Situ Infiltration Testing

Adjacent to each soil boring, an auger probe boring (no samples taken) was advanced to the approximate infiltration test elevation provided to us by you and a temporary solid PVC pipe was installed and seated near the bottom of the hole to keep the bore hole from collapsing prior to infiltration testing. ECS uses the Johnson Permeameter™ to perform a constant head infiltration test which is in general accordance with the publication entitled “DDOE (District Department of the Environment) Stormwater Guidebook, Appendix O.”

Each hole is prepared in general accordance with the information contained in the *Johnsom Permeameter™ Instruction Manual* dated June 14, 2014. A schematic of the equipment used is included in the Appendix of this report for reference. The test is then peformed in general accordance with the same manual and the test results are recorded during testing of each location. The final design rate is typically the average of the last three to four readings taken during the test. The results of each infiltration test are included in the Appendix of this report for reference.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications, moisture content tests, Atterberg Limits tests and grain size distribution analysis tests. The data obtained from the laboratory tests is included in the Appendix of this report.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified Soil Classification System is included with this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual, rather than distinct.

The soil samples will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

EXPLORATION RESULTS

Regional Geology

The site is located within the Coastal Plain Physiographic Province of Washington, D.C. The subsurface materials typically consist of a surficial layer of historical man placed/disturbed materials which typically extended to depths of 2 to 7.5 feet below the existing ground surface. Beneath these near surface fill or disturbed materials, the river terrace deposits described above are generally encountered. These deposits vary in their percentages of sand, silt, clay and gravel, both laterally and vertically. A typical soil profile in the vicinity of the project consists of silty sands and sandy silts with varying amounts of clay and gravel. Within the sandy soils, clay and gravel seams are often encountered. Residual soils (generated from the weathering of the underlying bedrock) and bedrock will be encountered below and are expected to be at an elevation well below the planned development limits.

Soil Conditions

The surficial materials at the project site consisted of approximately 1 to 12 inches of topsoil at each location with the exception of B-2 which was performed within the sidewalk and consisted of approximately 10 inches of concrete. Underlying the surficial materials, the subsurface profile can be divided into two strata: (I) Fill, and (II) Natural Alluvial Soils. The following sections describe each soil strata in more detail.

Stratum I - Fill

Shallow fill soils were observed at each boring location with the exception of B-8 to depths ranging from 2± ft. to 4.5± ft. below the existing site grades. The fill soils typically consisted of CLAY (CL/CH), SILT (ML), Clayey GRAVEL (GC) and Clayey SAND (SC) with varying amounts of gravel, and organics. Standard Penetration Test (SPT) N-Values in this material varied between 11 blows per foot (bpf) to 30 bpf, which correspond to loose to medium dense relative densities for the cohesionless soils, and stiff to very stiff consistencies for cohesive soils. The fill soil constituents were consistent with local natural soils; however, the observed sample makeup indicates the soils had been reworked and not placed by natural mechanisms.

Stratum II – Natural Alluvial Soils

Natural alluvial deposits were observed below the Stratum I – Fill soils. The natural alluvial soils typically consisted of CLAY (CL), Poorly Graded SAND (SP), Clayey and Silty SAND (SC, SM) which are generally consistent with this formation. These soils were observed to the termination elevation of the borings, corresponding to an approximate elevation of EL. 161± ft. SPT N-Values in the Stratum II soils ranged between 3 bpf and 13 bpf, which corresponds to soft to medium stiff consistencies for cohesive soils, and very loose to medium dense relative densities for cohesionless soils.

Groundwater Observations

In auger drilling operations, water is not introduced into the boreholes, and the groundwater position can often be determined by observing water flowing into or out of the borings. Furthermore, visual observation of the soil samples retrieved during the auger drilling

exploration can often be used in evaluating the groundwater conditions. Groundwater observations were made while drilling, after boring but before the augers were removed, and after the augers were removed prior to grouting.

During the subsurface exploration, groundwater was not encountered in the boreholes at the depths explored.

The highest groundwater observations are normally encountered in late winter and early spring and our current groundwater observations are not expected to be at the seasonal maximum water table. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of our explorations.

ANALYSIS AND RECOMMENDATIONS

Infiltration Test Results and Recommendations

The individual infiltration tests, and a portion of the lab testing results, are included as an attachment to this report and are summarized in Table 1 below:

Table 1: Field Infiltration Rates

Infiltration Test Location	Depth of Infiltration Test (ft)	USDA Classification	Measured Field Infiltration Rate (in/hr)
B-1	4	Clay Loam	0.069*
B-2	4	Loam	0.005*
B-3	4	Clay Loam	0.134*
B-4	4	Clay Loam	0.000*
B-5	4	Silt Loam	0.078*
B-6	4	Clay Loam	0.034*
B-7	4	Sandy Clay Loam	0.126*
B-8	4	Sandy Loam	0.222*

*The measured infiltration rate is less than 0.50 in/hr; the project civil engineer should review the enclosed data to determine feasibility of the proposed infiltration facilities.

Closing

This report has been prepared in order to aid in the evaluation of this project. The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings and tests performed at the locations as indicated on the Boring Location Diagram and other information referenced in this report. This report does not reflect any variations that may occur between the test locations. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well known fact that variations in soil conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will become necessary for a reevaluation of the recommendations for this report after performing onsite observations during the construction period and noting the characteristics and variations.

This report was prepared for the sole use of MHG and its consultants; the only intended beneficiaries of our work. The scope is limited to this specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to it. In the event of any change in the nature or location of the proposed construction outlined in this report or the accompanying plans and specifications, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the design engineer. No other party should rely on the information contained herein without prior written consent of ECS Capitol Services, PLLC.

In addition to geotechnical engineering services, ECS Capitol Services, PLLC has the in-house capability to perform multiple additional services as this project moves forward. These services include the following:

- Pre-Construction and Post-Construction Visual Surveys of adjacent building and infrastructure,
- 3-D Movement Monitoring of the SOE and adjacent structures;
- Construction Material Testing / Special Inspections; and,
- Third Party Inspections / Code Compliance for MEP, Fire, Elevators, etc.

We would be pleased to provide these services for you. If you have any questions with regard to this information or need any further assistance during the design and construction of the project please feel free to contact us.

APPENDIX

Unified Soil Classification System

Reference Notes for Boring Logs

Boring Logs B-1 through B-8

Laboratory Test Results

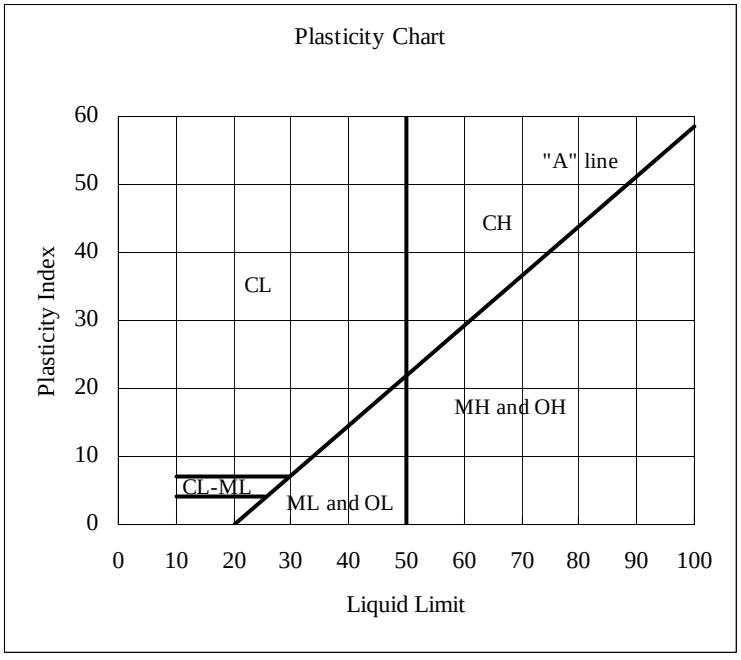
Infiltration Test Results

Johnson Permeameter™ Schematic Equipment

Boring Location Diagram

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4; $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM [a]	d	Silty gravels, gravel-sand mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6; $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM [a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt		Peat and other highly organic soils			



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC,well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash sample
REC	Rock Sample Recovery %	RQD	Rock Quality Designation %

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00–8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	⦿▽	Est. Seasonal High GWT

The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

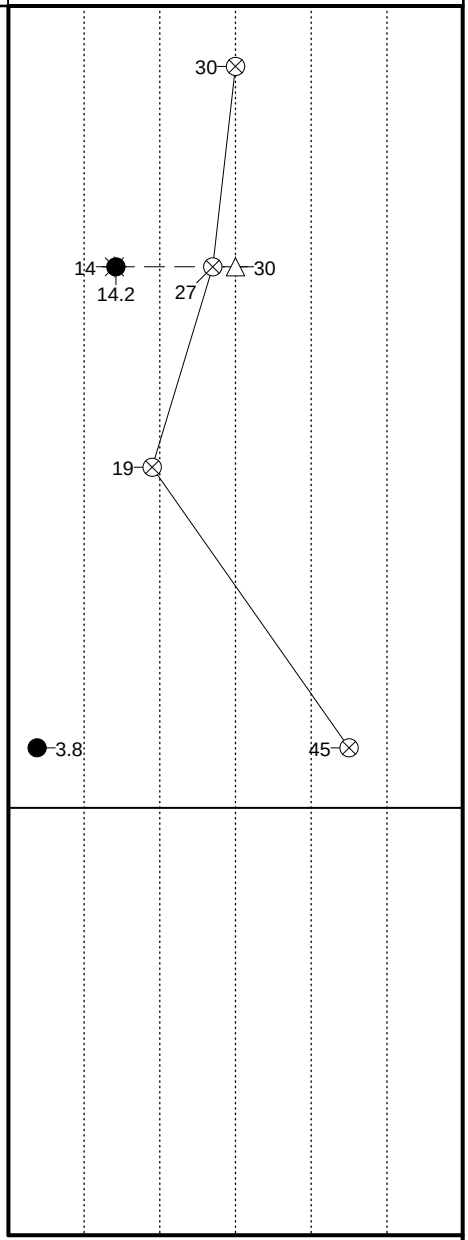
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 182

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [6"]			
	S-1	SS	18	18	(CL FILL) SANDY LEAN CLAY, Contains Roots, Brown, Moist, Very Stiff			8 16 14
							180	
2.5					(CL) SANDY LEAN CLAY, Brown, Moist, Very Stiff			
	S-2	SS	18	18				7 12 15
							177.5	
5								
	S-3	SS	18	18				4 8 11
							175	
7.5					(SC) CLAYEY SAND, Trace Gravel, Tan, Moist, Very Dense			
	S-4	SS	18	18				16 23 22
							172.5	
10					END OF BORING @ 10.00'			
							170	
12.5								
							167.5	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG CME 55 FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

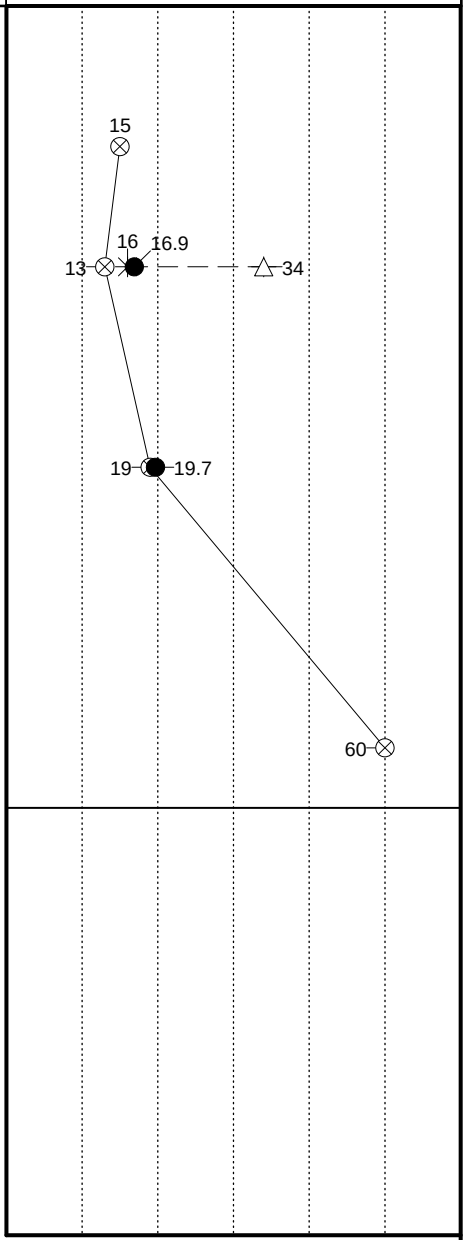
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 181.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Concrete Depth [10"]			
	S-1	SS	18	18	(CL FILL) SANDY LEAN CLAY, Contains Roots, Dark Brown, Moist, Stiff		180	6 12 3
2.5	S-2	SS	18	18	(CL) SANDY CLAY, Brown, Moist, Hard to Very Stiff		177.5	1 5 8
5	S-3	SS	18	12			175	4 8 11
7.5	S-4	SS	18	18	(SM) SILTY SAND, Trace Gravel, Tan, Moist, Very Dense		172.5	12 24 36
10					END OF BORING @ 10.00'		170	
12.5							167.5	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG CME 55 FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

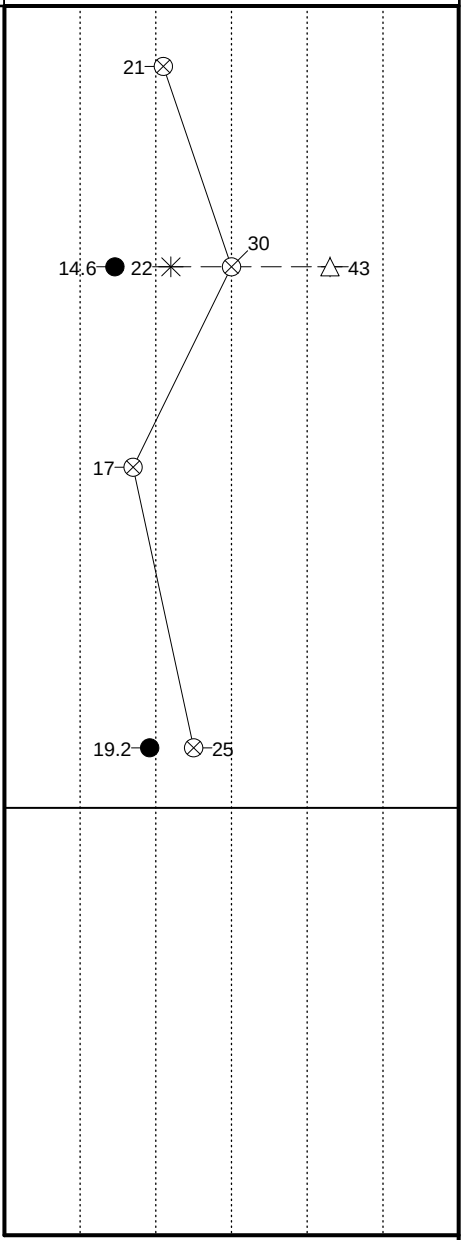
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 173.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	Topsoil Depth [12"]		172.5	7 10 11
					(CL FILL) SANDY LEAN CLAY, Dark Brown, Moist, Very Stiff			
2.5	S-2	SS	18	12			170	11 14 16
5	S-3	SS	18	18	(SC) CLAYEY SAND, Reddish Brown, Moist, Medium Dense		167.5	8 8 9
7.5	S-4	SS	18	18	(SC) CLAYEY SAND, Contains Mica, Orangish Brown, Moist, Medium Dense		165	9 11 14
10					END OF BORING @ 10.00'		162.5	
12.5							160	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG CME 55 FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-4	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

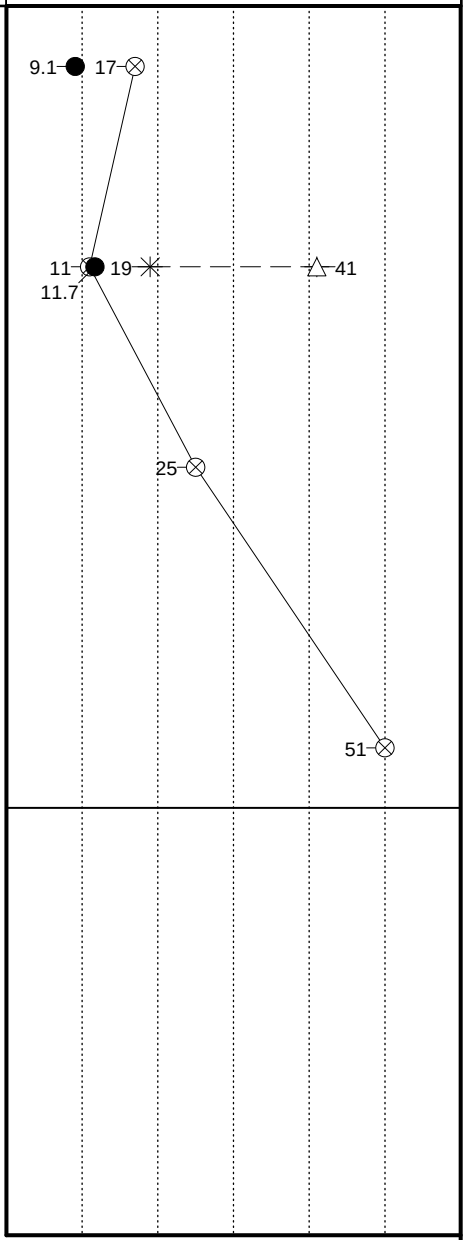
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 173.2

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [6"]			
	S-1	SS	18	6	(ML FILL) SANDY SILT, Contains Roots, Dark Brown, Moist, Medium Dense		172.5	5 7 10
2.5	S-2	SS	18	12	(GC POSSIBLE FILL) CLAYEY GRAVEL WITH SAND, Orangish Brown, Moist, Medium Dens		170	5 5 6
5	S-3	SS	18	0	No Recovery		167.5	10 11 14
7.5	S-4	SS	18	12	(SC) CLAYEY SAND, Contains Mica, Orangish Brown, Moist, Very Dense		165	20 23 28
10					END OF BORING @ 10.00'		162.5	
12.5							160	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG CME 55 FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-5	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

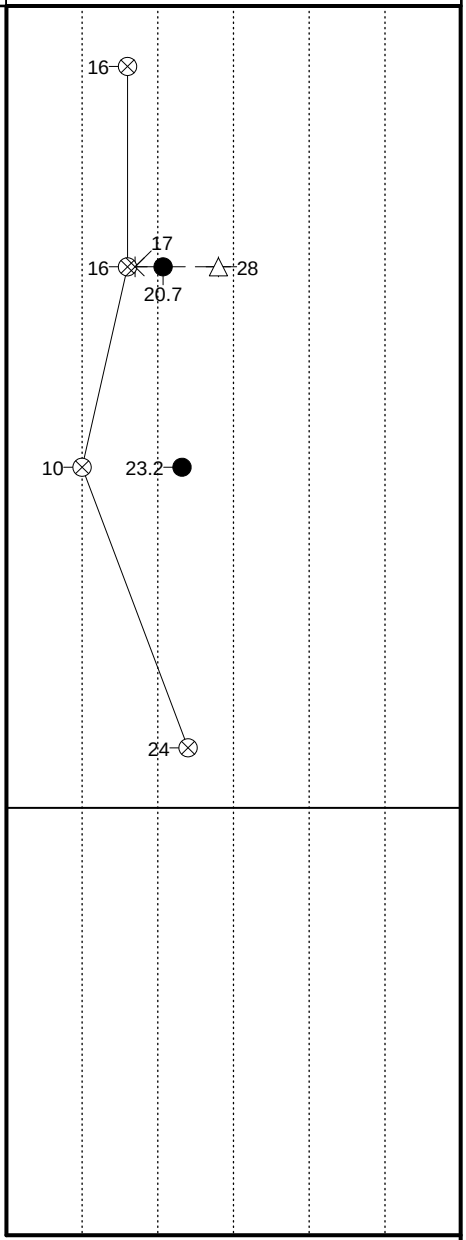
PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

BOTTOM OF CASING ▶ LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 169

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	12	Topsoil Depth [6"]			4 7 9
					(ML FILL) SANDY SILT, Contains Roots, Dark Brown, Moist, Medium Dense		167.5	
2.5	S-2	SS	18	12	(CL) LEAN CLAY WITH SAND, Dark Brown, Moist, Stiff to Very Stiff		165	4 7 9
5	S-3	SS	18	18			162.5	3 3 7
7.5	S-4	SS	18	18	(SC) CLAYEY SAND, Contains Mica, Orangish Brown, Moist, Medium Dense		160	5 9 15
10					END OF BORING @ 10.00'		157.5	
12.5							155	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG 45B ATV FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

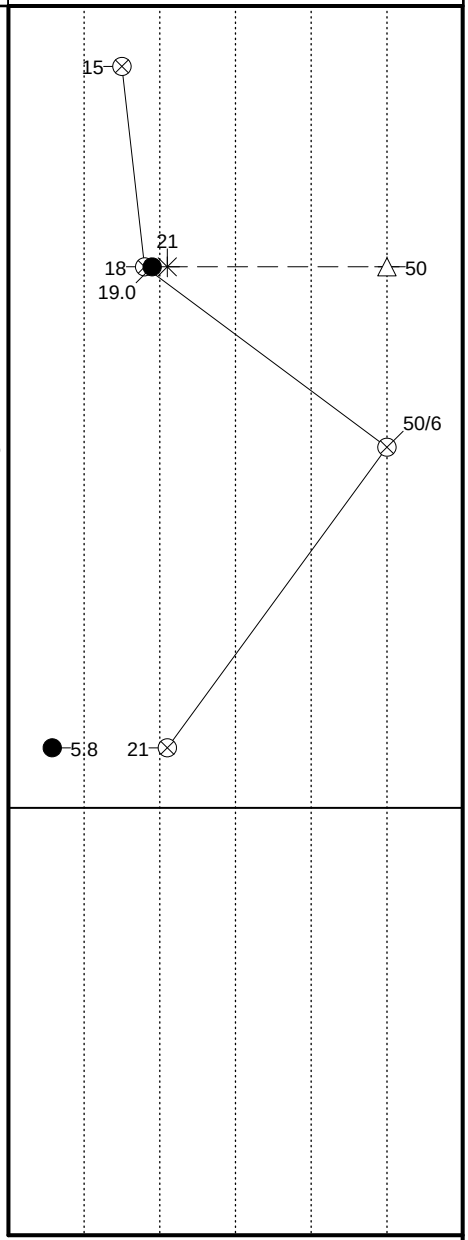
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 168.5

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	Topsoil Depth [1"] (SC FILL) CLAYEY SAND, Trace Gravel, Contains Roots, Orangish Brown and Brown, Moist, Medium Dense		167.5	7 8 7
2.5	S-2	SS	18	18	(CH) SANDY FAT CLAY, Orangish Brown, Moist, Very Stiff to Very Hard		165	8 11 7
5	S-3	SS	12	12			162.5	9 50/6
7.5	S-4	SS	18	3	(SP) SAND, Trace Gravel, Dark Brown, Moist, Medium Dense		160	12 18 3
10					END OF BORING @ 10.00'		157.5	
12.5							155	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG CME 55 FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-7	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION

Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

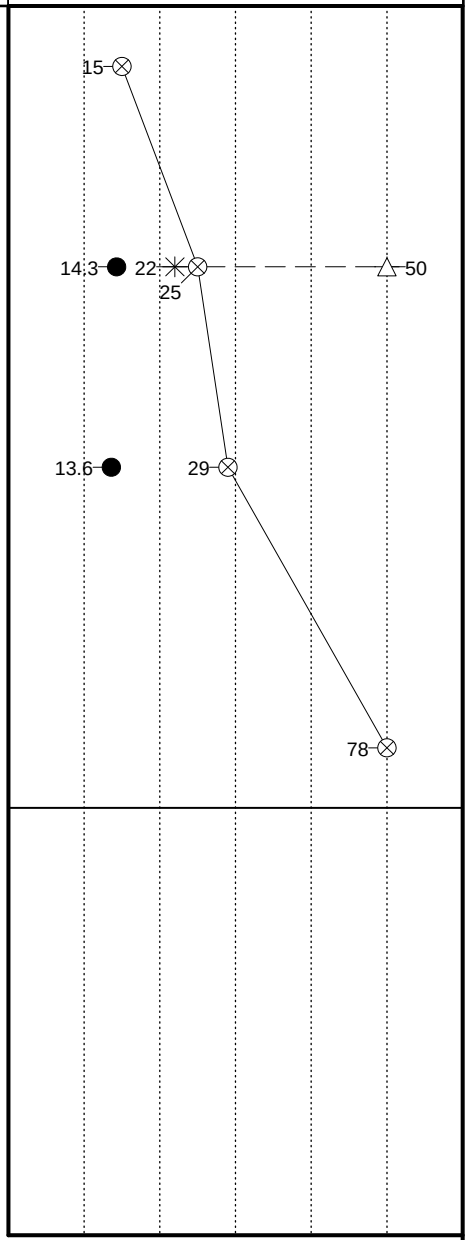
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 166.6

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [4"]			
	S-1	SS	18	18	(SC) CLAYEY SAND, Trace Gravel, Brown and Reddish Brown, Moist, Medium Dense		165	13 7 8
2.5	S-2	SS	18	18				9 11 14
							162.5	
5	S-3	SS	18	18				9 14 15
							160	
7.5	S-4	SS	18	18	(SM) SILTY SAND, Trace Gravel, Brown, Moist, Very Dense		157.5	25 31 47
10					END OF BORING @ 10.00'			
							155	
12.5								
							152.5	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG 550 ATV FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

CLIENT	JOB #	BORING #	SHEET
Macris, Hendricks & Glascock, P.A.	37:1341	B-8	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Kalorama Park	

SITE LOCATION: Columbia Road and Kalorama Road, NW, Washington, DC

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 157.1

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [6"]			
	S-1	SS	18	15	(SM) SILTY SAND, Contains Mica, Orangish Brown, Moist, Loose to Dense			2 2 3
							155	
2.5	S-2	SS	18	15				4 NP 6 NP 9
							152.5	
5	S-3	SS	18	18				10 11 14
							150	
7.5	S-4	SS	18	18				14 14 17
							147.5	
10					END OF BORING @ 10.00'			
							145	
12.5								
							142.5	
15								

Penetrometer values: 5, NP, NP, 15, 22.8, 25, 31

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 07/28/14	
WL(BCR) WL(ACR)	BORING COMPLETED 07/28/14	CAVE IN DEPTH
WL	RIG 550 ATV FOREMAN K. Kersh	DRILLING METHOD 3.25" HSA

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1												
	S-2	2.50 - 4.00	14.2	CL	30	14	16	64.3				
	S-4	8.50 - 10.00	3.8									
B-2												
	S-2	2.50 - 4.00	16.9	CL	34	16	18	68.0				
	S-3	5.00 - 6.50	19.7									
B-3												
	S-2	2.50 - 4.00	14.6	CL	43	22	21	63.0				
	S-4	8.50 - 10.00	19.2									
B-4												
	S-1	0.00 - 1.50	9.1									
	S-2	2.50 - 4.00	11.7	GC	41	19	22	44.7				
B-5												
	S-2	2.50 - 4.00	20.7	CL	28	17	11	71.1				
	S-3	5.00 - 6.50	23.2									
B-6												
	S-2	2.50 - 4.00	19.0	CH	50	21	29	64.0				
	S-4	8.50 - 10.00	5.8									
B-7												
	S-2	2.50 - 4.00	14.3	SC	50	22	28	49.6				
	S-3	5.00 - 6.50	13.6									
B-8												
	S-2	2.50 - 4.00	22.8	SM	NP	NP	NP	34.9				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 37:1341
Project Name: Kalorama Park
PM: Michael D. Venezia
PE: Stephen F. Patt
Printed On: Wednesday, August 13, 2014

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Chantilly, VA 20151-3232
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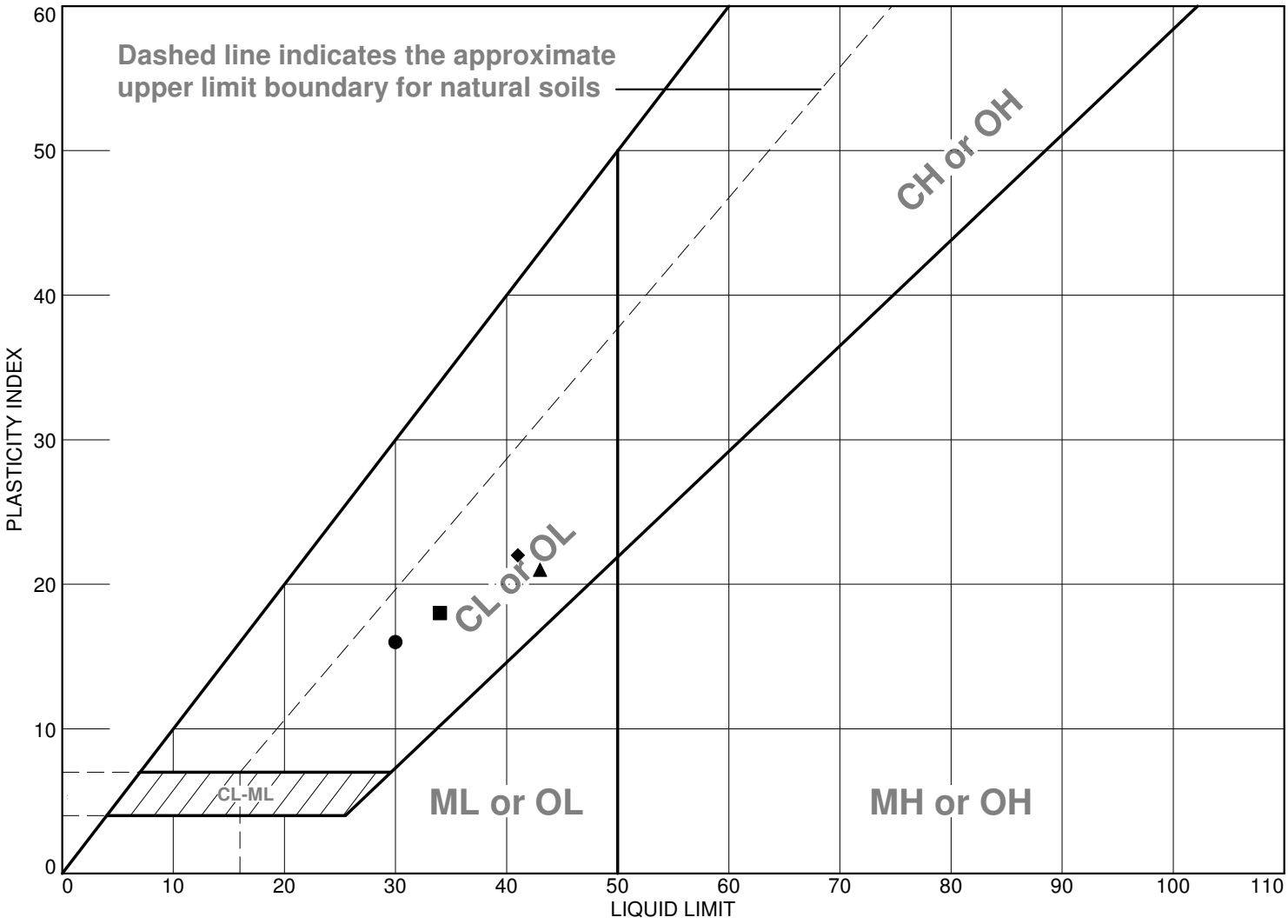
LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sandy Lean Clay Yellow	30	14	16	87.2	64.3	CL
■	Sandy Lean Clay Yellow	34	16	18	87.4	68.0	CL
▲	Sandy Lean Clay Yellowish Light Brown	43	22	21	84.6	63.0	CL
◆	Clayey Gravel with Sand Yellow Light Brown	41	19	22	55.1	44.7	GC

Project No. 37:1341 **Client:** Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

● **Source of Sample:** B-1 **Depth:** 2.50-4.00 **Sample Number:** S-2

■ **Source of Sample:** B-2 **Depth:** 2.50-4.00 **Sample Number:** S-2

▲ **Source of Sample:** B-3 **Depth:** 2.50-4.00 **Sample Number:** S-2

◆ **Source of Sample:** B-4 **Depth:** 2.50-4.00 **Sample Number:** S-2

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Remarks:

● Data Entered: 8/11/14

■ Data Entered: 8/11/14

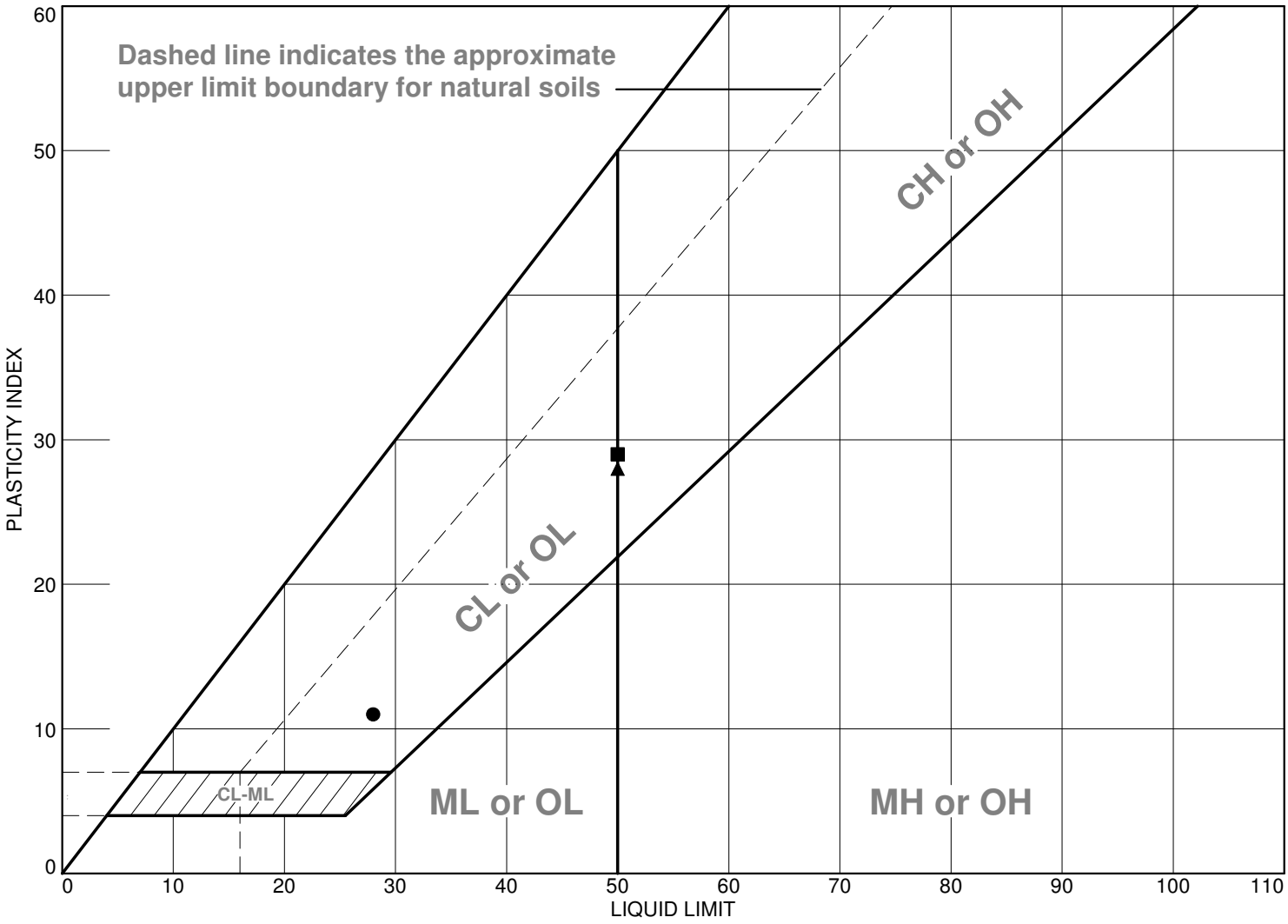
▲ Data Entered: 8/12/14

◆ Data Entered: 8/12/14

Figure

Tested By: HNT **Checked By:** DVT

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay with Sand Yellowish Light Brown	28	17	11	90.4	71.1	CL
■	(SC POSSIBLE FILL) CLAYEY SAND, Orangish Brown, Moist, Medium Dense to Very Dense	50	21	29	84.2	64.0	CH
▲	Clayey Sand Dark Yellow	50	22	28	80.7	49.6	SC
◆	Silty Sand Trace Mica Yellowish Brown	NP	NP	NP	83.3	34.9	SM

Project No. 37:1341 **Client:** Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

● **Source of Sample:** B-5 **Depth:** 2.50-4.00 **Sample Number:** S-2

■ **Source of Sample:** B-6 **Depth:** 2.50-4.00 **Sample Number:** S-2

▲ **Source of Sample:** B-7 **Depth:** 2.50-4.00 **Sample Number:** S-2

◆ **Source of Sample:** B-8 **Depth:** 2.50-4.00 **Sample Number:** S-2

Remarks:

● DAta Entered: 8/11/14

■ Data Entered: 8/12/14

▲ Data Entered: 8/11/14

◆ Data Entered: 8/11/14

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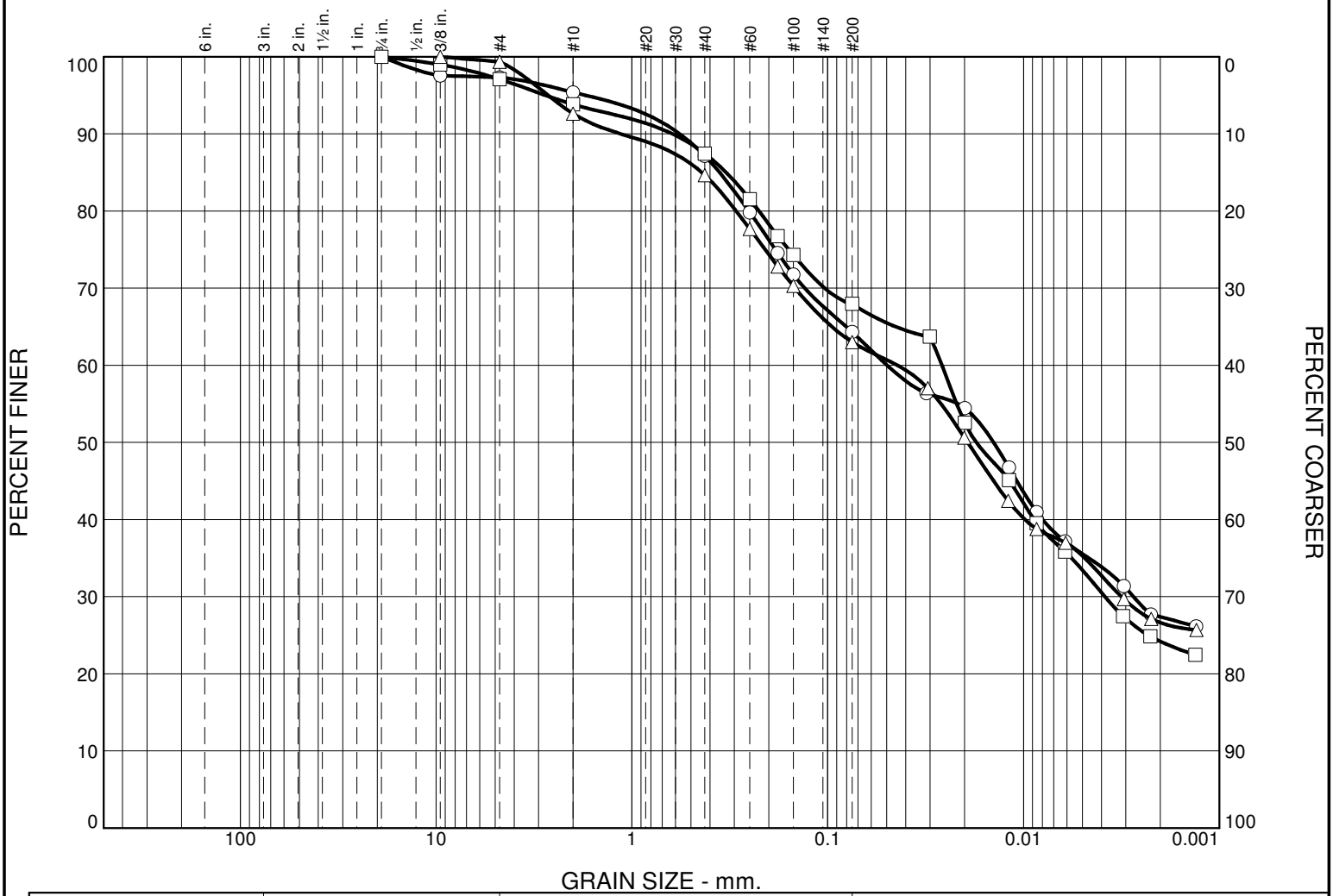
Figure

Tested By: HNT **Checked By:** DVT

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.7	1.9	8.2	22.9	28.8	35.5
□	0.0	0.0	2.9	3.3	6.4	19.4	34.6	33.4
△	0.0	0.0	0.6	6.8	8.0	21.6	27.7	35.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	14	0.3568	0.0497	0.0142	0.0027				
□	34	16	0.3304	0.0261	0.0174	0.0038				
△	43	22	0.4404	0.0440	0.0193	0.0032				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Sandy Lean Clay Yellow	8/6/14	CL	14.2
□ Sandy Lean Clay Yellow		CL	16.9
△ Sandy Lean Clay Yellowish Light Brown		CL	14.6

Project No. 37:1341 **Client:** Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

○ **Source of Sample:** B-1 **Depth:** 2.50-4.00 **Sample Number:** S-2

□ **Source of Sample:** B-2 **Depth:** 2.50-4.00 **Sample Number:** S-2

△ **Source of Sample:** B-3 **Depth:** 2.50-4.00 **Sample Number:** S-2

Remarks:

○ Data Entered: 8/12/14

□ Data Entered: 8/11/14

△ Data Entered: 8/11/14

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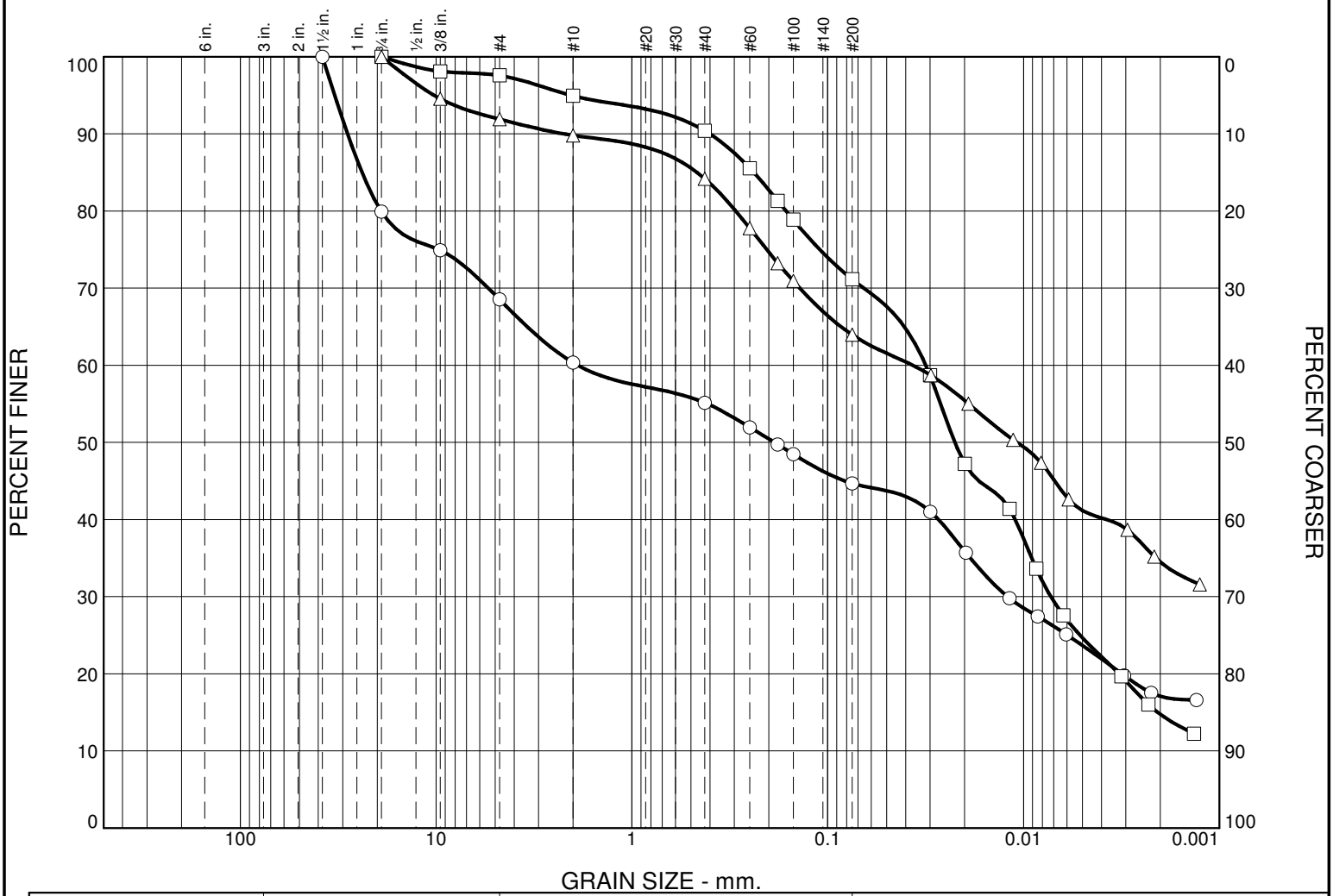
Figure

Tested By: HNT **Checked By:** DVT

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	20.1	11.4	8.2	5.2	10.4	21.0	23.7
□	0.0	0.0	2.4	2.7	4.5	19.3	46.4	24.7
△	0.0	0.0	8.1	2.1	5.6	20.2	22.8	41.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	41	19	23.9254	1.8967	0.1876	0.0121				
□	28	17	0.2388	0.0316	0.0224	0.0072	0.0021			
△	50	21	0.4651	0.0368	0.0108					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Clayey Gravel with Sand Yellow Light Brown		GC	11.7
□ Lean Clay with Sand Yellowish Light Brown		CL	20.7
△ (SC POSSIBLE FILL) CLAYEY SAND, Orangish Brown, Moist, Medium Dense to Very Dense		CH	19.0

Project No. 37:1341 **Client:** Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

○ **Source of Sample:** B-4 **Depth:** 2.50-4.00 **Sample Number:** S-2

□ **Source of Sample:** B-5 **Depth:** 2.50-4.00 **Sample Number:** S-2

△ **Source of Sample:** B-6 **Depth:** 2.50-4.00 **Sample Number:** S-2

Remarks:

○ Data Entered: 8/11/14

□ Data Entered: 8/12/14

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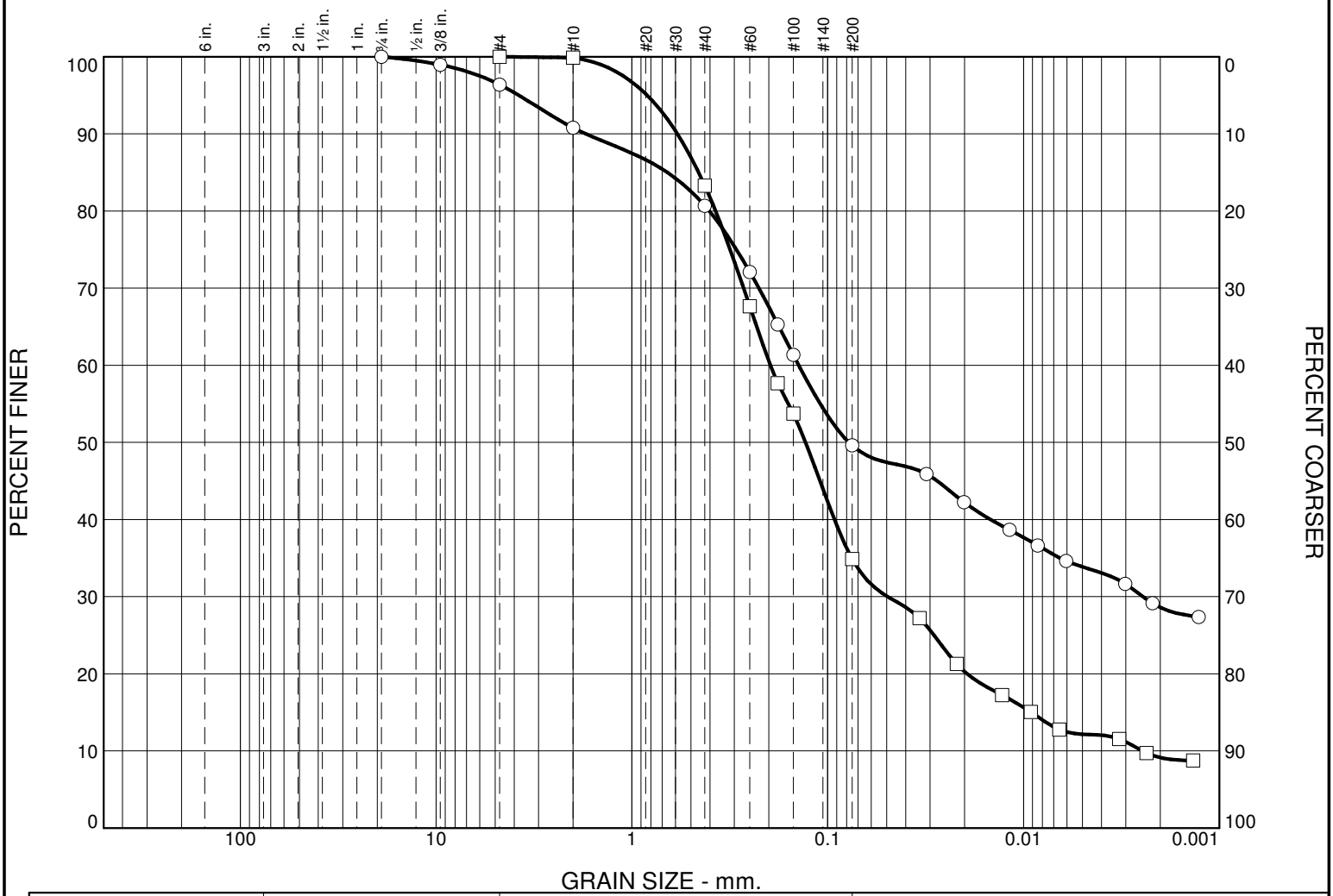
Figure

Tested By: HNT **Checked By:** DVT

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.6	5.6	10.1	31.1	15.7	33.9
□	0.0	0.0	0.0	0.1	16.6	48.4	22.7	12.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	50	22	0.6594	0.1406	0.0780	0.0025				
□	NP	NP	0.4568	0.1965	0.1297	0.0494	0.0091	0.0025	5.02	79.50

	MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○	Clayey Sand Dark Yellow		SC	14.3
□	Silty Sand Trace Mica Yellowish Brown		SM	22.8

Project No. 37:1341 **Client:** Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

○ **Source of Sample:** B-7 **Depth:** 2.50-4.00 **Sample Number:** S-2

□ **Source of Sample:** B-8 **Depth:** 2.50-4.00 **Sample Number:** S-2

Remarks:

□Data Entered: 8/12/14

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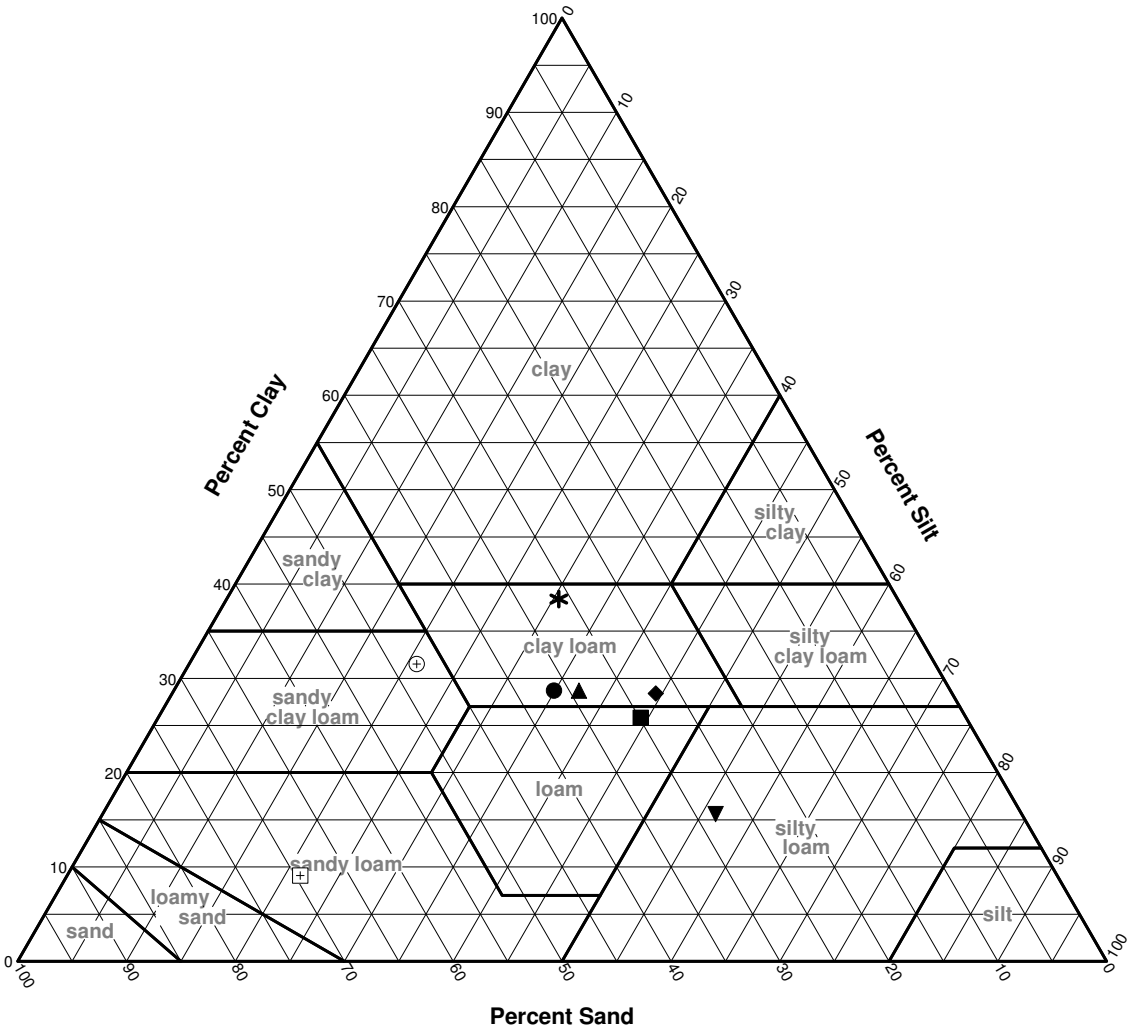
Figure

Tested By: HNT **Checked By:** DVT

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	B-1	S-2	2.50-4.00	36.4	34.9	28.7	Clay loam
■	B-2	S-2	2.50-4.00	29.9	44.3	25.8	Loam
▲	B-3	S-2	2.50-4.00	34.1	37.1	28.7	Clay loam
◆	B-4	S-2	2.50-4.00	27.2	44.4	28.4	Clay loam
▼	B-5	S-2	2.50-4.00	28.1	56.3	15.6	Silt loam
✱	B-6	S-2	2.50-4.00	31.1	30.5	38.4	Clay loam
⊕	B-7	S-2	2.50-4.00	47.6	20.9	31.5	Sandy clay loam
⊞	B-8	S-2	2.50-4.00	69.5	21.4	9.1	Sandy loam

ECS MID-ATLANTIC, LLC
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Chantilly, VA 20151-3232
Phone: (703) 471-8400
Fax: (703) 834-5527

Client: Macris, Hendricks & Glascock, P.A.

Project: Kalorama Park

Project No.: 37:1341

Figure

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Sheet No.: 1 of 1

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-1	**Date……..:**	07/29/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = $Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$	[Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
115		12:21:00 PM								
92	24	12:26:00 PM	0:05:00	5.00	4.70	0.003	5.56E-05	4.8	0.079	0.16
72	20	12:31:00 PM	0:05:00	5.00	3.90	0.003	4.61E-05	4.0	0.065	0.13
52	20	12:36:00 PM	0:05:00	5.00	4.05	0.003	4.79E-05	4.1	0.068	0.14
122										
93	29	12:41:00 PM								
62	31	12:46:00 PM	0:05:00	5.00	6.20	0.004	7.33E-05	6.3	0.104	0.21
36	27	12:51:00 PM	0:05:00	5.00	5.30	0.004	6.27E-05	5.4	0.089	0.18
17	19	12:56:00 PM	0:05:00	5.00	3.70	0.003	4.38E-05	3.8	0.062	0.12
120										
95	25	1:01:00 PM								
73	22	1:06:00 PM	0:05:00	5.00	4.40	0.003	5.21E-05	4.5	0.074	0.15
52	21	1:11:00 PM	0:05:00	5.00	4.20	0.003	4.97E-05	4.3	0.070	0.14
Natural Moisture: 14.2		**Init. Satur.Time:** 12:00:00 AM		**ESTIMATED FIELD Ksat……..:**		0.003	0.000	4.191	0.069	0.14
Texture/Classif: Clay Loam		**Consistency:**		**Bedrock Dpth:** n/a		**Notes:** Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.				
Structure/Fabric:		**Water Tbl. Dpth:** n/a		**Imprm. Lyr.** n/a						

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Sheet No.: 1 of 1

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-2	**Date……..:**	07/29/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - ($r^2/H^2+1)^{.5}$ + r/H] / ($2piH^2$) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
1960		12:00:00 PM								
1950	10	12:05:00 PM	0:05:00	5.00	2.00	0.001	2.37E-05	2.0	0.034	0.07
1948	2	12:10:00 PM	0:05:00	5.00	0.40	0.000	4.73E-06	0.4	0.007	0.01
1942	6	12:20:00 PM	0:10:00	10.00	0.60	0.000	7.10E-06	0.6	0.010	0.02
1940	2	12:30:00 PM	0:10:00	10.00	0.20	0.000	2.37E-06	0.2	0.003	0.01
1936	4	12:40:00 PM	0:10:00	10.00	0.40	0.000	4.73E-06	0.4	0.007	0.01
1925	11	1:10:00 PM	0:30:00	30.00	0.37	0.000	4.34E-06	0.4	0.006	0.01
1919	6	1:40:00 PM	0:30:00	30.00	0.20	0.000	2.37E-06	0.2	0.003	0.01
					ESTIMATED FIELD Ksat……..:	0.000	0.000	0.329	0.005	0.01

Natural Moisture:	16.9	**Init. Satur.Time:**		**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.
Texture/Classif:	Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-3	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	3'6"	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = $Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$	[Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
120		9:26:00 AM								
76	44	9:27:00 AM	0:01:00	1.00	44.00	0.031	5.21E-04	45.0	0.738	1.48
39	37	9:28:00 AM	0:01:00	1.00	37.00	0.026	4.38E-04	37.8	0.620	1.24
18	21	9:29:00 AM	0:01:00	1.00	21.00	0.015	2.48E-04	21.5	0.352	0.70
120										
104	16	9:30:00 AM								
87	17	9:31:00 AM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
72	15	9:32:00 AM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
60	12	9:33:00 AM	0:01:00	1.00	12.00	0.009	1.42E-04	12.3	0.201	0.40
51	9	9:34:00 AM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
42	9	9:35:00 AM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
34	9	9:36:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
25	9	9:37:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
17	8	9:38:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
9	8	9:39:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
120										
112	9	9:40:00 AM								
102	10	9:41:00 AM	0:01:00	1.00	9.50	0.007	1.12E-04	9.7	0.159	0.32
93	9	9:42:00 AM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
85	9	9:43:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29

Natural Moisture:	14.6	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC	**SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET**	Sheet No.: 2 of 2

Project Name.: Kalorama Park	**Parcel.............:** NA		**Terminology and Solution**	
Boring No......: B-3	**Date................:** 07/30/2014		Ksat :	Saturated hydraulic conductivity
Investigators.: SWF	**File Name.........:** NA		Q:	Steady-state rate of water flow into the soil
Boring Depth.: 3'6"	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia.....: 11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r): 5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat	$= Q[\sinh\text{-}1(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2piH^2)$ [Glover R. E.]

VOLUME (ml)	**Volume Out (ml) [a]**	**TIME (hr:min:sec a/p)**	**Elapsed Time (hr:min:sec)**	**Elapsed Time (min) [b]**	**Flow Rate Q (ml/min) [a/b]**	**Ksat Equivalent Values (cm/min)**	**(cm/sec)**	**(cm/day)**	**(in/hr)**	**(ft/day)**
85		9:43:00 AM								
76	9	9:44:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
68	8	9:45:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
60	8	9:46:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
52	8	9:47:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
44	8	9:48:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27

Natural Moisture: 14.6	**Init. Satur.Time:**	**ESTIMATED FIELD Ksat........:**		0.006	0.000	8.177	0.134 / 0.27
Texture/Classif: Clay Loam	**Consistency:**	**Bedrock Dpth:**	n/a	**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.		
Structure/Fabric:	**Water Tbl. Dpth:** n/a	**Imprm. Lyr.**	n/a				

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.: Kalorama Park	**Parcel…………...:** NA	**Terminology and Solution**	
Boring No…...: B-4	**Date……………..:** 07/29/2014	Ksat :	Saturated hydraulic conductivity
Investigators.: SWF	**File Name……...:** NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.: 3'7"	**WCU Base. Ht. h:** 15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..: 11.4 **cm**	**WCU Susp. Ht. S:** 0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r): 5.72 **cm**	**Const. Wtr. Ht. H:** 15.0 **cm**	Ksat	$= Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi H^2)$ [Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		1:39:00 PM								
2000	0	1:49:00 PM	0:10:00	10.00	0.00	0.000	0.00E+00	0.0	0.000	0.00
2000	0	1:59:00 PM	0:10:00	10.00	0.00	0.000	0.00E+00	0.0	0.000	0.00
2000	0	2:09:00 PM	0:10:00	10.00	0.00	0.000	0.00E+00	0.0	0.000	0.00
2000	0	2:19:00 PM	0:10:00	10.00	0.00	0.000	0.00E+00	0.0	0.000	0.00

Natural Moisture: 11.7	**Init. Satur.Time:**	**ESTIMATED FIELD Ksat……..:**	0.000	0.000	0.000	0.000	0.00
Texture/Classif: Clay Loam	**Consistency:**	**Bedrock Dpth:** n/a	**Notes:** Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.				
Structure/Fabric:	**Water Tbl. Dpth:** n/a	**Imprm. Lyr.** n/a					

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-5	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - (r^2/H^2+1)$^{.5}$ + r/H] / (2piH^2) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
122		1:24:00 PM								
113	9	1:39:00 PM	0:15:00	15.00	0.57	0.000	6.70E-06	0.6	0.010	0.02
110	3	1:40:00 PM	0:01:00	1.00	3.00	0.002	3.55E-05	3.1	0.050	0.10
107	3	1:41:00 PM	0:01:00	1.00	3.00	0.002	3.55E-05	3.1	0.050	0.10
104	3	1:42:00 PM	0:01:00	1.00	3.00	0.002	3.55E-05	3.1	0.050	0.10
101	4	1:43:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
97	4	1:44:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
94	4	1:45:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
90	4	1:46:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
86	4	1:47:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
83	4	1:48:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
79	4	1:49:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
75	4	1:50:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
71	4	1:51:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
67	4	1:52:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
63	4	1:53:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
59	5	1:54:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
54	5	1:55:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
50	4	1:56:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
46	5	1:57:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
41	5	1:58:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
37	4	1:59:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13

Natural Moisture:	20.7	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Silt Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-5	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = $Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi iH^2)$	[Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
37		1:59:00 PM								
33	5	2:00:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
28	5	2:01:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
122										
117	6	2:02:00 PM								
111	6	2:03:00 PM	0:01:00	1.00	5.50	0.004	6.51E-05	5.6	0.092	0.18
106	5	2:04:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
101	5	2:05:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
96	5	2:06:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
92	4	2:07:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
87	5	2:08:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
83	4	2:09:00 PM	0:01:00	1.00	4.00	0.003	4.73E-05	4.1	0.067	0.13
79	5	2:10:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
74	5	2:11:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
69	5	2:12:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
65	5	2:13:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
Natural Moisture:	20.7	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**		0.003	0.000	4.727	0.078	0.16
Texture/Classif:	Silt Loam	**Consistency:**		**Bedrock Dpth:**	n/a	**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.			
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a					

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-6	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	3'6"	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - (r^2/H^2+1)$^{.5}$ + r/H] / (2piH^2) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
110		11:53:00 AM								
93	18	11:54:00 AM	0:01:00	1.00	17.50	0.012	2.07E-04	17.9	0.293	0.59
78	15	11:55:00 AM	0:01:00	1.00	14.50	0.010	1.72E-04	14.8	0.243	0.49
64	14	11:56:00 AM	0:01:00	1.00	14.00	0.010	1.66E-04	14.3	0.235	0.47
52	12	11:57:00 AM	0:01:00	1.00	12.00	0.009	1.42E-04	12.3	0.201	0.40
41	12	11:58:00 AM	0:01:00	1.00	11.50	0.008	1.36E-04	11.8	0.193	0.39
30	11	11:59:00 AM	0:01:00	1.00	10.50	0.007	1.24E-04	10.7	0.176	0.35
20	10	12:00:00 PM	0:01:00	1.00	10.00	0.007	1.18E-04	10.2	0.168	0.34
120										
109	11	12:01:00 PM								
98	11	12:02:00 PM	0:01:00	1.00	11.00	0.008	1.30E-04	11.2	0.184	0.37
87	11	12:03:00 PM	0:01:00	1.00	11.00	0.008	1.30E-04	11.2	0.184	0.37
77	10	12:04:00 PM	0:01:00	1.00	10.00	0.007	1.18E-04	10.2	0.168	0.34
67	10	12:05:00 PM	0:01:00	1.00	10.00	0.007	1.18E-04	10.2	0.168	0.34
58	9	12:06:00 PM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
49	9	12:07:00 PM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
41	8	12:08:00 PM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
33	8	12:09:00 PM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
25	8	12:10:00 PM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
18	7	12:11:00 PM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23

Natural Moisture:	19.0	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-6	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	3'6"	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - ($r^2/H^2+1)^{.5}$ + r/H] / ($2piH^2$) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
95		12:14:00 PM								
87	8	12:15:00 PM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
80	7	12:16:00 PM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23
74	6	12:17:00 PM	0:01:00	1.00	6.00	0.004	7.10E-05	6.1	0.101	0.20
69	6	12:18:00 PM	0:01:00	1.00	5.50	0.004	6.51E-05	5.6	0.092	0.18
63	6	12:19:00 PM	0:01:00	1.00	5.50	0.004	6.51E-05	5.6	0.092	0.18
58	5	12:20:00 PM	0:01:00	1.00	5.00	0.004	5.91E-05	5.1	0.084	0.17
54	5	12:21:00 PM	0:01:00	1.00	4.50	0.003	5.32E-05	4.6	0.075	0.15
50	4	12:22:00 PM	0:01:00	1.00	3.50	0.002	4.14E-05	3.6	0.059	0.12
47	3	12:23:00 PM	0:01:00	1.00	3.00	0.002	3.55E-05	3.1	0.050	0.10
45	3	12:24:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
42	3	12:25:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
39	3	12:26:00 PM	0:01:00	1.00	3.00	0.002	3.55E-05	3.1	0.050	0.10
37	3	12:27:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
34	3	12:28:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
32	2	12:29:00 PM	0:01:00	1.00	2.00	0.001	2.37E-05	2.0	0.034	0.07
30	3	12:30:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
28	2	12:31:00 PM	0:01:00	1.00	2.00	0.001	2.37E-05	2.0	0.034	0.07
25	3	12:32:00 PM	0:01:00	1.00	2.50	0.002	2.96E-05	2.6	0.042	0.08
24	2	12:33:00 PM	0:01:00	1.00	1.50	0.001	1.77E-05	1.5	0.025	0.05
22	2	12:34:00 PM	0:01:00	1.00	2.00	0.001	2.37E-05	2.0	0.034	0.07
ESTIMATED FIELD Ksat……..:						0.001	0.000	2.044	0.034	0.07

Natural Moisture:	19.0	**Init. Satur.Time:**		**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.
Texture/Classif:	Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-7	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat =	$Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$ [Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
120		10:17:00 AM								
75	45	10:18:00 AM	0:01:00	1.00	45.00	0.032	5.32E-04	46.0	0.754	1.51
33	42	10:19:00 AM	0:01:00	1.00	42.00	0.030	4.97E-04	42.9	0.704	1.41
122										
84	38	10:20:00 AM								
43	41	10:21:00 AM	0:01:00	1.00	41.00	0.029	4.85E-04	41.9	0.687	1.37
5	38	10:22:00 AM	0:01:00	1.00	38.00	0.027	4.50E-04	38.8	0.637	1.27
122										
82	40	10:23:00 AM								
41	41	10:24:00 AM	0:01:00	1.00	41.00	0.029	4.85E-04	41.9	0.687	1.37
4	37	10:25:00 AM	0:01:00	1.00	37.00	0.026	4.38E-04	37.8	0.620	1.24
121										
92	29	10:26:00 AM								
65	27	10:27:00 AM	0:01:00	1.00	27.00	0.019	3.19E-04	27.6	0.453	0.91
39	26	10:28:00 AM	0:01:00	1.00	26.00	0.018	3.08E-04	26.6	0.436	0.87
17	23	10:29:00 AM	0:01:00	1.00	22.50	0.016	2.66E-04	23.0	0.377	0.75
122										
100	22	10:30:00 AM								

Natural Moisture:	14.3	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Sandy Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-7	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = $Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$	[Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
100		10:30:00 AM								
74	26	10:31:00 AM	0:01:00	1.00	26.00	0.018	3.08E-04	26.6	0.436	0.87
50	24	10:32:00 AM	0:01:00	1.00	24.00	0.017	2.84E-04	24.5	0.402	0.80
28	22	10:33:00 AM	0:01:00	1.00	22.00	0.016	2.60E-04	22.5	0.369	0.74
7	21	10:34:00 AM	0:01:00	1.00	21.00	0.015	2.48E-04	21.5	0.352	0.70
128										
111	17	10:35:00 AM								
93	18	10:36:00 AM	0:01:00	1.00	18.00	0.013	2.13E-04	18.4	0.302	0.60
75	18	10:37:00 AM	0:01:00	1.00	18.00	0.013	2.13E-04	18.4	0.302	0.60
58	17	10:38:00 AM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
42	16	10:39:00 AM	0:01:00	1.00	16.00	0.011	1.89E-04	16.4	0.268	0.54
27	15	10:40:00 AM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
12	15	10:41:00 AM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
120										
108	12	10:42:00 AM								
98	10	10:43:00 AM	0:01:00	1.00	10.00	0.007	1.18E-04	10.2	0.168	0.34
89	9	10:44:00 AM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
81	9	10:45:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
73	8	10:46:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
65	8	10:47:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27

Natural Moisture:	14.3	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Sandy Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-7	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - (r^2/H^2+1)$^{.5}$ + r/H] / (2piH^2) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
65		10:47:00 AM								
57	9	10:48:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
49	8	10:49:00 AM	0:01:00	1.00	7.50	0.005	8.87E-05	7.7	0.126	0.25
42	8	10:50:00 AM	0:01:00	1.00	7.50	0.005	8.87E-05	7.7	0.126	0.25
35	7	10:51:00 AM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23
28	7	10:52:00 AM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23
21	7	10:53:00 AM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23
14	7	10:54:00 AM	0:01:00	1.00	6.50	0.005	7.69E-05	6.6	0.109	0.22
118										
110	8	10:54:00 AM								
102	9	10:55:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
93	9	10:56:00 AM	0:01:00	1.00	8.50	0.006	1.01E-04	8.7	0.143	0.29
84	9	10:57:00 AM	0:01:00	1.00	9.00	0.006	1.06E-04	9.2	0.151	0.30
76	8	10:58:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
68	8	10:59:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
60	8	11:00:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
52	8	11:01:00 AM	0:01:00	1.00	8.00	0.006	9.46E-05	8.2	0.134	0.27
45	8	11:02:00 AM	0:01:00	1.00	7.50	0.005	8.87E-05	7.7	0.126	0.25
38	7	11:03:00 AM	0:01:00	1.00	7.00	0.005	8.28E-05	7.2	0.117	0.23
30	8	11:04:00 AM	0:01:00	1.00	7.50	0.005	8.87E-05	7.7	0.126	0.25
ESTIMATED FIELD Ksat……..:						0.005	0.000	7.666	0.126	0.25

Natural Moisture:	14.3	**Init. Satur.Time:**		**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.
Texture/Classif:	Sandy Clay Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-8	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat =	$Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$ [Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
125		2:32:00 PM								
94	31	2:33:00 PM	0:01:00	1.00	31.00	0.022	3.67E-04	31.7	0.520	1.04
63	31	2:34:00 PM	0:01:00	1.00	31.00	0.022	3.67E-04	31.7	0.520	1.04
67	-4	2:35:00 PM	0:01:00	1.00	-4.00	-0.003	-4.73E-05	-4.1	-0.067	-0.13
44	23	2:36:00 PM	0:01:00	1.00	23.00	0.016	2.72E-04	23.5	0.386	0.77
130										
109	21	2:36:00 PM								
88	21	2:37:00 PM	0:01:00	1.00	21.00	0.015	2.48E-04	21.5	0.352	0.70
67	21	2:38:00 PM	0:01:00	1.00	21.00	0.015	2.48E-04	21.5	0.352	0.70
47	20	2:39:00 PM	0:01:00	1.00	20.00	0.014	2.37E-04	20.4	0.335	0.67
28	19	2:40:00 PM	0:01:00	1.00	19.00	0.013	2.25E-04	19.4	0.319	0.64
122										
104	18	2:41:00 PM								
85	19	2:42:00 PM	0:01:00	1.00	19.00	0.013	2.25E-04	19.4	0.319	0.64
66	19	2:43:00 PM	0:01:00	1.00	19.00	0.013	2.25E-04	19.4	0.319	0.64
47	19	2:44:00 PM	0:01:00	1.00	19.00	0.013	2.25E-04	19.4	0.319	0.64
30	17	2:45:00 PM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
124										
107	17	2:46:00 PM								

Natural Moisture:	22.8	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Sandy Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-8	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat =	$Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2\pi i H^2)$ [Glover R. E.]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
107		2:46:00 PM								
90	17	2:47:00 PM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
73	17	2:48:00 PM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
56	17	2:49:00 PM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
41	15	2:50:00 PM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
25	16	2:51:00 PM	0:01:00	1.00	16.00	0.011	1.89E-04	16.4	0.268	0.54
124										
108	16	2:52:00 PM								
91	17	2:53:00 PM	0:01:00	1.00	17.00	0.012	2.01E-04	17.4	0.285	0.57
75	16	2:54:00 PM	0:01:00	1.00	16.00	0.011	1.89E-04	16.4	0.268	0.54
59	16	2:55:00 PM	0:01:00	1.00	16.00	0.011	1.89E-04	16.4	0.268	0.54
44	15	2:56:00 PM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
29	15	2:57:00 PM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
122										
105	17	2:58:00 PM								
90	15	2:59:00 PM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
76	15	3:00:00 PM	0:01:00	1.00	14.50	0.010	1.72E-04	14.8	0.243	0.49
61	15	3:01:00 PM	0:01:00	1.00	14.50	0.010	1.72E-04	14.8	0.243	0.49
47	14	3:02:00 PM	0:01:00	1.00	14.00	0.010	1.66E-04	14.3	0.235	0.47
34	13	3:03:00 PM	0:01:00	1.00	13.00	0.009	1.54E-04	13.3	0.218	0.44

Natural Moisture:	22.8	**Init. Satur.Time:**		**ESTIMATED FIELD Ksat……..:**	
Texture/Classif:	Sandy Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Notes: Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.

ECS Capitol Services, PLLC

SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET

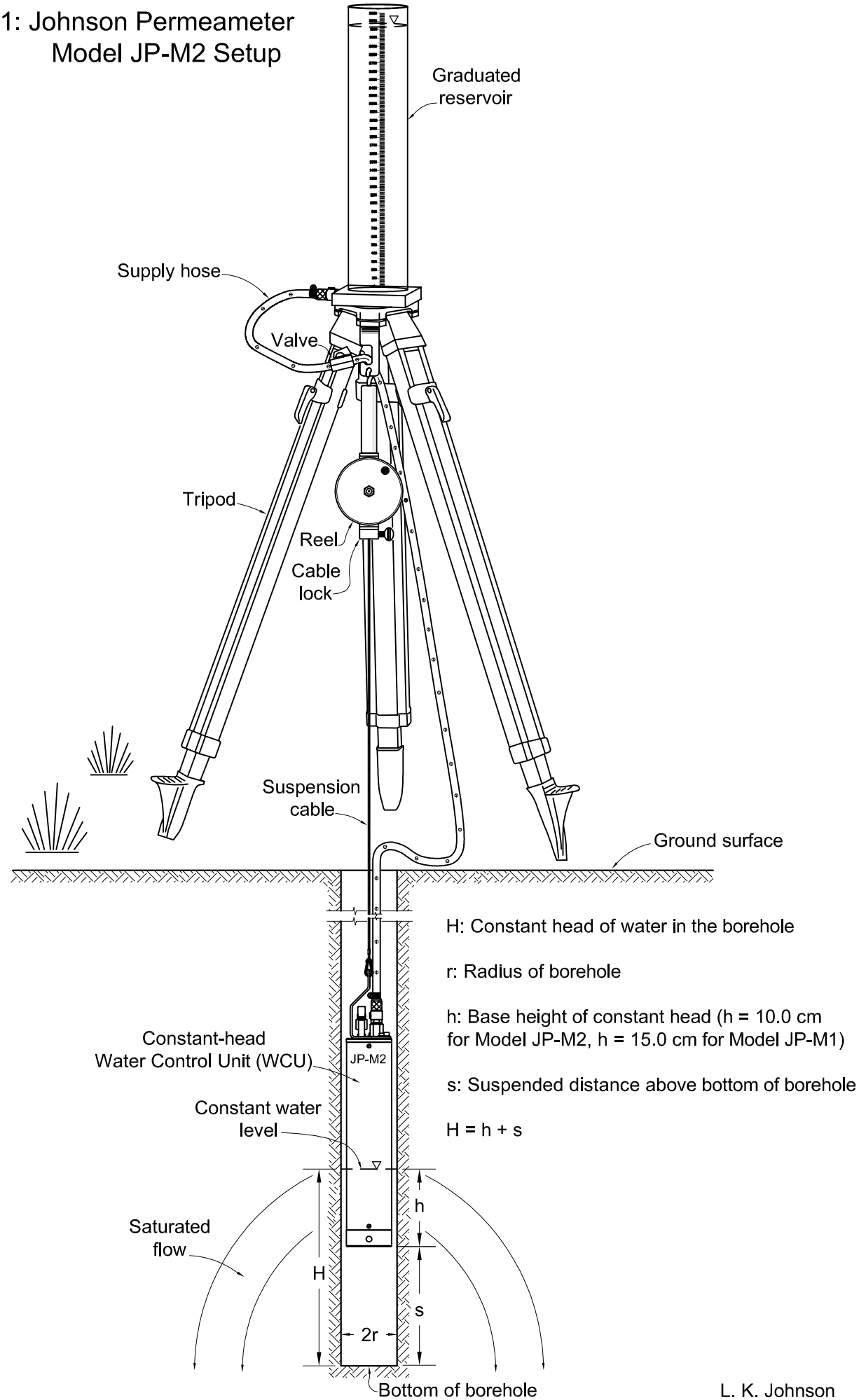
Sheet No.: 3 of 3

Project Name.:	Kalorama Park	**Parcel……..:**	NA	**Terminology and Solution**	
Boring No…..:	B-8	**Date……..:**	07/30/2014	Ksat :	Saturated hydraulic conductivity
Investigators.:	SWF	**File Name……..:**	NA	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	4'	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia…..:	11.4 **cm**	**WCU Susp. Ht. S:**	0.0 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	5.72 **cm**	**Const. Wtr. Ht. H:**	15.0 **cm**	Ksat = Q[sinh-1(H/r) - ($r^2/H^2+1)^{.5}$ + r/H] / ($2piH^2$) [Glover R. E.]	

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
34		3:03:00 PM								
21	13	3:04:00 PM	0:01:00	1.00	13.00	0.009	1.54E-04	13.3	0.218	0.44
9	12	3:05:00 PM	0:01:00	1.00	12.00	0.009	1.42E-04	12.3	0.201	0.40
123										
110	13	3:06:00 PM								
95	15	3:07:00 PM	0:01:00	1.00	15.00	0.011	1.77E-04	15.3	0.251	0.50
81	14	3:08:00 PM	0:01:00	1.00	14.00	0.010	1.66E-04	14.3	0.235	0.47
68	13	3:09:00 PM	0:01:00	1.00	13.00	0.009	1.54E-04	13.3	0.218	0.44
55	13	3:10:00 PM	0:01:00	1.00	13.00	0.009	1.54E-04	13.3	0.218	0.44
42	13	3:11:00 PM	0:01:00	1.00	13.00	0.009	1.54E-04	13.3	0.218	0.44
ESTIMATED FIELD Ksat……..:						0.009	0.000	13.543	0.222	0.44

Natural Moisture:	22.8	**Init. Satur.Time:**		**Notes:**	Estimated Field Ksat is determined by averaging and/or rounding of test results for final three or four intervals.
Texture/Classif:	Sandy Loam	**Consistency:**		**Bedrock Dpth:**	n/a
Structure/Fabric:		**Water Tbl. Dpth:**	n/a	**Imprm. Lyr.**	n/a

Drawing 1: Johnson Permeameter Model JP-M2 Setup

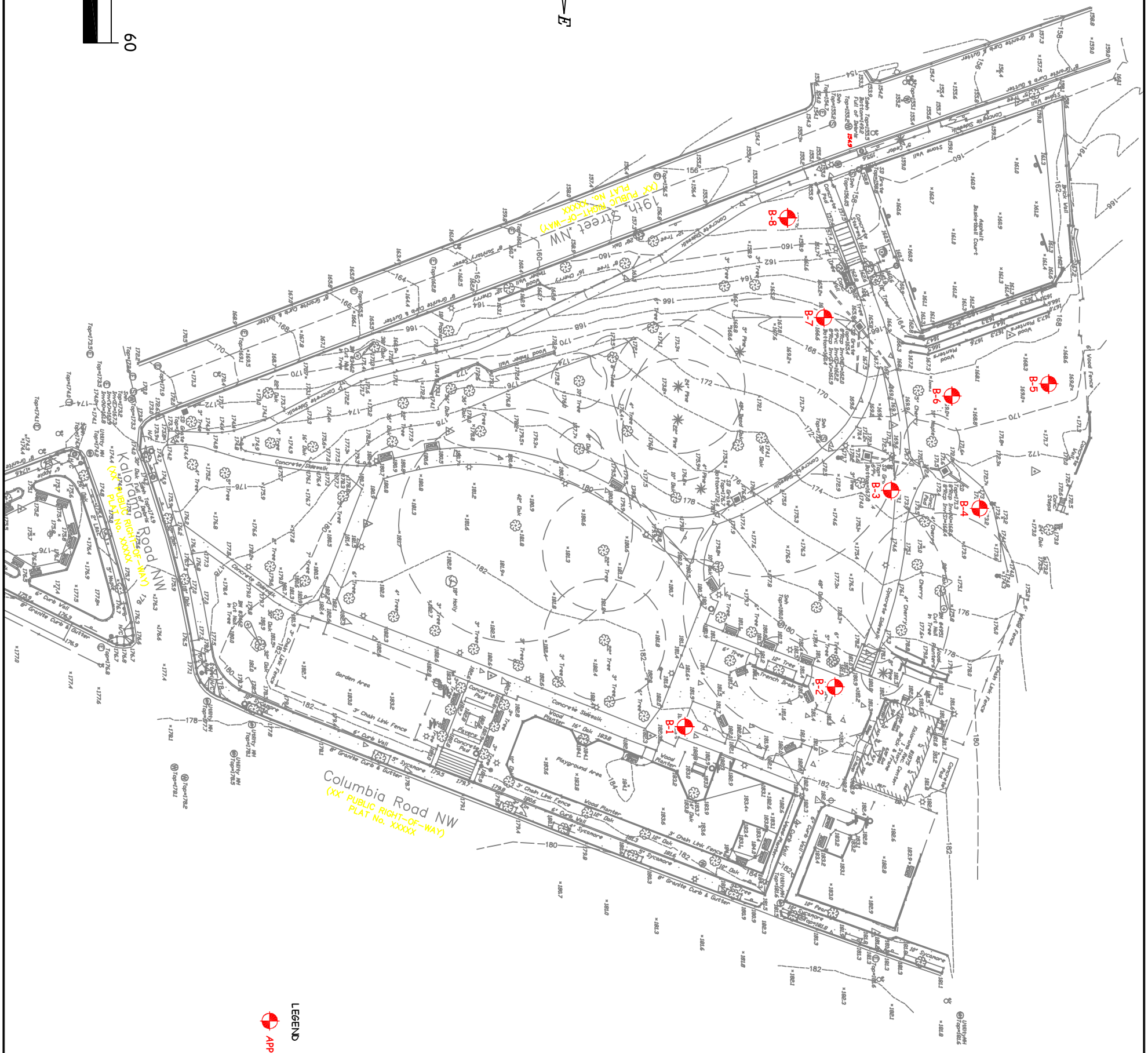


L. K. Johnson

60 0 30 60

SCALE (IN FEET)

W S N E



LEGEND

APPROX. BORING LOCATION

ECS REVISIONS	
ENGINEER SFP / DRAFTING RAC	
SCALE	1"=60'
PROJECT NO.	37:1341
SHEET	1 OF 1
DATE	08-14-14

BORING LOCATION DIAGRAM

MARCIS, HENDRICKS & GLASCOCK, P.A.

KALORAMA PARK

NW, WASHINGTON, DC

SECTION 02055 - SOILS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subsoil materials.
   2. Topsoil materials.

B. Related Sections:
   1. Section 02050 - Subsurface Investigations.
   2. Section 02060 - Aggregate.
   3. Section 02320 - Backfill.
   4. Section 02324 - Trenching.
   5. Section 02315 - Excavation and Fill: Subbase preparation.
   6. Section 02374 - Soil Erosion and Sediment Control.
   7. Section 02920 – Lawns and Grasses.

1.2 REFERENCES

A. District of Columbia, Department of Transportation (DDOT)
   1. 2009 Standard Specifications for Highways and Structures.

B. American Association of State Highway and Transportation Officials
   1. AASHTO T180 – Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop.

C. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   3. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in airtight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish subsoil and topsoil material from single source throughout the Work.

B. Perform Work in accordance with District of Columbia, Department of Transportation Standard Specifications, Section 203.

C. The Owner's Independent Testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Excavation shall be considered unclassified to subgrade elevation(s).

B. Soils for Embankments – Meeting the requirements of DDOT Standard Specifications, Section 804.02.

C. Blanket Soil – Meeting the requirements of DDOT Standard Specifications, Section 804.03.

D. Soils for Trench Backfill – Meeting the requirements of DDOT Standard Specifications, Section 804.05.

E. Soils for Base Courses and Structural Backfill – Meeting the requirements of DDOT Standard Specifications, Section 804.04.

F. Additives for soil drying, modification and stabilization shall be permitted with prior approval from Owner and Geotechnical Engineer. Gradation, Proctor, pH and other testing must be conducted and furnished to Owner by Geotechnical Engineer prior to using additives. Testing for use of such additives shall be solely at the Contractor's expense.

2.2 TOPSOIL MATERIALS

A. Topsoil - Meeting the requirements of DDOT Standard Specifications, Section 823.

2.3 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services
   1. Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance DDOT Standard Specifications, Section 203.03.

C. Testing and Analysis of Topsoil Material: Perform in accordance DDOT Standard Specifications, Section 823.

D. When tests indicate materials do not meet specified requirements, change material and retest.

E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated on the DDOE approved Soil Erosion & Sediment Control Plan and with approval by the DDOE Inspector.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 20 feet high maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stabilize stockpiled material in accordance with the DDOE approved Soil Erosion & Sediment Control Notes.

H. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

I. Remove from site and dispose of unsuitable materials at a location approved by local Department of the Environment.

3.3 STOCKPILE CLEANUP

A. Remove all unused stockpile materials.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent freestanding surface water.

END OF SECTION 02055

SECTION 02230 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing surface debris.
2. Removing designated paving, curbs, and other surface improvements.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.
6. Select demolition.
7. Salvage materials.

B. Related Sections:
1. Section 02231 - Tree Protection and Trimming.
2. Section 02315 - Excavation and Fill.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with District Department of Transportation Standard Specification Section 201.

B. Conform to applicable code for environmental requirements, disposal of debris, and use of herbicides.

C. Perform Work and coordinate with project Demolition Plan(s), Tree Preservation Plan and existing features to remain.

D. The Owner’s Independent Testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

PART 2 PRODUCTS

2.1 MATERIALS

A. Section 02055 - Topsoil Materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions & features before starting work.

B. Verify existing plant life designated to remain is tagged or identified.

C. Review and verify Site Demolition Plan before starting work.

3.2 PREPARATION

A. Call Local Utility Line Information service at 1 (800) 257-7777 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Schedule and conduct meeting with Owner & Engineer prior to commencing Work.

3.3 PROTECTION

A. Locate, identify, and protect utilities indicated to remain, from damage.

B. Protect trees, plant growth, and features designated to remain, in accordance with the Tree Preservation Plan and field recommendations from the project Arborist.

C. Locate, identify and protect all improvements and furnishings to remain within the work area.

D. Protect benchmarks, and survey control points from damage or displacement.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches.

B. Remove trees and shrubs within marked areas. Remove stumps, and root system to depth of 12 inches.

C. Clear undergrowth and deadwood, without disturbing subsoil.

3.5 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on 36 mil Hypalon material and cover over with same material, until reuse.

D. Do not remove topsoil from site.

3.6 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs, and, other surface improvements as indicated on Drawings. Neatly saw cut edges at right angle to surface.

C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

D. Continuously clean up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Do not burn or bury materials on site. Leave site in clean condition.

3.7 SALVAGE

A. Remove and salvage existing features as shown on the Site Demolition Plan. Store salvaged materials at a location approved by the Owner & Engineer.

END OF SECTION 02230

SECTION 02231 - TREE PROTECTION AND TRIMMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

B. Related Sections include the following:

1. Division 1 Section "Summary" for limits placed on Contractor's use of the site.
2. Division 1 Section "Temporary Facilities and Controls" for temporary tree protection.
3. Division 2 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
4. Division 2 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
5. Division 2 Section "Exterior Plants" for tree and shrub planting, tree support systems, and soil materials.

1.3 DEFINITIONS

A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

C. Qualification Data: For tree service firm and arborist. Include qualification requirements in Division 1 Section “Quality Assurance” and as supplemented in “Quality Assurance” article below.

D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of tree protection and trimming.

B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Use tree protection details that comply with local jurisdictions. If none apply, provide as described in this specification and/or as detailed on the drawings.
2. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, and other concerned entities to review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19-mm) sieve.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1-inch (25-mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Fence: As required by authorities having jurisdiction over the project, or if there are no such directives, provide the following according to ASTM 567.

1. Chain Link: Galvanized steel chain-link fence fabric of 0.120-inch (3-mm) diameter wire on a 2 x 2-inch (25 mm) grid, a minimum of 48 inches (1200 mm) high; with

1.9-inch (48-mm) diameter line posts; 1-5/8-inch (41-mm) diameter top rail; and 0.177-inch (4.5-mm) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

E. Organic Mulch: Shredded hardwood free of deleterious materials.

F. Tree preservation signs: Provide permanent tree preservation signs indicating, “This is a Tree Preserve – Do Not Disturb” or similar message attached securely to the fencing at reasonable intervals not to exceed 75’ apart.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence during construction and remove it only when construction is complete.

1. Install fencing as directed by local authorities or plans approved by the local jurisdiction, or if no such directives exist, install chain-link fence as detailed on the drawings and/or as described within.
2. Unless otherwise directed by local authorities or plans approved by the local jurisdiction, do not use concrete to anchor posts.
3. Fencing panels held erect by the use of concrete blocks designed with two holes specifically for that purpose are not permitted.
4. Allow access to inside tree protection zones by one moveable section which otherwise is to remain padlocked using a chain.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Mulch areas inside tree protection zones and other areas indicated.

1. Apply 2-inch (50-mm) average thickness of organic mulch, unless otherwise directed by the arborist. Do not place mulch within 1-foot of tree trunks.

D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.

E. Maintain tree protection zones free of trash.

F. Do not allow fires anywhere on the property.

3.2 EXCAVATION

A. If construction or utility trenching approaches the edge of the tree protection fencing, install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones or the drip-line of a tree to remain, root prune the edge of the excavation closest to the tree using a vibratory knife.

3.3 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist, unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Raising Grade 6 inches or less: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

C. Raising Grade more than 6 but less than 12 inches: Where existing grade is more than 6 inches (150 mm) but less than 12 inches (300 mm) below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above elevation of finish grade and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches (150 mm) below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches (150 mm) minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction.

B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

C. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

1. Type of Pruning:

a. Cleaning: Remove dead wood from all trees within the Limits of Work.
b. Thinning: Thin trees which experienced root loss or as indicated on the drawings.
c. Raising: Remove lower branches within a 7-foot clear zone in pedestrian areas.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Remove tree branches and dispose of off-site.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

B. Remove and replace trees indicated to remain that die or are damaged during construction operations that arborist or Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species (verify with Architect) as those being replaced; plant and maintain as specified in Division 2 Section "Exterior Plants."
2. Provide new trees of 6-inch (150-mm) caliper size and of a species selected by Architect when damaged trees more than 6-inches (150 mm) in caliper size, measured 12 inches (300 mm) above grade, are required to be replaced. Tree replacement(s) must equal the total number of caliper-inches of the damaged tree(s). For example, a damaged 15” caliper tree would require (2) 6-inch (150 mm) and (1) 3-inch caliper tree replacements. Plant and maintain new trees as stated above. Architect reserves the right to direct the replacement trees be planted anywhere within the limit of Work.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material and tree debris from Project property.

END OF SECTION 02231

SECTION 02315 - EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating for site structures.
   2. Excavating for landscaping.

B. Related Sections:
   1. Section 02050 - Subsurface Investigations.
   2. Section 02055 – Soils: Stockpiling excavated materials.
   3. Section 02231 – Tree Protection & Trimming.
   4. Section 02320 - Backfill.
   5. Section 02324 - Trenching: Excavating for utility trenches.

1.2 REFERENCES

A. District of Columbia, Department of Transportation:
   1. 2009 Standard Specifications for Highways and Structures.

B. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. Local utility standards when working within 48 inches of utility lines.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with District of Columbia Department of Transportation Standard Specification Sections 202-206.

B. The Owner's Independent Testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

1.5 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the District of Columbia.

PART 2 PRODUCTS

A. Excavation and fill shall be considered unclassified to subgrade & final elevation(s).

B. Additives for soil drying, modification and stabilization shall be permitted with prior approval from Architect and Geotechnical Engineer. Gradation, Proctor, pH and other testing must be conducted and furnished to Architect by Geotechnical Engineer prior to using additives. Testing for use of such additives shall be at the Contractor's expense.

PART 3 EXECUTION

3.1 PREPARATION

A. Call Local Utility Line Information service at 1 (800) 257-7777 not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Protect utilities indicated to remain from damage.

D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

E. Protect benchmarks, survey control points, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

A. Underpin adjacent structures, which may be damaged by excavation work.

B. Excavate subsoil to accommodate wall foundations, slabs-on-grade, paving, and site structures.

C. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Sections 02320 and 02324.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45 degree bearing splay of foundations.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation. Water ponding within excavation following a rain event shall be immediately pumped toward an approved sediment control measure.

G. Trim excavation. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.

I. Notify Engineer of unexpected subsurface conditions immediately.

J. Correct areas over excavated with structural fill as specified in Section 02055 or as directed by the Geotechnical Engineer.

K. Remove excess and unsuitable material from site.

L. Repair or replace items indicated to remain damaged by excavation.

3.3 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services.

B. Request visual inspection of bearing surfaces by inspection agency before installing subsequent work.

3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 02315

SECTION 02320 - BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backfilling site structures to subgrade elevations.
   2. Fill for over-excavation.

B. Related Sections:
   1. Section 02050 – Subsurface Investigations.
   2. Section 02055 – Soils: Soils for fill
   3. Section 02315 - Excavation and Fill.
   4. Section 02324 – Trenching: Backfilling of utility trenches.

1.2 REFERENCES

A. District of Columbia, Department of Transportation (DDOT):
   1. 2009 Standard Specifications for Highways and Structures.

B. American Association of State Highway and Transportation Officials
   1. AASHTO T180 – Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop.

C. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   6. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

C. Samples: Submit, in airtight containers, 10 lb sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: As specified in Section 02055.

B. Structural Fill: As specified in Sections 02055 and 02060.

C. Soil Additives: As specified in Section 02055.

D. Excavation and fill shall be considered unclassified to subgrade & final elevation(s).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01310 – Project Management and Coordination: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place as directed by the Geotechnical Engineer. Backfill with structural or granular fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface as Specified in DDOT Standard Specifications Section 211.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place fill material in continuous layers and compact in accordance with schedule at end of this section.

D. Employ placement method that does not disturb or damage other work.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Do not backfill against unsupported foundation walls.

G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

H. Slope grade away from structures minimum 2 1/2 inches in 10 ft, unless noted otherwise.

I. Make gradual grade changes. Blend slope into level areas.

J. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Within Structure Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 2 inches from required elevations.

3.5 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and inspection services.

B. Perform laboratory material tests in accordance with AASHTO T180 or ASTM D698.

C. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
   2. Moisture Tests: ASTM D3017.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: As determined by the testing and inspection services provider.

F. Proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and walks.

3.6 PROTECTION OF FINISHED WORK

A. Section 01770 – Closeout Procedures: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

A. Fill Under Grass Areas:
   1. Fill to 12 inches below finish grade, compact uniformly to 95 percent of maximum density.

B. Fill Under Landscaped Areas:
   1. Fill to 12 inches below finish grade, compact uniformly to 92 percent of maximum density.

C. Fill Under Hot Mix Asphalt and Portland Cement Concrete Paving:
   1. Compact subsoil to 95 percent of its maximum dry density.
   2. Fill to subgrade elevation, compact uniformly to 95 percent of maximum density.

D. Fill to Correct Over-excavation:
   1. Concrete as specified.

END OF SECTION 02320

SECTION 02750 - PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete sidewalks.
   2. Concrete stairs.
   3. Concrete integral curbs and gutters.
   4. Concrete common areas.
   5. Aggregate base course.

B. Related Sections:
   1. Section 02320 - Backfill: Compacted subbase for paving.
   2. Section 02721 – Aggregate Base Course: Base course.

1.2 REFERENCES

A. District of Columbia, Department of Transportation:
   1. Standard Specifications for Highways and Structures.
   2. 2009 Standard Drawings.

B. ASTM International:
   1. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   2. ASTM C150 - Standard Specification for Portland Cement.
   3. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   4. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   5. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   6. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
   7. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on joint filler, admixtures and curing compounds.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with District of Columbia, Department of Transportation Standard Specifications Division 500.

B. Obtain cementitious materials from same source throughout.

C. The Owner's Independent Testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 – Product Requirements: Environmental conditions affecting products on site.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: As specified in Section 03100.

B. Joint Filler: ASTM D1751 type; 1/2 inch thick.

C. Joint Sealant: As specified in 07900

2.2 REINFORCEMENT

A. Reinforcing Steel and Wire Fabric: Type specified in Section 03200.

2.3 CONCRETE MATERIALS

A. Concrete Materials: Provide in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.02 and as indicated on the Drawings.

2.4 ACCESSORIES

A. Curing Compound: Provide in accordance with District of Columbia, Department of Transportation Standard Specifications Section 814.

B. Joint Sealers: Provide in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.02.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.

B. Provide concrete mix design meeting District of Columbia, Department of Transportation Standard Specifications Section 817.

C. Do not use calcium chloride.

2.6 SOURCE QUALITY CONTROL AND TESTS

A. Section 01400 - Quality Control: Testing and Inspection Services: Provide mix design for each class of concrete.

B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.15.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01322 – Construction Photographs: Verification of existing conditions before starting work.

B. Verify compacted subgrade and aggregate base is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Prepare subbase in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.05.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and storm drain frames with oil to prevent bond with concrete pavement.

C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at expansion joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

D. Provide doweled joints in accordance with District of Columbia, Department of Transportation standard.

3.6 PLACING CONCRETE

A. Place concrete in accordance with District of Columbia, Department of Transportation Standard Specifications Section 501.

3.7 JOINTS

A. Place contraction joints at 20 foot intervals or as otherwise indicated on the drawings. Align curb, gutter, and sidewalk joints unless otherwise indicated on the Drawings.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement.

C. Provide sawn joints at 5 feet intervals between sidewalks and curbs unless otherwise indicated on the Drawings.

D. Provide keyed joints as indicated.

3.8 FINISHING

A. Common Area Paving: Light broom.

B. Sidewalk Paving: Light broom.

C. Curbs and Gutters: Light broom.

D. Direction of Texturing: Transverse to pavement direction.

E. Inclined Ramps: Light broom, perpendicular to slope.

F. Place curing compound on exposed concrete surfaces immediately after finishing.

3.9 JOINT SEALING

A. Separate pavement from vertical surfaces with 1/2 inch thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/4 inch of finished surface.

D. Refer to Section 07900

3.10 TOLERANCES

A. Section 01400 - Quality Control: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

C. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. Section 01400 - Quality Control: Testing and inspection services.

B. Three concrete test cylinders will be taken for every 100 or less cu yds of each class of concrete placed each day.

C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

END OF SECTION 02750

SECTION 02923 - LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Final grade topsoil for finish landscaping.

B. Related Sections:
   1. Section 02055 - Soils for Earthwork.
   2. Section 02311 - Rough Grading: Site contouring.
   3. Section 02320 - Backfill: Backfilling at building areas.
   4. Section 02324 - Trenching: Backfilling trenches.
   5. Section 02930 - Exterior Plants: Topsoil fill for trees, plants and ground cover.

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures

B. Samples: Submit, in air-tight containers,5 lb sample of each type of topsoil to testing laboratory.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

B. The Owner’s Independent testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

PART 2 PRODUCTS

2.1 MATERIAL

A. Topsoil: Fill Type S4 or S5 as specified in Section 02055.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, planting, is required. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material and building to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

3.5 TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1/2 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

3.7 SCHEDULES

A. Topsoil thicknesses:
   1. Seeded Grass: 12 inches.
   2. Sod: 8 inches.
   3. Shrub Beds: 18 inches or as indicated on Drawings.
   4. Flower Beds: 12 inches or as indicated on Drawings.

END OF SECTION

SECTION 02930 - EXTERIOR PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Trees, plants, and ground covers.
2. Mulch.
3. Seeding & Sodding.
4. Fertilizer.
5. Pruning.
6. Maintenance.

B. Related Sections:
1. Section 02055 - Soils for Earthwork: Topsoil material.
2. Section 02320 - Backfill: Rough grading of site.
3. Section 02324 - Trenching: Rough grading over trench cut.
4. Section 02923 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
2. ANSI Z60.1 - Nursery Stock.

B. District of Columbia, Department of Transportation (DDOT)
1. 2009 Standard Specifications for Highways and Structures.

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

B. Plants: Living trees, plants, and ground cover specified in this Section.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include pruning objectives, types and methods; [types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Tree Pruning: In accordance with recommendations from Owner's Arborist.

B. Perform Work in accordance with DDOT Standard Specification Sections 610 & 611, as well as Drawings.

C. The Owner's Independent testing and quality control program does not relieve the Contractor of responsibility for quality control and meeting the project specifications.

1.7 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating plants with five years documented experience.

B. Installer: Company specializing in installing and planting plants with five years documented experience.

C. Tree Pruner: Company specializing in performing work of this section with minimum five years documented experience.

D. Maintenance Services: Performed by installer.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Protect and maintain plant life until planted.

D. Deliver plant life materials immediately prior to placement. Keep plants moist.

E. Plant material damaged as a result of delivery, storage or handling will be rejected.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

C. Do not install plant life when wind velocity exceeds 30 mph.

1.11 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

1.12 WARRANTY

A. Section 01700 - Execution Requirements: Requirements for warranties.

B. Furnish one year manufacturer warranty for trees, plants, and ground cover.

1.13 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Requirements for maintenance service.

B. Maintain plant life immediately after placement. Continue maintenance until termination of warranty period.

C. Maintenance includes:
1. Cultivation and weeding plant beds and tree pits.
2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
3. Remedy damage from use of insecticides.
4. Irrigating sufficient to saturate root system and maintain health.
5. Pruning, including removal of dead or broken branches.
6. Disease control.
7. Maintaining wrapping, guys, [turnbuckles,] and stakes. [Adjust turnbuckles to keep guy wires tight.] Repair or replace accessories when required.
8. Replacement of mulch.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

A. Trees, Plants and Ground Covers: Species and size identifiable on Drawings, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

A. Topsoil: As specified in Section 02055.

2.3 SOIL AMENDMENT MATERIALS

A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
   1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil.

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

2.4 MULCH MATERIALS

A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.

2.5 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Stakes: Softwood lumber, pointed end, mild steel angle, galvanized, pointed end or as indicated on Drawings.

C. Cable, Wire, Eye Bolts [and Turnbuckles]: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

2.6 SEED MIXTURE

A. Furnish materials in accordance with DDOT Standard Specifications Section 610.

2.7 SOD

A. Furnish materials in accordance with DDOT Standard Specifications Section 610.

2.8 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze imported and existing topsoil.

C. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; pH value.

D. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.

E. Testing is not required when recent tests (within three months) are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared subsoil is ready to receive work.

C. Saturate soil with water to test drainage.

D. Verify required underground utilities are available, in proper location, and ready for use.

3.2 SEEDING & HYDROSEEDING

A. Apply seed at rates outlined in DDOT Standard Specifications Section 610.

B. Apply during planting seasons outlined in DDOT Standard Specifications Section 610.

C. Perform Work in accordance with DDOT Standard Specifications Section 610.

3.3 LAYING SOD

A. Perform Work in accordance with DDOT Standard Specifications Section 610.

B. Moisten prepared surface immediately prior to laying sod.

C. Lay sod immediately after delivery to site to prevent deterioration.

D. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

E. Lay smooth. Align with adjoining grass areas.

F. Place top elevation of sod 1/2 inch below adjoining paving or curbs.

G. Do not place sod when temperature is lower than 32 degrees F.

H. Water sodded areas immediately after installation.

3.4 FERTILIZING

A. Apply starter fertilizer at rate indicated on Drawings.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil.

D. Lightly water soil to aid dissipation of fertilizer.

3.5 PLANTING

A. Place plants for best appearance for review and final orientation by Landscape Architect.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth as indicated on Drawings under each plant. Remove or loosen burlap, ropes, and wires, from top half of root ball.

E. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.

F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.6 PLANT RELOCATION AND RE-PLANTING

A. Relocate plants as directed by Landscape Architect or Owner.

B. Ball or pot removed plants when temporary relocation is required.

C. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at minimum depth as indicated on Drawings under each plant. Remove or loosen burlap, ropes, and wires, from top half of root ball.

D. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant materials in vertical position.

E. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.7 INSTALLATION OF ACCESSORIES

A. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.8 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 - 2 inches	2 stakes with two ties
2 - 4 inches	3 guy wires [with eye bolts and turn buckles]
Over 4 inches	4 guy wires [with eye bolts and turn buckles]

3.9 TREE PRUNING

A. When pruning trees is required, lightly prune trees in accordance with recommendations of Project Arborist.

3.10 SEEDED & SODDED AREA MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Roll surface to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

G. Immediately reseed areas showing bare spots.

H. Repair washouts or gullies.

I. Protect seeded areas with warning signs during maintenance period.

3.11 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.12 SCHEDULE

A. Plant Schedule: As indicated on Drawings.

END OF SECTION