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Interim Remedial Measure Supplemental Pre-Design Investigation Report for the 50 Kent Avenue Parcel

Former Williamsburg Works MGP Site
Site ID No. 224055
Brooklyn, Kings County, New York

Prepared for:

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July 2013

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INTERIM REMEDIAL MEASURE
SUPPLEMENTAL PRE-DESIGN INVESTIGATION REPORT
FOR THE
50 KENT AVENUE PROPERTY
FORMER WILLIAMSBURG WORKS MGP SITE
SITE ID NO. 224055
BROOKLYN, KINGS COUNTY, NEW YORK

PREPARED FOR:

NATIONAL GRID
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TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

GLOSSARY

ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
CAMP	Community Air Monitoring Plan
cm/sec	Centimeters per Second
DOT	Department of Transportation
EOB	End of Boring
IDW	Investigation Derived Waste
IRM	Interim Remedial Measure
LF	Linear Feet
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquid
NW	Northwest
NYC	New York City
NYCDOS	New York City Department of Sanitation
NYSDEC	New York State Department of Environmental Conservation
PDI	Pre-Design Investigation
PID	Photoionization Detector
RI	Remedial Investigation
SCO	Soil Cleanup Objective
SE	Southeast
SW	Southwest
TCB	Temporary Containment Building
UCS	Unconfined Compressive Strength
USCS	Unified Soil Classification System

EXECUTIVE SUMMARY

On behalf of National Grid, URS Corporation (URS) has prepared this Supplemental Pre-Design Investigation (PDI) Report for the 50 Kent Avenue property ("the Site") of the former Williamsburg Works Manufactured Gas Plant (MGP) site to support the design of an Interim Remedial Measure (IRM) for the Site. The former Williamsburg Works MGP site consists of four parcels located in the Williamsburg neighborhood of Brooklyn, New York along North 12th and North 11th Streets, Kent Avenue, and the East River. The purpose of this Report is to describe the results of the April 2013 Supplemental PDI at the 50 Kent Avenue property.

The field data collected under this Supplemental PDI program is presented in a brief report that summarizes the purpose of the program, required and actual methodology, results, and interpretation. The completed program and results serve to supplement the August 2012 IRM Design Investigation Report prepared by URS, referenced herein as the 2012 PDI.

The Williamsburg Works former MGP site is covered under an administrative order on consent and administrative settlement #A2-0552-0606, which was entered into by KeySpan Corporation, a predecessor to National Grid, and the New York State Department of Environmental Conservation (NYSDEC).

The conceptual approach for the IRM would be to excavate the former holder foundations, and the soils immediately below them, excavate shallow soils elsewhere on the Site, and install NAPL collection wells along North 12th Street, northwest of the Site and along the 55-foot zone between the northwestern edge of shallow excavation and the CitiStorage building. Because of the depth of the holder foundations and their extent below the groundwater table, shoring and dewatering will be required. The excavations will be backfilled with a combination of site soils with concentrations of total polycyclic aromatic hydrocarbons less than 500 milligrams per kilogram (deeper backfill) and clean imported soil (shallow backfill).

This Supplemental PDI Report describes the geotechnical data acquired to close identified data gaps prior to preparation of the IRM design. To perform the design, URS identified needs for additional ("supplemental") geotechnical data along the locations where shoring will be installed and additional information on the location of utilities near the Site.

The supplemental exploratory boring program specifically targeted the southeast half of the Site where deep excavations will be performed along with deep barrier/retaining walls, and was based on the understanding that the remedy conforms to the following:

- Deep excavation (about 30 feet) in the southeast half of the Site (towards Kent Ave.);
- Shallow excavation (to the water table, or approximately 5 feet) in the northwest half of the Site (towards the East River);
- The remedial limits for excavation and shoring contained to within the existing sidewalks;
- Installation of product recovery wells along the north boundary of the Site and the 55-foot zone between the western edge of shallow excavation and the CitiStorage building.
- Remediation in southeast (holders) portion of the Site encompasses the 3 holder quadrant/areas only, excluding the quadrant bounded on two sides by Kent Avenue and North 12th Street.

1. Introduction

URS Corporation – New York (URS) has prepared this Supplemental PDI Reportfor data collected from Supplemental Pre-Design Investigation (PDI) activities performed for National Grid in support of an Interim Remedial Measure (IRM) for the former Williamsburg Works manufactured gas plant (MGP). This Report describes what should be the final pieces of information needed for the design of the IRM.

1.1 Site History

The former Williamsburg Works MGP operated from approximately 1863 through the late 1930s or early 1940s. The former MGP was located on land which is now divided into four separate properties in the Williamsburg neighborhood of Brooklyn, New York along North 12th and North 11th Streets, Kent Avenue, and the East River. Following the closure of the MGP, the MGP structures were dismantled. However, the holder tanks, their foundations, and other structures remain underground.

The PDI efforts to date support a planned IRM that addresses solely the 50 Kent Avenue component of the former MGP. This component, referred in this report as "the Site" is at Block 2287, Lot 1 and was the location for toluol recovery operations, purifying operations, condensers and three gas holders. The 50 Kent Avenue parcel is bordered by North 12th Street to the northeast, Kent Avenue to the southeast, North 11th Street to the southwest, and Block 2287, Lot 16 to the northwest (see Figures 1-1 and 1-2).

Most recently, the Site was used by the New York City Department of Sanitation (NYCDOS) and included a NYCDOS garage on the northwestern half of the Site. The garage was demolished in 2009 and the Site is currently a vacant lot owned by the New York City Parks Department. Figure 1-2 shows the Site location with the outlines of the historic MGP structures.

A history of the investigation of the Site prior to the IRM PDIs is summarized in detail in the Final Interim Remedial Measure Design Work Plan (GEI 2011). In brief, attention was initially drawn to the Site through the operations of NYCDOS. Prompted by observations of fuel-related free product in wells, remedial actions, including limited excavation and in situ treatment with oxygen release compound, bionutrient addition, and vacuum enhanced fluid recovery, were performed in the

late 1990s and early 2000s. Figure 1-3 shows the location of previous and Supplemental PDI sample locations on and near the Site.

1.1.1 **2006 Investigation**

A comprehensive investigation for portions of the former MGP, including the Site, was performed in 2006 by Metcalf and Eddy for the City of New York in anticipation of transforming properties into a part of the planned Bushwick Inlet Park. The 2006 investigation studied the former NYCDOS property, the accessible corridors along 11thand 12th streets between the Site and the East River, and sediments in the East River adjacent to the former MGP. Results of the investigation were summarized in a Site Investigation Report (Metcalf and Eddy, 2006).

The 2006 investigation advanced 28 soil borings and 9 sediment borings, installed 9 monitoring wells, and sampled the 9 new and 2 existing wells. Historic fill, was reported to be present to depths of up to 9 to 42 feet below ground surface (bgs), and consisted mainly of sand with gravel, brick, ash, and cinders. Field observations for 18 of the 28 soil borings indicated that petroleum and coal tar contamination was found to exist throughout the subsurface from the ground surface to the top of the clay layer approximately 55-60 feet bgs. Petroleum contamination was found to be more prevalent in the historic fill material, while MGP contamination was encountered at depths below the water table (at 4 to 8 feet bgs) to approximately 50 feet bgs. Free coal tar product was observed in two new monitoring wells. Sediment samples collected from the East River contained petroleum and coal tar contamination, with petroleum contamination closer to the surface transitioning to coal tar contamination as the borings were advanced deeper.

1.1.2 **2009-2010 RI Investigations at 50 Kent Ave.**

In August 2007,KeySpan,a National Grid predecessor, entered into a modification of Order on Consent and Administrative Settlement #A2-0552-0606 (the Order) with the New York State Department of Environmental Conservation (NYSDEC). The modification included the former Williamsburg Works MGP in the Order. During 2009-2012, GEI, a National Grid consultant,, performed a Remedial Investigation (RI) of the former Williamsburg Works MGP, including the Site. The portion of the RI activities on the 50 Kent Avenue property were conducted in 2009-2010. These activities included advancement of 56 soil borings and 7 sediment borings, excavation of 6 test pits, groundwater sampling from 16 monitoring wells and surface soil sampling at 9 locations. The results

of the investigation were reported by National Grid in an interim data transmittal letter to NYSDEC dated August 2010 (GEI, 2010).

Soil borings exhibited petroleum impacts to as deep as 43 feet bgs, but primarily in the zone up to 20 feet bgs. Coal tar impacts, including sheen, staining, blebs, globs, coating, tar lenses, and tar saturation were observed as deep as 65 feet below grade. However, no impacts were observed below the clay layer present at approximately 55 to 65 feet bgs, and only one sample taken from just above the clay layer exceeded NYSDEC Part 375 commercial use soil cleanup objectives (SCOs).

1.1.3 **2012 PDI**

URS performed a PDI in 2012 in support of the planned IRM for the Site. The PDI field work primarily consisted of the following activities:

- Delineation Soil Borings
- Geotechnical Borings
- Monitoring Well Installation
- Test Pits
- Groundwater Level and NAPL Gauging
- Hydraulic Conductivity Testing (slug tests)
- Utility and Subsurface Infrastructure Investigation
- Bench-Scale Treatability Testing
- Baseline Groundwater Modeling
- Noise and Vibration Study
- Adjacent Building Foundation Assessment

For the 2012 PDI work URS installed eleven borings for delineation and/or geotechnical analyses, installed three monitoring wells, and excavated fourteen test pits throughout the Site. See Figure 1-3 for sample locations. Observations during these activities revealed the presence of MGP waste as evidenced by the presence of odors to tar saturated soils. No simply-described pattern of contamination was observed, but the contaminant extent was consistent with the existing site conceptual model that describes coal tar contamination migrating vertically downward from the former holders until reaching lower permeability lenses whereupon the NAPL would migrate horizontally downgradient.

The 2012 slug testing indicated that the soils have moderate to low permeability. This information was used in the groundwater modeling effort to suggest that closely spaced wells or sumps would be required to lower the water table, if necessary, for soil excavation.

The 2012 geotechnical evaluation concluded that the soils are poorly sorted and are considered moderately to very dense based on blow counts. Cobble lenses were encountered. The basal clay layer was observed to be very stiff. The geotechnical properties of the soil are conducive to the installation of shoring to aid in excavation, with the fines content assisting to reduce permeability. The clay layer would provide a firm base for shoring installation and tie-in. However, the presence of cobbles and fill debris would make some technologies, such as sheet pile, difficult to install.

The 2012 test pits were installed along the perimeter of the southeast end of the Site and revealed frequent obstacles such as walls, pipes, and former holder tank walls that would require removal during the implementation of the IRM.

1.1.4 **2013 Supplemental PDI**

The 2013 Supplemental PDI consisted of seven geotechnical borings (see Figure 1-3) along with geotechnical laboratory testing of select samples. The data collected generally confirmed previous findings but with a more precise delineation of geotechnical stratigraphy. Details of the drilling and laboratory testing results are discussed below in *Geotechnical Conditions and Supplemental Investigation Findings*.

1.2 **IRM description**

Based on the results of the 2012 PDI, URS developed a conceptual approach for the IRM. Under this conceptual approach, the IRM would include excavation of the former holder foundations, and the soils below them, excavation of shallow soils elsewhere on the Site, and installation of NAPL collection wells in a line starting along North 12th Street, and continuing along the 55-foot zone between the northwestern edge of shallow excavation and the CitiStorage building located northwest of the Site. Because of the depth of the holder foundations and their extent below the groundwater table, shoring and dewatering will be required. The excavations will be backfilled with a combination of site soils containing less than 500 milligrams per kilogram total polycyclic aromatic hydrocarbons (in deeper portions) and clean imported soil (in shallow portions).

For the planned sequence of events for IRM Implementation refer to the February 2013 PDI Report. Upon approval of the IDIP and the review/approval of this Supplemental PDI Report, URS will commence preparation of the design. The target date for approval of the 100% design is early to mid-2014. National Grid targets construction of the IRM starting in late 2014.

2. Supplemental Pre-Design Investigation

2.1 Purpose

Prior to implementing the Supplemental Pre-Design Investigation, Site information had been appropriate for the completed conceptual level design evaluation. Now that the NYSDEC and National Grid have had the opportunity to review the project and shape the preferred path forward, supplemental field data necessary to support detailed design was identified and collected. The supplemental data collected has the main purpose of supporting a thoroughly thought-out design that is readily and reliably biddable with little to no significant opportunity for construction change orders (e.g., due to unforeseen conditions). This supplemental data collection will also provide for a more accurate engineer's construction cost estimate for client budgeting purposes and to minimize bidders' price quotes so that they do not have to price in too many unknown field conditions. These supplemental data consisted of the following investigations:

- Geotechnical borings to accomplish the following:
    - Close data gaps and support design of shoring and dewatering systems. The previous investigation by URS generated a fairly well-defined description of the general types of soil encountered but their variation with depth and across the Site was not sufficiently defined;
    - Better identify and quantify soil conditions/obstructions/structures that will be encountered;
- Collect available overhead and underground utility information so that construction contractor can plan its coordination activities with "outside" entities such as utility owners.

As discussed in the IRM Pre-Design Investigation Report, completion of supplemental soil borings along the proposed excavation support alignment was recommended in order to more precisely characterize the likelihood of obstructions and to better delineate the highly variable soil conditions at the Site. The detailed geotechnical information collected prior to the Supplemental Pre-Design Investigation at the Site was primarily from four borings spaced 120 feet apart at the perimeter of the proposed construction area (i.e. the holder area in the southeast half of the Site). Supplemental borings closed the information gap to about 50 feet apart. Supplemental borings were advanced into the clay layer, which started about 55 feet bgs, exclusive of any silt or sand

seams/lenses that may have "interrupted" the clay further below. These borings were terminated at depths of up to81 feet bgs.

In general, the Site itself and proposed type of construction dictated the depth, spacing, and type of boring data to be collected. The inconsistent soil stratigraphy in general and large obstructions encountered in the upper 40 feet dictated the need for supplemental data. The detailed design will consist primarily of a contiguous perimeter shoring system to allow excavation of the holder foundations and associated contamination and to limit the amount of dewatering; an interior shoring system subdividing each of the three holder areas into manageable construction cells; and excavation/backfill to approximate 30 feet bgs (performed within a temporary containment building (TCB)). Necessary geotechnical information was obtained so that conservative assumptions about geotechnical conditions, that would otherwise raise construction costs, will be minimized to the extent practicable. Thus, it was decided to acquire all essential geotechnical information during this pre-design phase in order to minimize unknowns during bidding and construction.

2.2 Supplemental Boring Locations and Rationale

The supplemental boring locations are shown on Figure 1-3. A summary list of the supplemental borings with rationale for each boring is provided in Table 2-1 below. The borings are concentrated on the southeast half of the Site (the former holder foundation area), where the deep (approximate 30-foot) excavation, dewatering and shoring/barrier walls will occur. The locations of GR-2, -3, -6, and -7 were adjusted from their planned locations due to obstructions. Their planned locations were just inside the site fence along North 11th Street. To accommodate placement of the mud tub needed to contain drilling fluid, the borings had to be moved five to ten feet further away/inward from street. Additionally, pre-clearing at the revised location for boring GR-6 indicated shallow obstructions (presumably the tank wall of Holder No. 1), requiring the boring location to be moved about thirty feet northwest. Because of this move, the planned boring location for GR-2 was moved slightly northeast to maintain relatively uniform spacing between borings

In addition to closing the data gaps and to better identify obstructions, 2012 PDI boring WW-SB-103 showed the deep clay layer interrupted by numerous thick sand seams or lenses. If perimeter shoring were to extend to the clay, it would have to extent down to 80 feet bgs or more in this area. Therefore, borings along the North 11th Street side of the Site were advanced to at least 80 feet bgs or to a minimum 10 feet into the clay.

Table 2-1

Boring Summary for Supplemental PDI

Boring	Location	Total Depth (ft bgs)	Depth to Water (ft bgs)	Max PID	Comments
GR-1	Located at north corner to close data gap at Site corner.	81	5	2,353 ppm @ 40' bgs	FILL to 7 ft; SAND/SILT to 22 ft; CLAY/SILT to 35 ft; SAND/SILT to 53 ft; CLAY to EOB(SILT/SAND lens from 65 to 72 ft); NAPL coating or saturation 15-22 and 35-45 ft
GR-2	Located near west corner to close data gap at Site corner.	81	5	1,891 ppm @ 53' bgs	FILL to 13 ft; SAND/SILT to 62 ft; CLAY to 73 ft; SILT/SAND to EOB; NAPL coating or saturation 14-17, 27-29, 45-55, and 59-61 ft
GR-3	Deeper south corner boring for Site perimeter delineation.	71	17 ft to wet mat'l	505 ppm @ 30' bgs	FILL to 27 ft; SAND/SILT to 52 ft; CLAY to EOB; No NAPL coating or saturation
GR-4	Along northwest perimeter of holder zone to close data gap to less than 60 feet.	71	4	2,092 ppm @30' bgs	FILL to 28 ft; SAND/SILT to 53 ft; CLAY to 70 ft, SILT to EOB; COBBLES at 41 and 49 ft; NAPL coating or saturation 29-34and 41-43 ft
GR-5	Center of holder zone, to close data gap to about 60 feet.	81	7	1,144 ppm @46' bgs	FILL to 29 ft; SAND/SILT to 53 ft; COBBLES at 21-25 ft and 33-35 ft. CLAY to 77 ft (SAND lens 58 to 61 ft); SAND to EOB; NAPL coating or saturation 10-13, 39-44, and 48-49 ft
GR-6	Along N. 11th St adjacent to Holder No. 1, to close data gap to less than 60 ft	81	4	1,053 ppm @ 54' bgs	FILL to 22 ft; COBBLES at 27 ft, 29-33ft and 39-43 ft. SAND/SILT to 55ft (CLAY 55 to 80ft); SAND lens 57to 62ft; SAND to EOB; NAPL coating or saturation 10-11, 17-9, and 43-55 ft
GR-7	Along N. 11th St adjacent to Holder No. 2, to close data gap to less than 60 ft	77	11	792 ppm @35' bgs	FILL to 27 ft; SAND/SILT to 59 ft; CLAY to EOB; NAPL coating 29-33, 34-36, and 41-43 ft

TABLE REMARKS:

1) Boring locations were biased towards North 11th Street to better delineate apparent sand lenses/seams shown in existing boring WW-SB-103.

2) Clay layer was expected to occur at about 60 feet bgs so a minimum boring depth of 70 feet was required in order to advance a minimum 10 additional feet into the clay. Additional depth was required if sand lenses or seams were observed within the clay.

3) Depth to water is based on apparent saturation on the day of drilling.

4) Soil zones described in *Comments* column are major zones not necessarily including seams/lenses of other materials.

5) EOB = end of boring. Equal to the total depth.

2.3 Utility Clearance for Drilling

The drilling subcontractor, Associated Environmental Services, obtained the required permits and appropriate utility clearances prior to drilling.Each boring location was pre-cleared prior to drilling commencing.The initial 5 feet of each boring was advanced using soft dig procedures (i.e., air knife/vacuum) to identify potential utilities. After the location was cleared for drilling, theexploratory hole was temporarily backfilled flush with the ground surface using the excavated spoils.

2.4 Drilling, Sampling and Logging Procedures

The soil borings were advanced using 4-inch mud rotary drilling. Two-inch outside diameter split-spoon samples were collected continuously using standard penetration techniques (ASTM D1586-84) except where an obstruction was encountered that required the advancement of the drill string past the obstruction. Where shallow refusal occurred, the depth and drilling information (e.g. hard refusal) was noted and the boring was offset nearby from the original location. Only boring GR-4 required such an offset drilling due to shallow obstructions at 5 feet bgs.

URS' on-site geologist described the soil in accordance with the Unified Soil Classification System (USCS). Soil descriptions, along with other pertinent drilling information, were recorded on a geologic boring log. Soil samples were evaluated for the presence of MGP-related contamination using a PID, olfactory, and visual observation. Any indications of MGP-related contamination (e.g., odors, staining, elevated PID readings, blebs/globs, tar saturation) were recorded on the boring logs in accordance with the National Grid and NYSDEC approved color scheme describing observed contamination. Select samples were submitted to a laboratory for geotechnical testing. All borings were tremie grouted to original grade using a Portland cement/bentonite slurry mixture. All drill cuttings and other investigation-derived waste were placed in drums for later characterization and proper off-site disposal.

2.4.1 Geotechnical Conditions and Supplemental Investigation Findings

The IRM Pre-Design Investigation Report (URS, February 2013) described the soil geotechnical properties and stratigraphy known at that time. In particular, the top down stratigraphy was described as fill, (upper) sandy silty native soil, clay, (lower) sandy silty native soil, and bedrock. That report describes the soils in great detail, including their impact on proposed construction features. The Supplemental PDI focused on the soils from the clay layer upwards since that is the zone where construction features and dewatering will be concentrated and required better delineation.

Thisreport more clearly describes those soils without discussing in detail the related construction impacts unless necessary.

The geotechnical data that was acquired during the Supplemental PDI was focused and limited to essential parameters of blow counts and soil index properties, meaning grain size distribution and Atterberg limits (plasticity type properties) to distinguish between sands, silts, and clays. Continuous blow counts and samples were obtained. Seven borings were advanced and three to four samples retained from each of the borings to yield a total of 24 samples that were tested for grain size distribution and Atterberg limits. All soil samples were retained until select intervals were identified for laboratory testing and the laboratory testing was completed and approved. The results are presented in Table 2-2. The boring logs are provided in Appendix A. The geotechnical laboratory test reports are provided in Appendix B.

Table 2-2
Laboratory Testing Data Summary

Boring No.	Depth (Ft.)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity. Index	USCS Symbol[1]	Sieve Minus No. 200 (%)	Hydrometer % Minus 2μm
GR-1	11-17	20.4			NP	SM	39.7	5
GR-1	27-35	11.1	25	1	10	SC	38.5	9
GR-1	65-71	23.1			NP	SM	32.2	3
GR-1	73-77	25.0	37	2	14	CL	93.5	18
GR-2	21-25	15.0	27	1	11	SC	38.4	4
GR-2	31-39	15.3	30	1	14	SC	34.6	7
GR-2	65-69	25.1	49	2	25	CL	91.6	28
GR-2	73-77	20.5	32	1	13	CL	70.5	13
GR-3	13-19	22.4	24	1	5	SC-SM	47.3	7
GR-3	31-37	24.4			NP	SM	12.5	0
GR-3	53-57	22.7	43	2	22	CL	87.4	36
GR-4	7-13	16.5	25	1	10	SC	35.5	6
GR-4	35-41	13.7	26	1	10	SC	41.2	11
GR-4	53-57	21.7	40	2	19	CL	82.0	33
GR-5	17-23	14.0	25	1	8	SC	31.1	4
GR-5	39-43	20.5			NP	SP-SM	11.9	0
GR-5	61-65	23.8	51	2	26	CH	87.2	43
GR-6	13-17	15.0	24	1	8	SC	36.4	8
GR-6	29-35	15.2	30	1	15	SC	46.2	9
GR-6	45-49	19.9			NP	SP-SM	11.5	0
GR-6	65-69	23.9	46	2	23	CL	84.2	25
GR-7	17-23	19.2	31	1	14	SC	41.2	6
GR-7	33-39	20.0			NP	SW-SM	10.7	1
GR-7	61-65	29.6	49	2	22	CL	99.0	31

Note: (1) USCS symbol based on visual observation and sieve and Atterberg limits reported.

2.4.2 **Obstructions**

Obstructions such as cobbles can hinder the installation of shoring, particularly if cobbles are concentrated together, so shoring construction operations must account for the reduction in size or removal of cobbles before and/or during its construction. Obstructions were encountered during the 2012 PDI and the Supplemental PDI URS investigations. Obstructions were noted within the fill zone as expected, as well as within the native soil underlying the fill zone in the form of cobbles. For example, dense gravel or cobbles had been identified in borings WW-SB-101, WW-SB-105, and WW-SB-110, which are located on the northwest half of the site, indicated some presence of these obstructive materials at the periphery of the proposed deep excavation (i.e., holders) area. These zones were found down to 40 feet bgs. There appeared to be no consistent depth or thickness of such zones. Closing the boring data gap to about 50 to 60 feet apart by virtue of the Supplemental PDI was therefore reasonable due diligence that can be offered to any construction contractor for bidding purposes. This will enable potential construction contractors to bid more reliably on the URS-recommended shoring options that entail open cut or drilling type methodology (e.g. concrete slurry wall and concrete secant pile methodology). The test pits performed during the 2012 PDI helped identify shallow obstructions in many locations including the holder foundations, but the test pits were terminated just below the water table of about 5 feet bgs. The supplemental borings were therefore necessary to provide "top to bottom" information on obstructions at/near the perimeter, as well. All the supplemental borings were located at/near the proposed deep excavation perimeter.

The Supplemental PDI indicated evidence of cobbles within the native soil underlying the fill zone at boring locations GR-4, GR-5, and GR-6. This indicates that cobbles are more widespread than indicated by previous investigations, although sporadic as previously seen, and should be anticipated throughout the holders remediation area, not just the northwest half of the former MGP property. These three supplemental PDI borings indicated cobbles 25 to 50 feet bgs. Previous investigations indicated a maximum cobble depth of about 40 feet bgs.

2.5 **Geotechnical Stratigraphy and Soil Properties**

The previous PDI investigation indicated that, in general, the stratigraphy consists of, from top down, the following:

- Fill of a granular nature up to 30 feet thick. The supplemental PDI borings confirmed this;

- (Upper) Sandy silty native soil at least 30 feet thick. The supplemental PDI borings indicated that this zone appears to be about minimum 25 feet thick;
- Clay starting at about 60 feet bgs and extending to about 90 feet bgs (WW-SB-103 shows the clay to consist of alternating layers about 1-foot thick of clay and silt/sand). The Supplemental PDI borings indicates the first evidence of a clay layer starts as shallow as about 53 feet below ground surface and is sometimes interrupted by sand/silt seams or lenses as WW-SB-103 displayed;
- (Lower) Sandy silty native soil about 10 feet thick. The Supplemental PDI borings advanced into this zone only a few feet; and
- Bedrock at about 100 feet bgs. The Supplemental PDI borings did not advance to bedrock.

Fill: The supplemental PDI investigation confirmed findings of previous investigations. The fill layer appears to be primarily silty sand that also contains clay and brick materials. Based on blow count information, this layer appears generally medium dense to dense with some loose material, as well. The geotechnical laboratory test data show that the non-plastic sandy portion of the fill contains enough fines (i.e., silt and clay sizes) – 12 percent per WW-SB-102 – to prohibit relatively free flowing groundwater. Fines content of about 10 to 15 percent by weight is considered sufficient to prevent free flowing condition. Such data is useful in determination/confirmation of hydraulic conductivity. Some fines in this amount will also hinder free flow of water into the construction zone. However, since fill is likely highly variable, its properties are also more highly variable than a naturally deposited soil, and such variability and predictability should be expected. For example, zones of material that contain no fines at all and are highly pervious may very well exist. Additionally, debris such as the cemented brick found in this layer can hinder the installation of shoring, particularly if debris pieces are concentrated together, so shoring operations must account for the reduction in size or removal of such debris before and/or during its construction.

(Upper) Silty Sand/Silt Soil: The native silty sand/silt layer appears to contain a minimum of about 10 to 12 percent fines, based on geotechnical laboratory testing. See WW-SB-102, WW-SB-103, as well as supplemental borings GR-3, GR-5,GR-6, and GR-7 where the zones of least apparent fines were targeted for testing. There also is present sporadic evidence of clay lenses (e.g., a 2-foot thick lens that starts at 20 feet bgs at WW-SB-104 and a 10-foot thick lens that starts at 22 feet bgs at GR-1).Also, cobble zones should be expected. The laboratory test data show that there is occasionally a

few percent of clay or clay-size soil present in the most cohesionless (i.e., predominantly granular) soil which can also help to inhibit free flow of groundwater into the construction area.

Significantly high blow counts generally represent this layer. Blow counts over 30 per foot in granular material denote dense soil. Except for the upper 5 feet in WW-SB-101 and WW-SB-103, and soils shallower than about 30 feet deep in the supplemental PDI borings where loose and medium dense soils are found, the blow counts indicate dense soil and/or gravel. That is, the data indicate loose and medium dense soil within the 30-foot planned excavation zone, and dense soil beneath that.

Regarding the mass excavation work inside of shoring, native soil above 30 feet bgs will be directly excavated and no extraordinary excavation procedures or concerns are foreseen there. The native soils from 30 feet bgs down to top of clay will remain in place in their current condition. However, such soils will be displaced by shoring so those portions are addressed here.

Note that it should be recognized that the presence of coarse gravel can skew blow counts to a high value not necessarily representative of the in-situ compactiveness of soils. That is, there is gravel in these site soils that possibly caused blow counts to indicate values associated with dense soils. This is shown by, for example and discussed below, blow counts exceeding 100 over a few inches. The gravel cannot advance into the split-spoon sampler and does not get pushed aside by the sampler. Thus, blow counts in such zones are not necessarily representative or a true measure of the native soil density. A better gauge is to view the zones where there is nearly or fully 100 percent recovery of soils by the sampler. In the 30-foot bgs to 60-foot bgs zone near full or full recovery soils demonstrated blow counts of about 30 to 100 per foot, which are very dense. Boring WW-SB-100 from about 35 to 45 feet bgs is a good example of why gravel and not merely dense soil is presumed to exist there. The blow counts exceed 100 in this zone with recovery typically less than 50 percent. Geotechnical laboratory test data show these soils to contain significant fines and clay that would prevent cohesionless soil from falling out of the sampler. Thus, it appears that gravel, shown on the boring log to exist at that interval, prevented full recovery. Conversely, soil with high blow counts and full recovery such as boring WW-GR-5 at 44 feet bgs indicate, much more reliably, dense characterizations. Regardless of apparent blow counts, the widespread and consistent nature of blow counts will generally be considered an indication of soils toward the dense spectrum.

Clay: Based on previous investigations and the supplemental PDI borings, the clay layer appears to typically exist as a minimum 10-foot thick low permeability barrier underneath the silty sand/silt native soil. The blow counts for the clay layer typically were indicative of a hard soil (i.e., blow counts greater than 32 per foot). Cohesive soil classified as “very stiff” falls in the blow count range

of 16 to 32 per foot. The three unconfined compressive strength tests in the laboratory from the 2012 PDI showed an average unconfined compressive strength (UCS) of about 21 pounds per square inch (or 3,000 pounds per square foot) which is closer to a stiff material (i.e., not as compact as "hard" material). There was no gravel of note to skew blow counts to the high side so the UCS laboratory testing appeared to underestimate the strength. The three hydraulic conductivity tests from the 2012 PDI showed a narrow range of values from about 2×10^{-8}centimeters per second (cm/sec) to 6×10^{-8} cm/sec, serving as a very low permeability seepage barrier.

The Supplemental PDI investigation confirmed what was previously thought to be an anomaly shown by 2012 boring WW-SB-103. WW-SB-103 exhibited stratigraphy showing the deep clay in this area was not a continuous unit but rather a discontinuous layer of alternating clay and sand layers. Borings that displayed at least a few feet of a sand layer beneath a few feet of first-encountered-clay included WW-SB-103, GR-2, GR-5, and GR-6. These borings surround the Holder No. 1 area.

Except for borings WW-SB-103 and GR-1 there appears to be a typical thick uninterrupted clay zone starting at about 55 to 60 feet bgs. Boring WW-SB-103 is near North 11th Street and boring GR-1 is near North 12th Street so some discontinuity in the clay layer across the proposed remedial action site cannot be discounted. These two borings seem to indicate sand seams or beds less than one inch thick to sandy lenses up to about one foot thick; boring GR-1 also shows a 6 or 7-foot thick silty sand lens that contains clay seams, all within the clay layer. It should be noted that the apparent sand/silt lens within the clay in GR-1 was targeted for laboratory testing and it indicated a relatively high fines content of 32.2% such that the hydraulic conductivity of the lens would be expected to be low.

(Lower) Sandy Silty Native Soil: As described in the 2012 PDI report, the sandy silty native soil that exists underneath the clay appears very similar to the sandy silty native soil above the clay and, based on limited boring data, appears to be at least 8 to 10 feet thick. Remedial construction such as shoring and excavation, is not planned to extend to the sandy silty native soil underneath the clay.

Bedrock: As indicated in the 2012 PDI report, boring WW-SB-102 shows bedrock to exist about 100 feet bgs. Remedial construction such as shoring and excavation is not planned to extend to the bedrock layer.

2.6 **Surveying**

After completion of field investigation activities, the locations and elevations of the borings were surveyed by a New York State-licensed surveyor. The locations were surveyed to the nearest 0.1 ft and referenced to the New York State Plane Coordinate System and mean sea level. The survey will use the existing site datum. Survey work also included utility locating and will be presented in the Basis of Design Report.

Source: Google Earth Pro - © 2012 Google

APPROXIMATE SCALE IN FEET

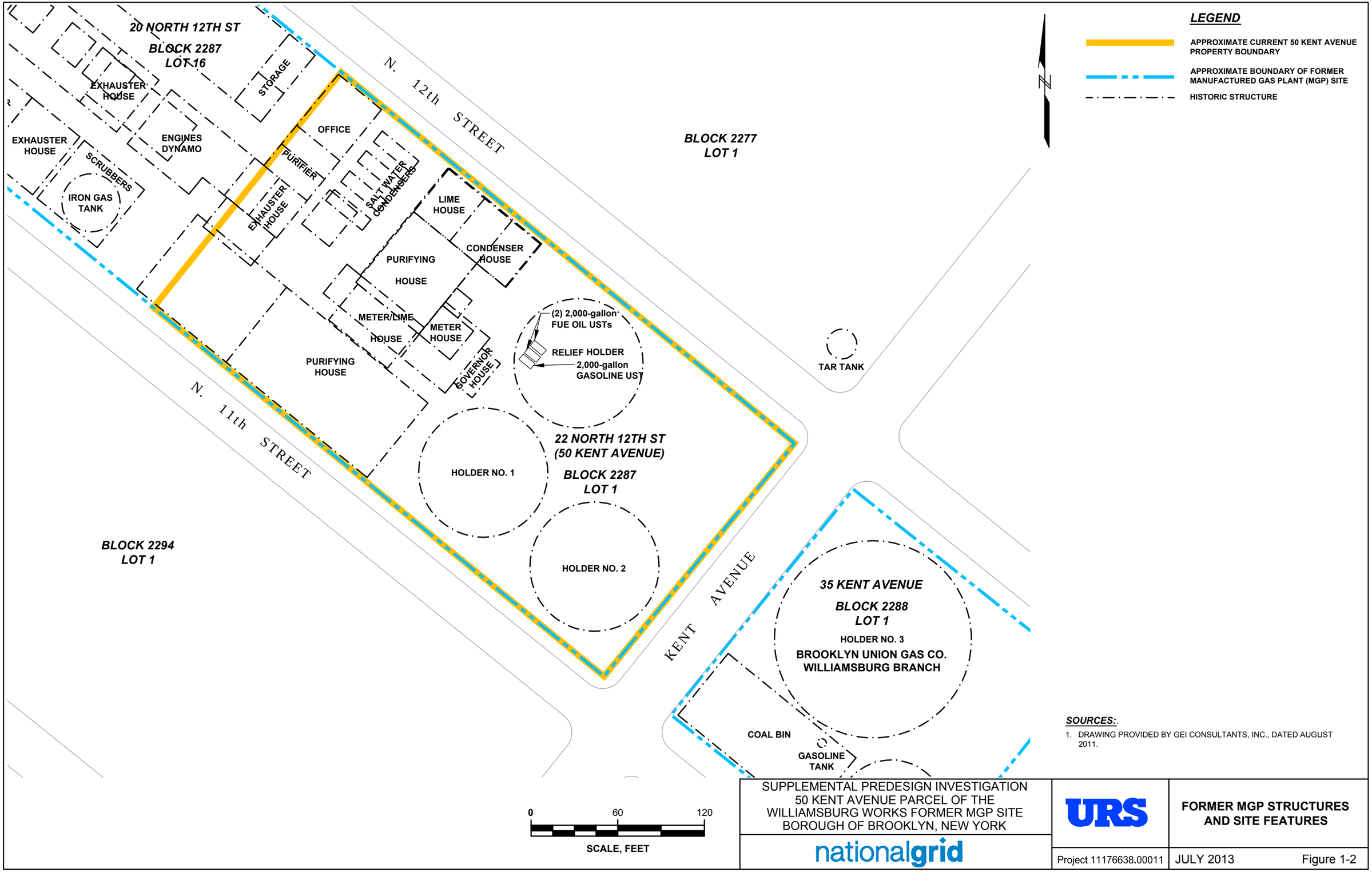
2000 0 2000

URS

SUPPLEMENTAL PRE-DESIGN INVESTIGATION
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
BOROUGH OF BROOKLYN, NEW YORK
SITE LOCATION MAP

FIGURE 1-1

AG20745-11176638-071812-GCM



SOURCES:

1. DRAWING PROVIDED BY GEI CONSULTANTS, INC., DATED AUGUST 2011.

SUPPLEMENTAL PREDESIGN INVESTIGATION
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
BOROUGH OF BROOKLYN, NEW YORK

nationalgrid

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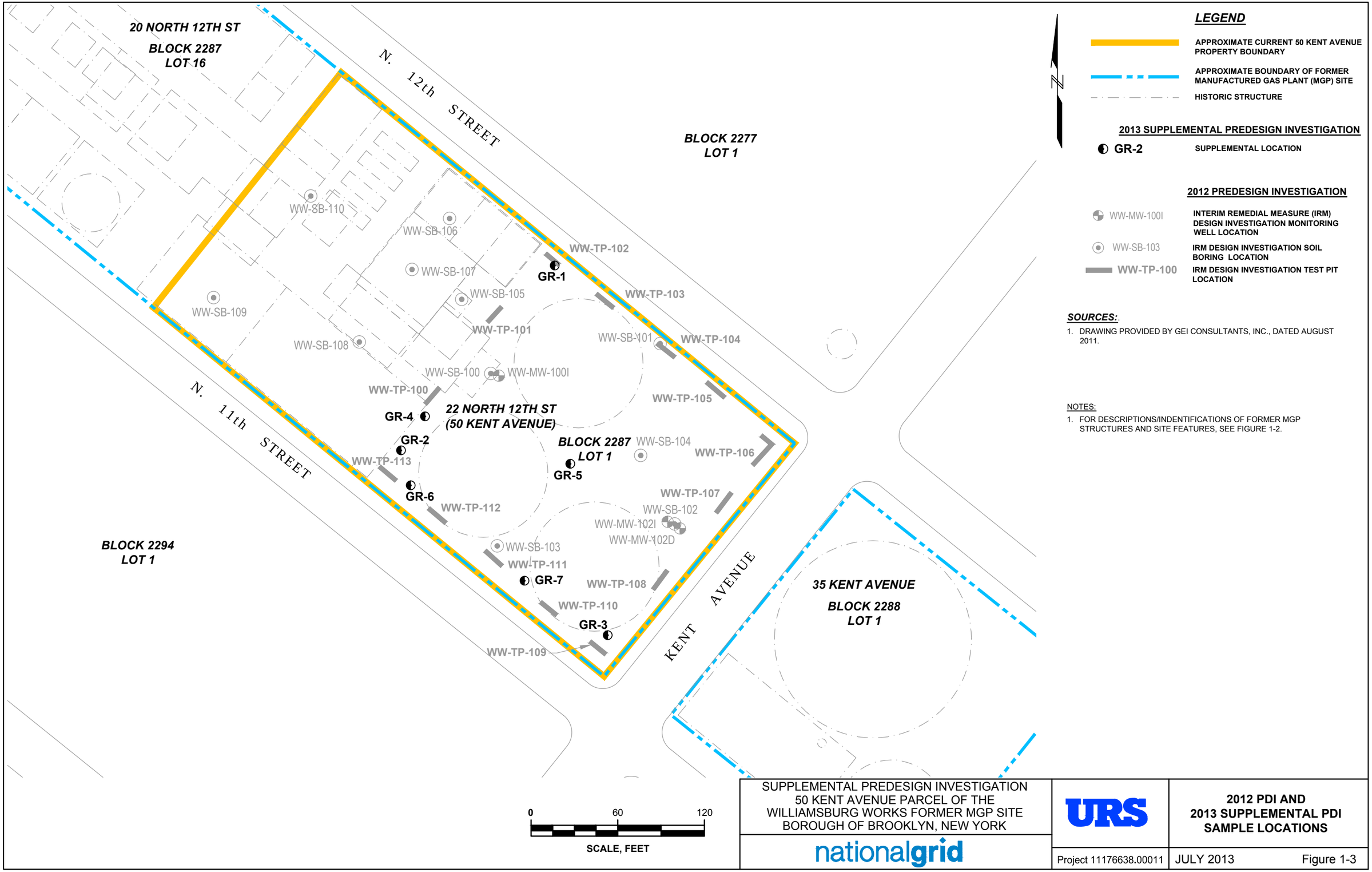
FORMER MGP STRUCTURES AND SITE FEATURES

Project 11176638.00011 | JULY 2013 | Figure 1-2

I:\11176638\CAD\JUNE 2013\FIGURE 1-2.dwg, 6/25/13 -1-RAL



LEGEND

- APPROXIMATE CURRENT 50 KENT AVENUE PROPERTY BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MANUFACTURED GAS PLANT (MGP) SITE
- HISTORIC STRUCTURE

2013 SUPPLEMENTAL PREDESIGN INVESTIGATION

- GR-2 — SUPPLEMENTAL LOCATION

2012 PREDESIGN INVESTIGATION

- WW-MW-100I — INTERIM REMEDIAL MEASURE (IRM) DESIGN INVESTIGATION MONITORING WELL LOCATION
- WW-SB-103 — IRM DESIGN INVESTIGATION SOIL BORING LOCATION
- WW-TP-100 — IRM DESIGN INVESTIGATION TEST PIT LOCATION

SOURCES:

1. DRAWING PROVIDED BY GEI CONSULTANTS, INC., DATED AUGUST 2011.

NOTES:

1. FOR DESCRIPTIONS/INDENTIFICATIONS OF FORMER MGP STRUCTURES AND SITE FEATURES, SEE FIGURE 1-2.

SUPPLEMENTAL PREDESIGN INVESTIGATION
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
BOROUGH OF BROOKLYN, NEW YORK

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2012 PDI AND 2013 SUPPLEMENTAL PDI SAMPLE LOCATIONS

Project 11176638.00011 | JULY 2013 | Figure 1-3

I:\11176638\CAD\JUNE 2013\FIGURE 1-3.dwg, 6/25/13 -1-RAL

Appendix A

Supplemental Boring Logs

URS Corporation

TEST BORING LOG

BORING NO. : GR-1

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~5'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688891.976 **EASTING:** 641932.499
GROUND ELEVATION:	10.57 ft amsl
DATE STARTED:	4/1/2013
DATE FINISHED:	4/3/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0							Brown to Black	Asphalt		Boring hand cleared to 5 ft bgs.
								Concrete	0.0	
								FILL: sand, silt, gravel, and brick, some wood and cobbles	0.0	Moist, faint petroleum-like odor
									0.0	
									0.0	
-5			1	8	5, 3, 5, 4	17	Dark Gray	FILL: sand and gravel, trace wood, loose	0.0	Wet, faint CT-like odor
			2	3	WOH/12, 3, 5	15		Very fine to medium SAND (SW), little silt, trace gravel, very loose	0.0	
-10			3	12	4, 8, 4, 4	21	Dark Gray to Beige	gravel medium dense	0.0	
			4	8	3, 4, 4, 6	46	Med. Gray to Med. Brown	1/2" clay seam, some silt and fine sand, loose	489	Coal tar NAPL saturation, mod. CT-like odor
								1" clay seam, some silt and fine sand		
			5	7	3, 3, 4, 4	71	Med. Brown	Very fine to fine SAND (SP), some clay, little silt, loose	9.8	Black staining, faint CT-like odor
-15								2" clay layer, some silt and little very fine sand	16.7	
			6	10	11, 7, 3, 5	83	Dark Brown	SILT (ML) with very fine sand, loose	37.8	Moist, sheen, mod. CT-like odor
								Very fine SAND (SP), some silt and clay, loose	37.0	
			7	21	7, 8, 13, 15	96	Dark Gray	medium dense	90.8	Light to heavy coating, mod. CT-like odor
							Med. Brown	Very fine to medium SAND (SW), some silt loose	296	Heavy coating, mod. CT-like odor
-20			8	10	5, 4, 6, 7	65			349	
									720	Coal tar NAPL saturation
			9	27	23, 12, 15, 18	71	Dark Brown	trace gravel, medium dense	85.7	Wet, heavy coating
								CLAY (CL), some fine to medium sand, very stiff	289	Coal tar NAPL saturation
			10	43	16, 20, 23, 27	65	Med. Brown to Med. Gray	Silty CLAY (CL), trace fine to medium sand, hard	25.8	Faint petroleum-like odor
-25									44.8	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 11 to 17', 27 to 35', 65 to 71', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-1

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	54	18, 25, 29, 24	17	Grayish Brown	some coarse sand	0.8	
			12	33	17, 17, 16, 22	55	Med. Gray	Very fine to fine SAND (SP), some clay and silt, very dense	0.0	Moist, faint petroleum-like odor
								Clayey SAND (SC), some fine sand, hard, little gravel	3.4	
-30			13	45	11, 21, 24, 32	35		trace coarse sand	71.0	
			14	19	4, 6, 13, 10	17		trace coarse sand very stiff	0.0	
			15	53	17, 21, 32, 28	42		little coarse sand, hard	0.0	
-35			16	42	10, 19, 23, 19	65	Dark Brown	Very fine to fine SAND (SP), micaceous, dense	39.0	Coal tar NAPL saturation, strong CT-like odor
			17	38	7, 16, 22, 17	96	Reddish Brown	Very fine SAND and SILT (SM), dense trace mica	7.0 193	
-40			18	40	18, 20, 20, 17	75	Grayish Brown	Very fine to medium SAND (SW), dense	128 2,353	
			19	37	10, 19, 18, 20	65	Dark Brown	Fine to medium SAND (SW), trace gravel, dense	184 17.0	Heavy coating, mod. CT-like odor
			20	34	9, 14, 20, 21	60	Brown	Fine SAND (SP), dense	783 8.1	Coal tar NAPL saturation Light coating, mod. CT-like odor
-45								Fine to very fine SAND (SP), trace mica, medium dense	30.1	
			21	27	11, 12, 15, 16	55		Fine to coarse SAND and GRAVEL (SW/GW), medium dense	10.9 600	Wet Coal tar NAPL saturation, mod. CT-like odor
			22	19	7, 9, 10, 11	55	Brown to Gray	Fine SAND (SP), medium dense	1,288 389	Heavy coating, faint CT-like odor
-50			23	25	9, 10, 15, 17	65	Gray	Silty CLAY (CL), very stiff	2.3	
			24	22	2, 12, 10, 18	60	Brown	Fine SAND (SP), medium dense	1.1 12.8	
								1/4" clay seam at 52.7'	8.0	
			25	26	7, 11, 15, 21	45		CLAY (CL), little to some silt, very stiff	0.2	Moist
-55							Red	gray to light gray banding throughout		
			26	27	10, 15, 12, 17	35			0.0	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 11 to 17', 27 to 35', 65 to 71', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-1

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			27	29	9, 11, 18, 11	80	Gray to Dark Gray	1/4" silt seam 58' and 58.5'	0.0 0.0	
-60			28	22	8, 9, 13, 12	100	Brown	Fine to medium SAND (SW), medium dense	15.3	
							Red to Gray	CLAY (CL), little silt, very stiff	0.0	
			29	27	7, 12, 15, 14	65	Gray	Silty CLAY (CL), very stiff	0.0 0.0	
			30	64	8, 14, 50/4	25		hard	0.0	
-65			31	30	11, 15, 15, 14	65		Silty SAND (SM), medium dense interspersed black banding from 65' to 67'	0.0 0.0	
			32	42	10, 17, 25, 34	85		dense interspersed gray clay seams (1/16" to 1/2") from 68.3' to 69'	0.0 0.0	
-70			33	23	10, 12, 11, 10	65		trace gravel, some black silt, medium dense	0.9	
			34	29	8, 10, 19, 19	95		1/16" clay seam	0.0 0.0	
			35	30	9, 12, 18, 23	65	Brown	Silty CLAY (CL), very stiff	0.0 0.0	
-75			36	37	10, 16, 21, 25	30		hard	0.0	
			37	33	13, 15, 18, 22	0		no recovery, stone is shoe		
-80			38	54	18, 22, 32, 39	25	Gray	CLAY (CL), hard	0.0	
								Boring completed at 81 ft bgs.		
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 11 to 17', 27 to 35', 65 to 71', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-2

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~4.5'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688764.076 **EASTING:** 641826.104
GROUND ELEVATION:	10.51 ft amsl
DATE STARTED:	4/3/2013
DATE FINISHED:	4/5/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC R D	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0							Brown	Asphalt		Boring hand cleared to 5 ft bgs.
								Concrete	0.0	Moist, faint petroleum-like odor
								FILL: sand, silt, gravel, and brick	0.0	
									0.0	
-5									0.0	Wet
			1	23	9, 11, 12, 13	0		No recovery		
			2	12	4, 7, 5, 6	35	Dark Brown to Gray	FILL: sand and silt, some gravel, medium dense trace brick	1.1	Moist
-10			3	9	8, 4, 5, 5	45		loose some mica	1.3	
			4	12	4, 7, 5, 4	55		medium dense	3.4	
			5	6	2, 3, 3, 4	60	Brown	Fine SAND (SP), loose	55.8	Wet Blebs, CT-like NAPL saturation, faint CT-like odor
-15			6	15	7, 8, 7, 11	95	Brown to Gray	trace gravel, medium dense	26.5 107	Moist Blebs, reddish brown to black staining, CT-like NAPL saturation, faint CT-like odor
			7	10	5, 6, 4, 7	0		no recovery	125	
			8	16	10, 8, 8, 10	30	Brown	Fine SAND and SILT (SM), medium dense	0.4	Moist
-20			9	17	5, 8, 9, 15	55		some clay, trace coarse sand and gravel	0.5 0.4	
			10	29	6, 12, 17, 21	40			4.0	
-25										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 21 to 25', 31 to 39', 65 to 69', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-2

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC□ R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	34	14, 18, 16, 12	35	Brown to Gray	Fine to medium SAND (SW), trace gravel and mica, dense	2.7	Moist
			12	20	10, 9, 11, 15	65	Brown	medium dense	17.7	Wet, light coating
									202	Black staining, CT-like NAPL saturation, mod. CT-like odor
-30			13	39	11, 13, 26, 22	0		no recovery, dense		
			14	42	15, 19, 23, 27	55	Gray	Fine SAND and SILT (SM), dense	76.3	
								Fine SAND (SP), trace gravel and mica, dense	1,010	Dark brown staining, CT-like NAPL saturation, strong CT-like odor
			15	25	12, 12, 13, 15	0		no recovery, medium dense		
-35										
			16	31	13, 13, 18, 19	40		Fine SAND and SILT (SM), some gravel, dense	15.2	Moist, faint CT-like odor
			17	25	12, 11, 14, 19	60		medium dense	10.2	
									9.5	
-40			18	53	17, 22, 31, 47	25		Fine SAND, SILT, and GRAVEL (SM/GM), very dense	2.2	
			19	34	15, 14, 20, 27	60		Fine SAND and SILT (SM), some gravel, dense	1.8	Wet
									0.0	
			20	42	4, 10, 32, 43	35		trace mica	24.2	
-45										
			21	44	28, 21, 23, 26	60	Brown	Fine SAND (SP), dense	227	
									204	Dark brown staining, CT-like NAPL saturation, mod. CT-like odor
			22	61	22, 23, 38, 48	0		no recovery, very dense		
			23	43	18, 20, 23, 25	85	Dark Brown	dense	273	Dark brown staining, CT-like NAPL saturation, mod. CT-like odor
-50									150	
			24	50	19, 23, 27, 37	95		trace gravel	539	
									678	Lightly coated
			25	47	15, 20, 27, 35	85	Brown		1,891	Dark brown to black staining, CT-like NAPL saturation, strong CT-like odor
								1.5" very fine sand and silt layer at 54.5'	1,287	
-55			26	47	24, 22, 25, 28	70		Fine SAND and SILT (SM), some gravel, dense	70.8	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 21 to 25', 31 to 39', 65 to 69', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-2

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
							Gray		24.4	Moist
			27	62	16, 33, 29, 39	90		Fine SAND (SP), dense	47.4	Dark brown staining, CT-like NAPL saturation, mod. CT-like odor
							Brown	Clayey SILT (ML), some mica, dense	1,223	
-60			28	42	20, 17, 25, 28	80	Gray	Silty CLAY (CL), hard 1/2" sand seam at 57.8'	307	
									170	Dark brown staining, CT-like NAPL saturation, mod. CT-like odor
			29	26	7, 10, 16, 17	50	Brown	Very fine to fine SAND (SP), very dense 4" layer of clayey silt at 58.6'	4.3	
							Red to Gray	Fine to medium SAND (SW), dense 2" layer of silty clay at 60.8'	4.6	
			30	60	17, 25, 35, 28	45		Medium SAND (SP), trace gravel, medium dense	5.3	
-65										
			31	30	10, 14, 16, 17	60	Gray	CLAY (CL), very stiff to hard some silt	0.9	
									0.4	
			32	39	14, 18, 21, 23	45		little silt	0.0	
			33	56	18, 23, 33, 38	0		Silty CLAY (CL), hard no recovery		
-70										
			34	52	16, 23, 29, 34	30		CLAY (CL), some silt, hard	0.0	
			35	57	25, 31, 26, 33	55		SILT (ML), some fine sand and clay, very dense	10.2	
									1.4	
-75			36	77	31, 39, 38, 50	60		1/4" dark gray clay seam at 76.1'	1.1	
									0.0	
			37	54	21, 25, 29, 38	70		Silty SAND (SM), black bands throughout, very dense	0.0	
									0.0	
								trace gravel	0.0	
-80			38	73	17, 31, 42, 35	60			0.0	
								Boring completed at 81 ft bgs.		
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 21 to 25', 31 to 39', 65 to 69', and 73 to 77' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-3

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~16.5'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688636.195 **EASTING:** 641969.212
GROUND ELEVATION:	12.49 ft amsl
DATE STARTED:	4/8/2013
DATE FINISHED:	4/9/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0							Brown	Asphalt		Boring hand cleared to 5 ft bgs. Dry
								FILL: sand, silt, and gravel	0.0	
									0.0	
									0.0	
-5									0.0	
			1	11	28, 6, 5, 5	50		FILL: sand, some silt and gravel, trace brick, medium dense	3.1	Moist, dark gray to black staining, light coating, faint pet.-like odor
			2	6	4, 3, 3, 7	45	Gray	loose	42.3	
			3	16	6, 9, 7, 10	100		medium dense	2.3	
-10									14.2	
			4	14	10, 10, 4, 3	0		no recovery		
			5	7	2, 2, 5, 9	25	Brown to Gray	FILL: sand, loose some silt	3.3	
-15			6	4	2, 3, 1, 2	45		trace gravel, very loose	0.5	
										Wet
			7	17	3, 4, 13, 7	70		trace medium sand and gravel, medium dense some silt	0.2	
									1.0	
-20			8	7	2, 3, 4, 4	0		no recovery, loose		
			9	8	4, 3, 5, 5	75	Brown	1/2" silt seam at 21.5' 1/2" silt seam at 22.0'	0.0	Moist
									0.0	
			10	8	2, 2, 6, 7	0		no recovery		
-25										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 19', 31 to 37', and 53 to 57' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-3

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	23	9, 11, 12, 18	85		FILL: sand and wood, medium dense	13.2	Wet, black staining, slight sheen, faint pet.-like odor
									46.6	
			12	29	11, 12, 17, 23	60		Very fine to fine SAND (SP), micaceous, medium dense	152	
									60.6	Brown staining, light coating, slight sheen, mod. CT-like odor
-30			13	37	15, 17, 20, 19	90	Dark Brown	dense	117	
									505	
			14	24	6, 9, 15, 15	55	Brown	trace mica medium dense some silt	22.9	Faint CT-like odor
									17.4	
			15	36	15, 17, 19, 17	100		dense some silt	6.6	
-35									2.0	
			16	28	9, 13, 15, 15	70		some medium sand, medium dense some black fine to medium sand	1.4	
									1.2	
			17	41	17, 19, 22, 25	100		dense	0.4	
									0.5	
-40			18	31	14, 15, 16, 19	70	Gray to Black	Fine to medium SAND (SW), dense	1.2	
									0.8	
			19	47	18, 21, 26, 34	100			64.1	
									23.5	Slight sheen, faint CT-like odor
			20	39	17, 19, 20, 28	80	Brown	Silty SAND (SM), dense	0.6	
-45								SILT (ML), dense	0.4	
			21	32	18, 14, 18, 21	80		Very fine to fine SAND (SM), some silt and mica, dense	4.4	
									1.8	
			22	21	8, 9, 12, 16	90		SILT (ML), some clay, medium dense	0.9	Moist
								Silty CLAY (CL), very stiff	0.6	
			23	53	19, 29, 24, 25	80	Gray	SILT (ML), little fine sand, and clay very dense	0.4	
-50							Brown		0.1	
			24	17	7, 8, 9, 16	60		Fine to coarse SAND (SW), some 1/4" silt seams, medium dense	0.0	
								Silty CLAY (CL), very stiff	0.0	
			25	27	9, 9, 18, 25	45	Red to Light Gray	CLAY (CL), little silt, very stiff	1.1	
-55										
			26	30	6, 12, 18, 19	55			0.0	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 19', 31 to 37', and 53 to 57' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-3

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC□ R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
									0.0	
			27	42	11, 17, 25, 25	65		hard	0.0	
									0.0	
-60			28	28	8, 13, 15, 17	65		very stiff	0.0	
									0.0	
			29	33	11, 15, 18, 19	70		hard	0.0	
									0.0	
			30	35	10, 15, 20, 26	65			0.0	
-65									0.0	
			31	45	14, 20, 25, 27	50	Red to Gray		0.0	
									0.0	
			32	37	11, 15, 22, 28	75			0.0	
									0.0	
-70			33	50	26, 25, 25, 26	60	Gray	Clayey SILT (ML), dense	0.0	
									0.0	
								Boring completed at 71 ft bgs.		
-75										
-80										
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 19', 31 to 37', and 53 to 57' for geotechnical analysis.

BORING NO. : GR-3

URS Corporation

TEST BORING LOG

BORING NO. : GR-□

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~4.1'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688787.601 **EASTING:** 641842.687
GROUND ELEVATION:	10.53 ft amsl
DATE STARTED:	4/15/2013
DATE FINISHED:	4/16/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC□ R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0							Brown to Black	Asphalt		Boring hand cleared to 5 ft bgs.
								Concrete	0.0	Moist
								FILL: sand, silt, gravel, and brick	0.0	
									0.0	
									0.0	Wet
-5			1	7	3, 3, 4, 5	50	Gray	FILL: sand and silt, little gravel, loose	12.7	Moist
			2	8	5, 4, 4, 6	55			0.8	
									9.2	Wet, dark brown to black staining, light coating, faint to mod. CT-like odor
-10			3	14	8, 6, 8, 7	35	Brown to Gray	FILL: sand, some silt, medium dense	44.7	
			4	11	4, 5, 6, 5	50		trace gravel 1/4" clay seam at 12'	9.6	Moist, black staining, faint CT-like odor
			5	12	8, 7, 5, 5	30			1.4	
-15			6	15	6, 8, 7, 10	80			9.6	Wet, black staining, slight sheen
									39.4	
			7	>50	50/3.5	0		no recovery, very dense		Few cobbles from 17' to 25', based on drilling
			8	17	8, 5, 12, 11	55	Brown	FILL: sand, trace gravel, medium dense	0.4	Moist
									0.8	
-20			9	20	8, 10, 10, 14	60		some silt	0.8	Wet
									35.4	Dark brown staining, heavy coating, sheen, mod. CT-like odor
			10	>50	19, 11, 50/3	35	Gray	FILL: sand and silt, some gravel, trace mica, very dense	2.0	
-25										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 7 to 13', 35 to 41', and 53 to 57' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-□

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC□ R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	36	8, 11, 25, 37	55			0.8	Moist
									0.4	
			12	59	16, 17, 42, 47	45			247	
							Brown	Very fine to fine SAND (SP), very dense		Wet, dark brown staining, heavy coating, mod. CT-like odor
-30			13	60	17, 26, 34, 37	70		1/2" silt seams at 29.6' and 30.2'	572	
									2,092	Dark brown staining, sheen, CT-like NAPL saturation, strong CT-like odor
			14	65	19, 32, 33, 35	50			876	
								dense		
			15	37	15, 19, 18, 20	80			374	
							Gray	Clayey SILT (ML), dense	75.6	
-35								Very fine to fine SAND (SP), dense	51.5	Dark brown staining, sheen, light to mod. coating, faint CT-like odor
			16	40	18, 20, 20, 21	35		Fine SAND and SILT (SM), some gravel, trace mica, dense		Moist
			17	29	8, 12, 17, 23	70		medium dense	3.1	
									4.7	
-□0			18	45	21, 22, 23, 22	40		dense	1.4	
			19	40	39, 20, 20, 23	60	Gray to Brown	Very fine to fine SAND (SP), some silt, dense	47.3	Dark brown staining, mod. coating, faint CT-like odor
									20.2	
			20	45	21, 22, 23, 25	60	Brown		51.7	
-□5									269	Dark brown staining, mod. coating, faint CT-like odor
			21	50	10, 15, 35, 31	75	Gray	Fine SAND and SILT (SM), some gravel dense	1.4	
									7.9	
			22	65	19, 31, 34, 32	50		very dense	3.0	Few cobbles at 41' and 49', based on drilling
-50			23	36	9, 16, 20, 28	50		dense	2.6	
			24	68	19, 30, 38, 35	30		very dense	1.7	
			25	35	9, 15, 20, 25	50	Brown to Gray	Silty CLAY (CL), hard	0.0	
-55										
			26	52	19, 22, 30, 32	45	Gray to Red		0.0	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 7 to 13', 35 to 41', and 53 to 57' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-□

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC□ R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			27	20	10, 7, 13, 18	30		CLAY (CL), trace silt, very stiff	0.0	
								hard		
-60			28	36	11, 16, 20, 22	55			0.0	
									0.0	
			29	32	10, 15, 17, 26	80			0.0	
									0.0	
			30	49	18, 25, 24, 27	50			0.0	
-65										
			31	43	11, 18, 25, 28	50			0.0	
								Silty CLAY (CL), hard		
			32	36	15, 16, 20, 29	50	Gray		0.0	
								Clayey SILT (ML), dense		
-70			33	47	20, 21, 26, 30	85			0.0	
								SILT (ML), some very fine sand, dense	0.0	
								Boring completed at 71 ft bgs.		
-75										
-80										
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 7 to 13', 35 to 41', and 53 to 57' for geotechnical analysis.

BORING NO. : GR-□

URS Corporation

TEST BORING LOG

BORING NO. : GR-5

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~7'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688754.745 **EASTING:** 641943.331
GROUND ELEVATION:	10.79 ft amsl
DATE STARTED:	4/17/2013
DATE FINISHED:	4/18/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC R D	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0								Asphalt		Boring hand cleared to 5 ft bgs. Dry
							Brown	Concrete	0.0	
								FILL: sand, silt, gravel, and brick	0.0	
									0.0	
-5									0.0	
			1	0	WOH/18, 1	0		No recovery, very loose		
			2	4	3, 2, 2, 2	35	Gray to Brown	FILL: sand and silt, trace gravel loose	1.6	
			3	22	7, 10, 12, 13	75		medium dense	66.7	Wet, dark brown staining, sheen, light coating, faint CT-like odor
-10									84.8	
			4	9	10, 3, 6, 6	50		FILL: sand, some silt, little gravel loose	262	
										Dark brown staining, sheen, CT-like NAPL saturation, mod. CT-like odor
			5	13	8, 8, 5, 9	60	Brown	medium dense	1.6	
-15									2.4	Moist
			6	14	4, 7, 7, 8	55			2.4	
									1.7	
			7	14	9, 6, 8, 7	45			254	Wet, dark brown staining, sheen, heavy coating
-20			8	38	41, 24, 14, 7	65		dense	2.2	Moist ~8" cobble at 20', few cobbles from 21' to 25', based on drilling
									1.3	
			9	20	9, 10, 10, 12	50		medium dense	376	Dark brown staining, heavy coating, strong CT-like odor
			10	21	12, 10, 11, 9	25	Gray		53.3	
-25										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 39 to 43', and 61 to 65' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-5

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 OF 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	50	16, 28, 22, 25	0		No recovery		
			12	44	29, 22, 22, 25	0		No recovery		
-30			13	47	13, 21, 26, 21	85		Fine SAND and SILT (SM), some gravel, trace mica, dense	14.1	
			14	71	23, 32, 39, 47	55		very dense	5.6 5.3 1.7	
			15	67	13, 24, 43, 40	40			2.8	Few cobbles from 33' to 35', based on drilling
-35			16	>50	41, 47, 50/3	35	Gray to Brownish Red	some medium to coarse white sand	3.7	
			17	54	32, 30, 24, 19	75	Brown	Fine to very fine SAND (SP), trace gravel and mica, very dense	5.2	Wet
								Fine to medium SAND (SW), very dense	25.1	
-40			18	47	20, 23, 24, 25	95		Fine to very fine SAND (SP), little silt, dense	805 1,007	Dark brown staining, sheen, light to heavy coating, mod. CT-like odor
			19	31	13, 15, 16, 20	75		Fine to medium SAND (SW), trace mica, dense	743 1,296	
			20	39	18, 15, 24, 28	100			92.5	
-45			21	34	6, 13, 21, 30	70		Fine to very fine SAND (SP), trace mica, dense 2" silt seam at 46.4'	16.6 406 1,144	Moist Dark brown staining, sheen, mod. to heavy coating, mod. CT-like odor
			22	68	28, 32, 36, 40	100		Medium to coarse SAND (SW), little gravel, very dense	183 576	Wet
-50			23	33	15, 16, 17, 17	80		Fine to very fine SAND (SP), some medium sand dense 1/4" silt seam at 50.1'	776 101	Black staining, sheen, CT-like NAPL saturation, strong CT-like odor
			24	33	13, 17, 16, 19	100		some silt from 51.9' to 52.2'	116 16.9	Sheen, faint CT-like odor
								Sandy SILT (ML), dense		
			25	23	8, 10, 13, 17	75		Silty CLAY (CL), very stiff some fine sand at 53', 53.8', and 54.5'	0.2 1.4	Wet
-55			26	34	15, 17, 17, 18	60		hard 1/2" sand seam at 56'	0.1	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 39 to 43', and 61 to 65' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-5

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
									0.3	
									0.0	
			27	45	12, 16, 29, 39	50		Fine SAND (SP), trace silt, dense		
-60			28	57	15, 22, 35, 36	100		very dense	0.0	
									0.0	
			29	24	9, 10, 14, 18	40	Brown/Black/ Red	Silty CLAY (CL), trace fine sand, very stiff	0.0	
			30	34	13, 14, 20, 26	50	Red to Gray	CLAY (CL), little silt, hard	0.0	
-65										
			31	33	12, 15, 18, 23	75	Gray to Brown	Silty CLAY (CL), hard	0.0	
									0.0	
			32	45	19, 19, 26, 29	45			0.0	
			33	44	11, 20, 24, 30	85	Gray		0.0	
-70									0.0	
			34	62	19, 27, 35, 37	65			0.0	
								Clayey SILT (ML), hard	0.0	
			35	35	10, 14, 21, 25	80		some very fine sand	0.0	
-75									0.0	
			36	63	23, 32, 31, 32	50		some very fine sand	0.0	
			37	43	11, 17, 26, 28	60		Fine to very fine SAND (SP), dense	0.0	
								Silty CLAY (CL), hard	0.0	
-80			38	53	22, 25, 28, 30	70		Stratified layers of very fine SAND and clayey SILT (SM), very dense	0.0	
									0.0	
								Boring completed at 81 ft bgs.		
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 39 to 43', and 61 to 65' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-6

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~3.9'

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	CORE	TUBE
						Split Spoon		
				DIA.		2"		
				WT.		140		
				FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688739.918 **EASTING:** 641832.788
GROUND ELEVATION:	10.81 ft amsl
DATE STARTED:	4/9/2013
DATE FINISHED:	4/11/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0								Asphalt		Boring hand cleared to 5 ft bgs.
							Brown	Concrete	0.0	Moist, faint pet.-like odor
								FILL: sand, silt, gravel, brick, and concrete	0.0	
									0.0	
									0.0	Wet
-5			1	0	1, WOH/18	25	Dark Brown	FILL: sand and gravel, very loose	0.2	
			2	3	1, 2, 1, 1	45		FILL: sand, trace gravel, mica, and brick, very loose	32.9	Slight sheen, faint CT-like odor
-10			3	4	3, 2, 2, 3	50	Brown to Dark Brown		17.8	Light to mod. coating, faint CT-like odor
			4	2	3, WOH, 2, WOH	0		no recovery		
			5	10	2, 5, 5, 5	60	Brown to Gray	FILL: sand, some silt, little gravel loose	0.8	Moist
									0.0	
-15			6	8	5, 4, 4, 4	60			0.8	Slight sheen
									1.2	
			7	4	3, 2, 2, 3	100		very loose	7.7	Light to mod. coating, mod. CT-like odor
									24.1	
-20			8	12	6, 5, 7, 8	40		medium dense	3.7	Wet, slight sheen, faint CT-like odor
							Brown			
			9	46	8, 18, 28, 13	90	Brown to Gray	dense	8.4	Moist, slight sheen, black staining, faint CT-like odor
							Gray	Medium to coarse SAND (SW), dense	3.8	
							Brown			
			10	19	16, 8, 11, 15	65		Fine SAND (SP), trace silt and gravel, medium dense	6.7	Few cobbles at 24', based on drilling
-25							Gray	1/4" clayey silt seam	4.3	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 17', 29 to 35', 45 to 49', and 65 to 69' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-6

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 OF 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	36	11, 13, 23, 19	70		Fine SAND and SILT (SM), trace gravel, dense 3" fine sand layer at 26.2'	0.6 51.0	Dark brown to black staining, mod. CT-like odor, heavy coating
			12	54	18, 26, 28, 24	15		Fine SAND, few cobbles, very dense	0.3	Wet
-30			13	26	10, 16, 10, 19	60		Fine SAND and SILT (SM), little clay, trace gravel and mica, medium dense	4.0 5.1	Moist Few cobbles at 27' and from 29' to 33', based on drilling
			14	32	11, 15, 17, 19	25		trace coarse sand, dense	0.0	
			15	24	8, 10, 14, 36	60		medium dense	15.8 8.7	
-35			16	35	8, 18, 17, 19	40		dense	20.6	
			17	40	30, 25, 15, 16	45			5.1	
-40			18	83	22, 33, 50/3	55		very dense no sample, drilled past cobbles	8.7	Few cobbles from 39' to 43', based on drilling
			19	39	19, 18, 21, 24	85	Brown	Fine SAND (SP), little silt, trace medium sand, gravel, and mica, dense	446 168	Wet, light to mod. coating, faint CT-like odor
-45			20	48	20, 25, 23, 27	100		some medium sand	49.8 128	Sheen, light to mod. coating, mod. CT-like odor
			21	30	20, 14, 16, 23	80		medium dense	689 194	Dark brown staining, CT-like NAPL saturation, mod. CT-like odor
-50			22	59	22, 25, 34, 42	100		some medium sand, very dense	88.2 56.6	Moist, slight sheen, mod. coating, faint CT-like odor
			23	43	23, 22, 21, 22	75		dense 1" silt layer	577 908	Wet, black staining, CT-like NAPL saturation, strong CT-like odor
			24	33	15, 16, 17, 21	100	Brown to Gray	Fine to very fine Silty SAND (SM), dense	1,053 656	Light to mod. coating, mod. CT-like odor
-55			25	30	9, 14, 16, 21	50	Gray	Silty CLAY (CL), trace very fine sand, very stiff	0.0	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 17', 29 to 35', 45 to 49', and 65 to 69' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-6

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / R□D□	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			26	71	26, 35, 36, 28	40	Brown	Fine SAND (SP), very dense 1/4" silty clay seams interspersed throughout	1.8	
-60			27	49	14, 21, 28, 24	80	Brown to Gray	Fine to very fine SAND (SP), some silt and clay, dense 1/4" silty clay seam at 60.1' and 60.3'	0.8 0.2	
			28	29	15, 14, 15, 20	95	Brown	Fine to medium SAND (SW), some coarse sand, trace mica, medium dense	0.0 0.0	
			29	42	12, 18, 24, 31	75	Red to Gray	CLAY (CL), little silt and fine sand, hard	0.0 0.0	
-65			30	52	18, 23, 29, 28	60			0.0 0.0	
			31	35	11, 14, 21, 28	70			0.0 0.0	
-70			32	48	12, 23, 25, 24	60			0.0 0.0	
			33	37	12, 16, 21, 32	80	Gray	Clayey SILT (ML), dense	0.0 0.0	
			34	60	18, 28, 32, 37	90		very dense	0.0 0.0	
-75			35	51	16, 20, 31, 33	70			0.0 0.0	
			36	44	18, 17, 27, 31	65		Silty CLAY (CL)	0.0 0.0	
-80			37	41	9, 16, 25, 35	75		Clayey SILT (ML), dense Fine to very fine SAND (SP), dense	0.0 0.0	
								Boring completed at 81 ft bgs.		
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 13 to 17', 29 to 35', 45 to 49', and 65 to 69' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-7

PROJECT/PROJECT LOCATION:	National Grid - Williamsburg
CLIENT:	National Grid
BORING CONTRACTOR:	Associated Environmental Services, Inc.
GROUNDWATER:	~11'

DATE	TIME	LEVEL	TYPE	CAS.	SAMPLER	CORE	TUBE
			TYPE		Split Spoon		
			DIA.		2"		
			WT.		140		
			FALL		24"		

SHEET:	1 OF 3
JOB NO. :	11176638.00011
NORTHING:	688673.851 **EASTING:** 641911.588
GROUND ELEVATION:	12.05 ft amsl
DATE STARTED:	4/11/2013
DATE FINISHED:	4/15/2013
DRILLER:	Charles Blumberg Jr.
GEOLOGIST:	Tim Ifkovich
REVIEWED BY:	Scott McCabe

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
0								Asphalt		Boring hand cleared to 5 ft bgs. Dry
							Brown	Concrete	0.0	
								FILL: sand, silt, gravel, and brick	0.0	
									0.0	
-5									0.0	
			1	3	3, 2, 1, 3	55		very loose	0.0	Moist
								loose	0.0	
			2	5	4, 3, 2, 1	75	Gray	FILL: sand and silt, trace to some gravel	0.0	Black staining
-10			3	0	WOH/24	0		very loose		
							Brown		0.0	Wet
			4	7	5, 4, 3, 1	100	Gray	FILL: sand, some silt, loose 1/4" black banding throughout	10.2	Faint CT-like odor
			5	8	3, 4, 4, 4	25	Brown to Gray	FILL: sand and gravel, loose	0.0	
-15			6	10	5, 7, 3, 2	45		FILL: sand, little gravel, loose some 1/4" black bands of fine sand throughout	0.7	Faint CT-like odor
			7	20	3, 5, 15, 50/2	60		FILL: sand, some silt, medium dense	41.0	Dark brown staining, heavy coating, mod. CT-like odor
							Brown	FILL: sand and silt, little gravel, medium dense	14.5	
-20			8	18	5, 6, 12, 33	50	Gray	trace mica	7.2	Moist
			9	29	11, 15, 14, 24	50	Brown		60.2	Wet, black staining, sheen, faint CT-like odor
			10	26	23, 13, 13, 12	65			4.2	
-25							Gray	FILL: sand, medium dense	21.1	Black staining, sheen, mod.

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 33 to 39', and 61 to 65' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-7

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 2 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
			11	40	12, 19, 21, 20	0		no recovery, dense		CT-like odor
			12	15	7, 5, 10, 12	75	Dark Brown	Fine to very fine SAND (SP), some medium sand and mica, medium dense	40.4	Sheen, light to heavy coating, faint CT-like odor
									23.3	
-30			13	27	12, 14, 13, 14	100			27.5	Sheen, light coating, faint CT-like odor
									31.3	
			14	23	9, 10, 13, 16	80	Brown		38.5	
									50.0	
			15	29	10, 13, 16, 17	100			82.5	Faint CT-like odor
-35							Dark Brown	Fine to medium SAND (SW), little silt, medium dense trace gravel	792	Sheen, light to heavy coating, mod. CT-like odor
			16	26	6, 12, 14, 15	70			83.8	
							Brown	Fine to very fine SAND (SP), some medium sand and mica, little silt, medium dense	4.4	
			17	30	7, 14, 16, 20	90			3.8	Sheen, faint CT-like odor
									1.2	
-40			18	26	12, 13, 13, 12	85		Fine to medium SAND, some mica, medium dense	5.0	
									16.6	Sheen, CT-like NAPL saturation, mod. CT-like odor
			19	32	7, 14, 18, 19	90	Dark Brown	Fine SAND (SP), trace to some mica, dense	12.5	Heavy coating
									4.1	Sheen, dark brown to black staining, light coating, faint CT-like odor
			20	41	11, 18, 23, 25	85	Brown	Fine to very fine SAND (SP), some mica, dense	0.0	
-45									0.0	
			21	28	9, 10, 18, 22	85		Fine to medium SAND (SW), trace gravel medium dense 2" silt layer at 46.6'	0.0	
									0.0	
			22	43	15, 14, 29, 21	75		dense	0.0	
								trace mica	0.0	
-50			23	41	13, 17, 24, 26	90			0.0	
									0.0	
			24	43	15, 19, 24, 19	80		Fine to very fine SAND (SP), some silt and mica, dense	0.0	
									0.0	
			25	30	12, 15, 15, 17	100	Gray	medium dense	0.0	
								Clayey SILT (ML), medium dense	0.0	
-55			26	25	12, 12, 13, 23	75		Fine to very fine SAND and SILT (SM), some mica, medium dense	0.0	

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 33 to 39', and 61 to 65' for geotechnical analysis.

URS Corporation

TEST BORING LOG

BORING NO. : GR-7

PROJECT/PROJECT LOCATION: National Grid - Williamsburg

SHEET: 3 **OF** 3

CLIENT: National Grid

JOB NO. : 11176638.00011

DEPTH FEET	STRATA	VISUAL IMPACTS	SAMPLE "S" NO.	SAMPLE "N" NO.	SAMPLE BLOW COUNT	REC / RQD	COLOR	MATERIAL DESCRIPTION	PID	REMARKS
									0.0	
			27	41	15, 17, 24, 26	75	Brown	Fine to very fine SAND (SP), some medium sand, little silt, dense	0.0	
									0.0	
-60			28	39	11, 19, 20, 25	65	Red to Light Gray	CLAY (CL), hard trace silt	0.0	Moist
									0.0	
			29	44	19, 18, 26, 19	50			0.0	
			30	34	14, 13, 21, 24	90			0.0	
									0.0	
-65			31	30	13, 16, 14, 22	25	Gray	very stiff	0.0	
								no sample		
-70			32	38	12, 16, 22, 29	80	Red to Light Gray	hard	0.0	
									0.0	
			33	43	15, 19, 24, 24	50			0.0	
			34	39	11, 17, 22, 29	80		little silt	0.0	
									0.0	
-75			35	53	15, 23, 30, 32	60	Gray	Clayey SILT (ML), very dense 1/4" black silt seam at 75.5'	0.0	
									0.0	
								Boring completed at 77 ft bgs.		
-80										
-85										

COMMENTS: Boring advanced using a Diedrich D-120 truck-mounted drill rig.

CT = Coal Tar, NAPL = Non-Aqueous Phase Liquid

Composite soil samples were collected from 17 to 23', 33 to 39', and 61 to 65' for geotechnical analysis.

Appendix B

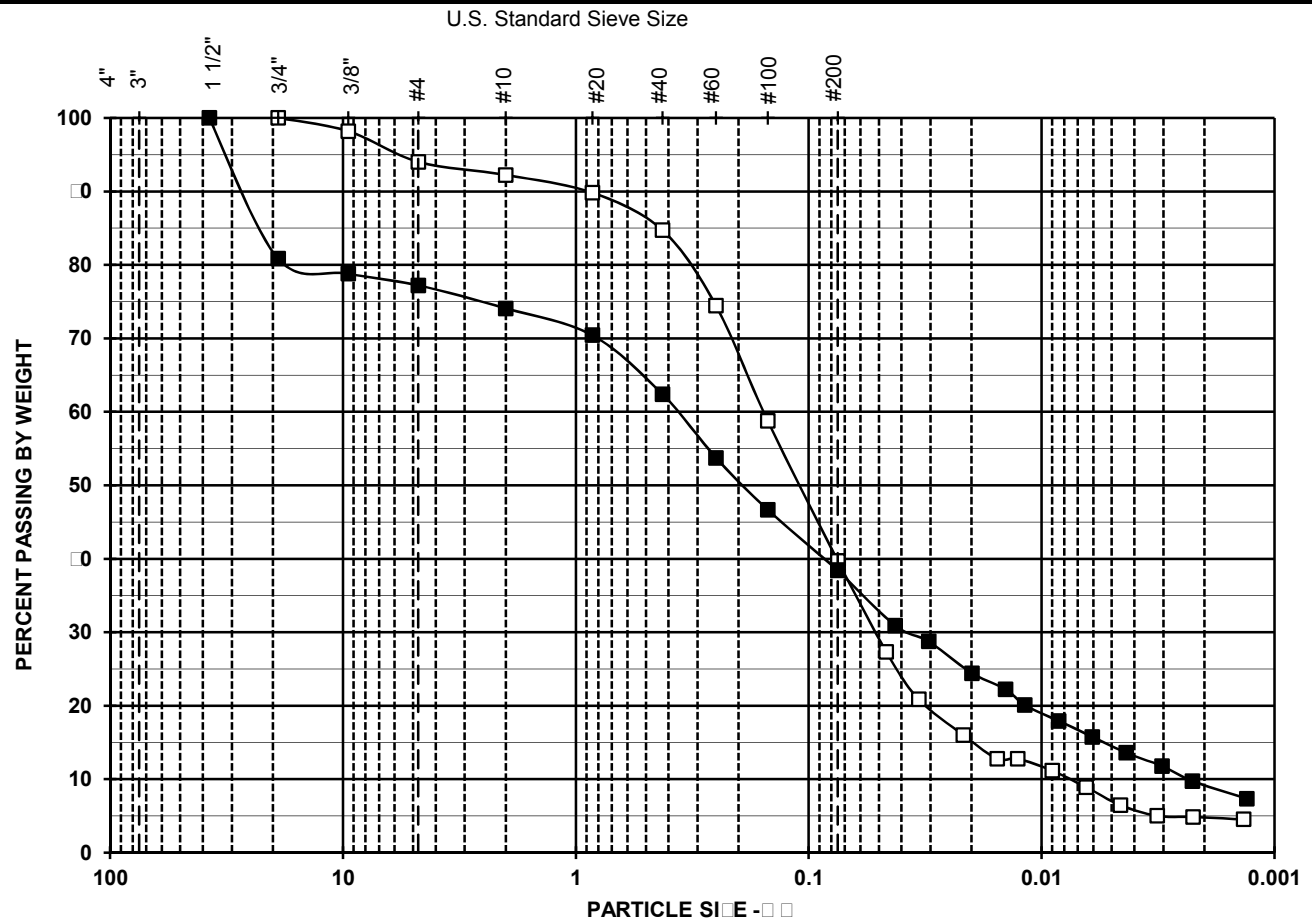
Supplemental Geotechnical Laboratory Test Reports

URS □11176638
Na□onal Gr□d W□ll□a□ s□□rg - S□□□l□□ □n□al PDI
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	
GR-1		11-17	20.4			NP	SM	39.7	5	
GR-1		27-35	11.1	25	15	10	SC	38.5	9	
GR-1		65-71	23.1			NP	SM	32.2	3	
GR-1		73-77	25.0	37	23	14	CL	93.5	18	
GR-2		21-25	15.0	27	16	11	SC	38.4	4	
GR-2		31-39	15.3	30	16	14	SC	34.6	7	
GR-2		65-69	25.1	49	24	25	CL	91.6	28	
GR-2		73-77	20.5	32	19	13	CL	70.5	13	
GR-3		13-19	22.4	24	19	5	SC-SM	47.3	7	
GR-3		31-37	24.4			NP	SM	12.5	0	
GR-3		53-57	22.7	43	21	22	CL	87.4	36	
GR-4		7-13	16.5	25	15	10	SC	35.5	6	
GR-4		35-41	13.7	26	16	10	SC	41.2	11	
GR-4		53-57	21.7	40	21	19	CL	82.0	33	
GR-5		17-23	14.0	25	17	8	SC	31.1	4	
GR-5		39-43	20.5			NP	SP-SM	11.9	0	
GR-5		61-65	23.8	51	25	26	CH	87.2	43	
GR-6		13-17	15.0	24	16	8	SC	36.4	8	
GR-6		29-35	15.2	30	15	15	SC	46.2	9	
GR-6		45-49	19.9			NP	SP-SM	11.5	0	
GR-6		65-69	23.9	46	23	23	CL	84.2	25	
GR-7		17-23	19.2	31	17	14	SC	41.2	6	
GR-7		33-39	20.0			NP	SW-SM	10.7	1	
GR-7		61-65	29.6	49	27	22	CL	99.0	31	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	20.4			NP	SM	Brown , Silty sand	5/1/2013
■	11.1	25	15	10	SC	Gray, Clayey sand with gravel	4/30/2013
○							

Symbol	□	■	○
Boring	GR-1	GR-1	
Sample			
Depth	11-17	27-35	
% +3"	0.0	0.0	
% Gravel	6.0	22.8	
% SAND	54.3	38.7	
%C SAND	1.8	3.1	
%M SAND	7.5	11.7	
%F SAND	45.0	23.9	
% FINES	39.7	38.5	
% -2μ	5	9	
D_{100} (mm)	19.00	37.50	
D_{60} (mm)	0.16	0.38	
D_{30} (mm)	0.05	0.04	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"		100.0	
3/4"	100.0	80.8	
3/8"	98.2	78.8	
4	94.0	77.2	
10	92.2	74.1	
20	89.8	70.4	
40	84.7	62.4	
60	74.4	53.7	
100	58.8	46.7	
200	39.7	38.5	

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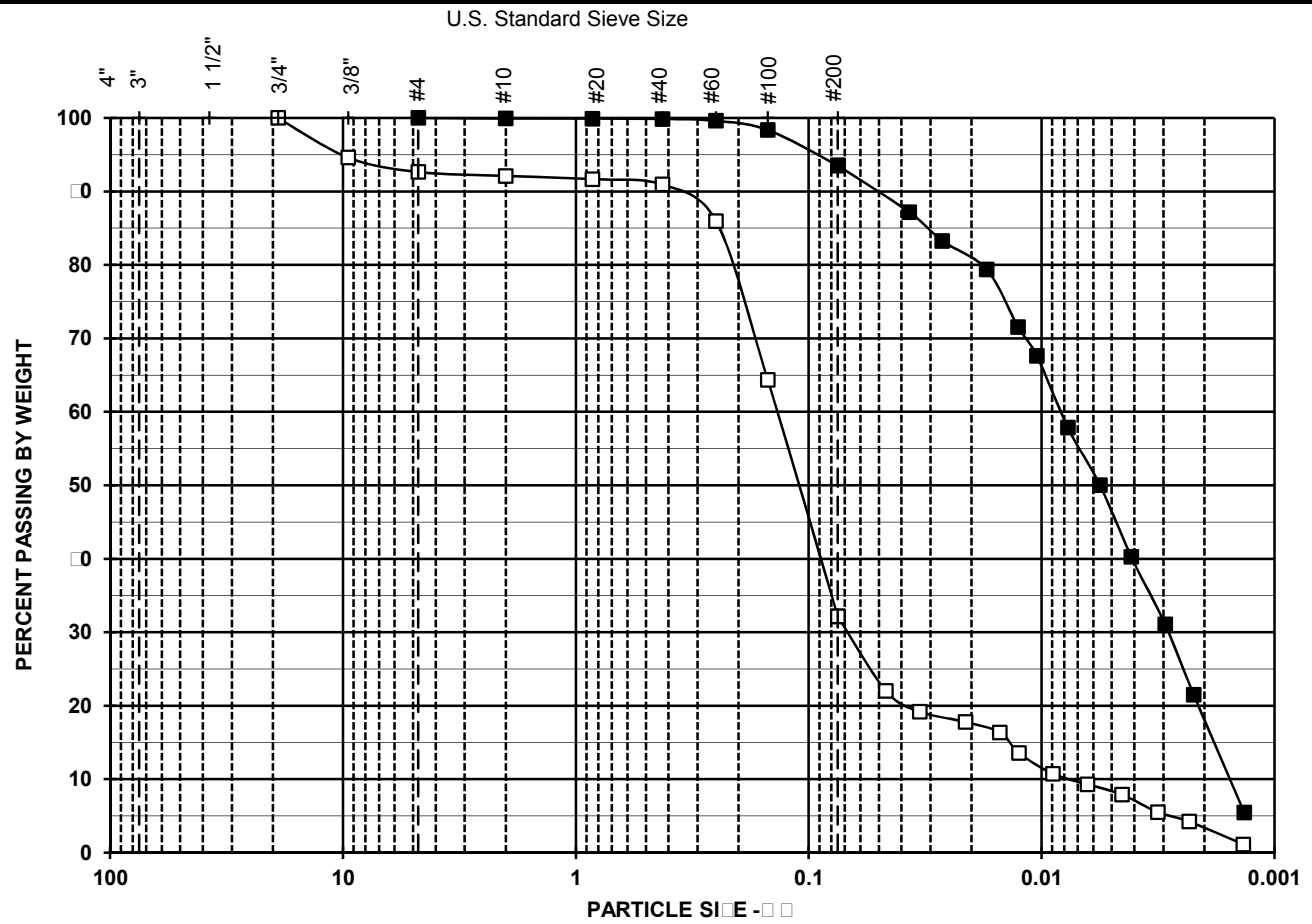
PARTICLE SIZE DISTRIBUTION

National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	23.1			NP	SM	Gray, Silty sand	4/30/2013
■	25.0	37	23	14	CL	Gray, Lean clay	4/30/2013
○							

S ol	□	■	○
Boring	GR-1	GR-1	
Sample			
Depth	65-71	73-77	
% +3"	0.0	0.0	
% Gravel	7.4	0.0	
% SAND	60.4	6.5	
%C SAND	0.5	0.1	
%M SAND	1.2	0.1	
%F SAND	58.8	6.3	
% FINES	32.2	93.5	
% -2μ	3	18	
D_{100} (mm)	19.00	4.75	
D_{60} (mm)	0.14	0.01	
D_{30} (mm)	0.07	0.00	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"	100.0		
3/8"	94.6		
4	92.6	100.0	
10	92.1	99.9	
20	91.7	99.9	
40	90.9	99.9	
60	86.0	99.6	
100	64.4	98.4	
200	32.2	93.5	

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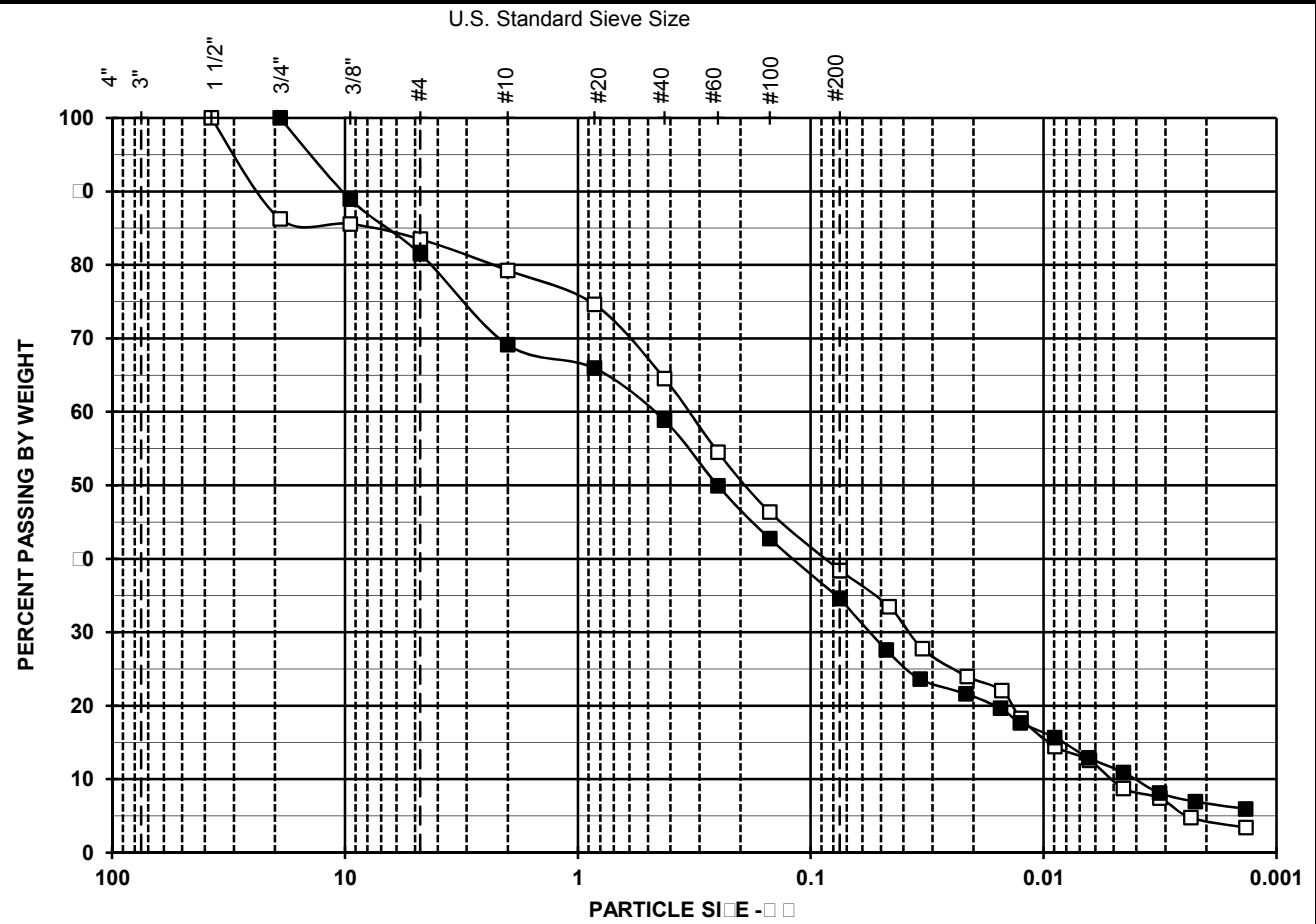
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	15.0	27	16	11	SC	Brown , Clayey sand with gravel	4/30/2013
■	15.3	30	16	14	SC	Gray, Clayey sand with gravel	5/1/2013
○							

S ol	□	■	○
Boring	GR-2	GR-2	
Sample			
Depth	21-25	31-39	
% +3"	0.0	0.0	
% Gravel	16.5	18.5	
% SAND	45.1	46.9	
%C SAND	4.2	12.4	
%M SAND	14.7	10.3	
%F SAND	26.2	24.3	
% FINES	38.4	34.6	
% -2μ	4	7	
D_{100} (mm)	37.50	19.00	
D_{60} (mm)	0.35	0.49	
D_{30} (mm)	0.04	0.06	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"	100.0		
3/4"	86.3	100.0	
3/8"	85.6	88.9	
4	83.5	81.5	
10	79.3	69.1	
20	74.6	65.9	
40	64.5	58.8	
60	54.5	49.9	
100	46.4	42.7	
200	38.4	34.6	

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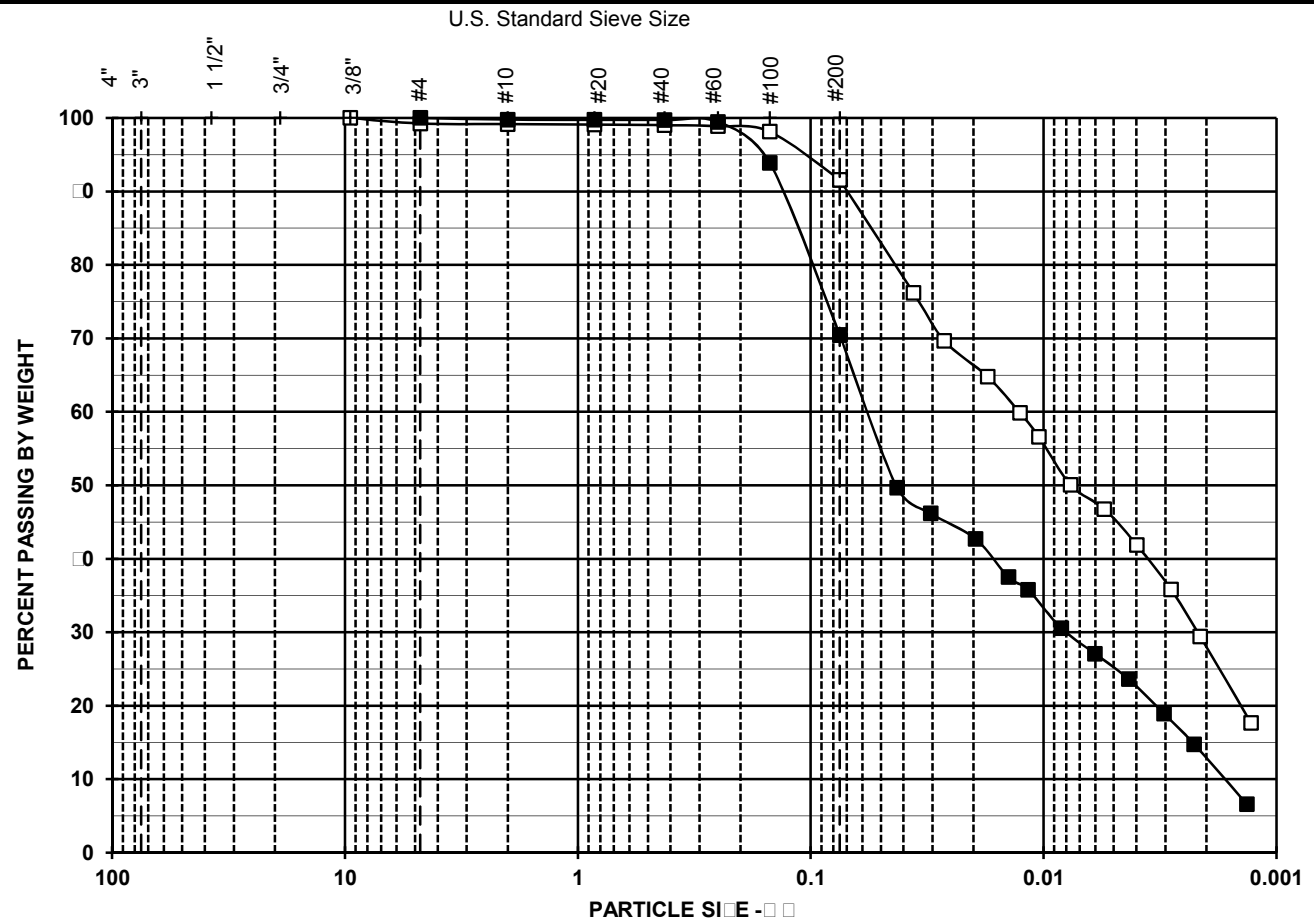
National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	25.1	49	24	25	CL	Gray, Lean clay	4/30/2013
■	20.5	32	19	13	CL	Gray, Lean clay with sand	4/30/2013
○							

S ol	□	■	○
Boring	GR-2	GR-2	
Sample			
Depth	65-69	73-77	
% +3"	0.0	0.0	
% Gravel	0.8	0.0	
% SAND	7.6	29.5	
%C SAND	0.1	0.2	
%M SAND	0.1	0.1	
%F SAND	7.4	29.3	
% FINES	91.6	70.5	
% -2μ	28	13	
D_{100} (mm)	9.50	4.75	
D_{60} (mm)	0.01	0.06	
D_{30} (mm)	0.00	0.01	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0		
4	99.2	100.0	
10	99.2	99.8	
20	99.1	99.8	
40	99.0	99.7	
60	98.9	99.5	
100	98.1	93.9	
200	91.6	70.5	

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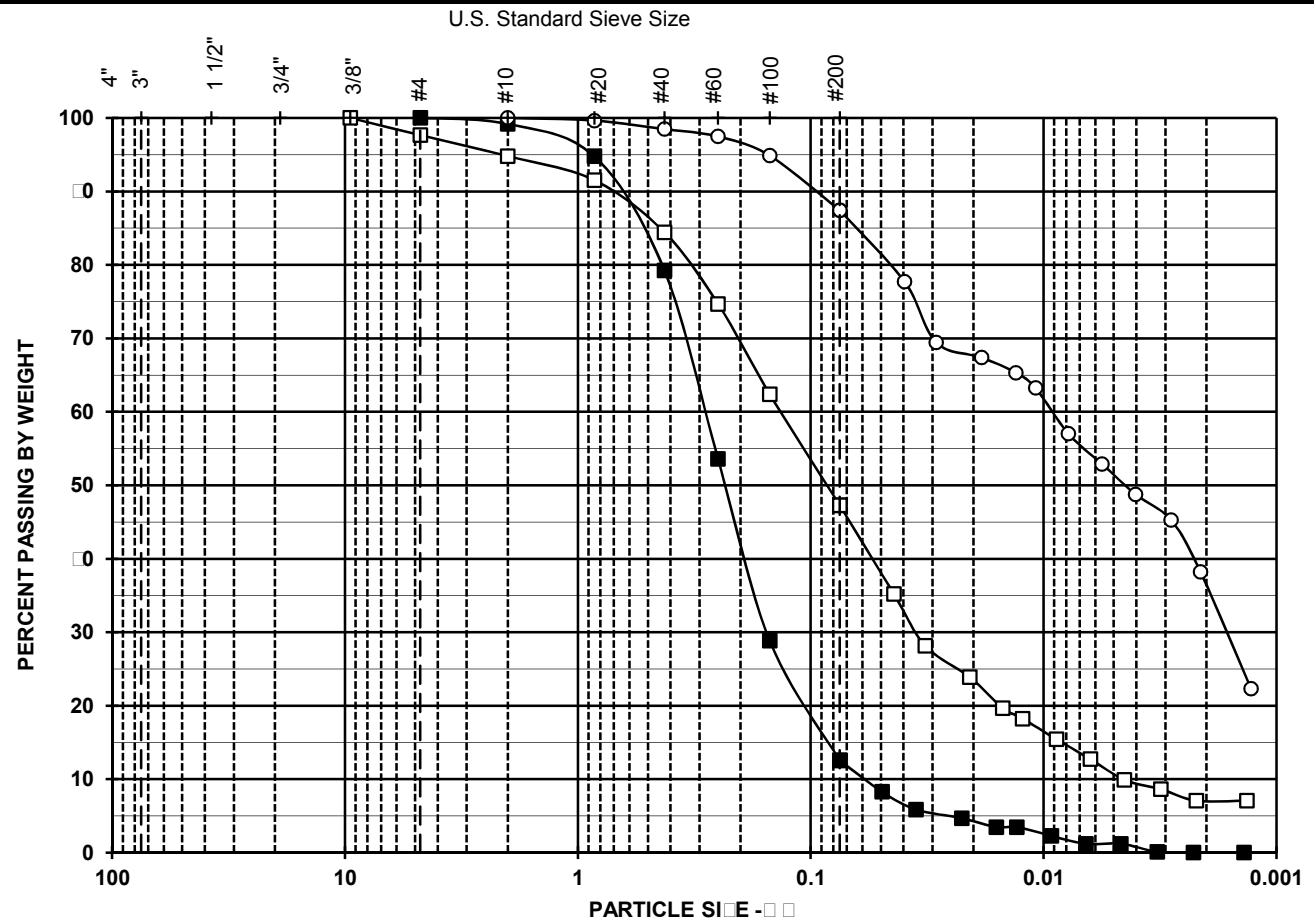
National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	22.4	24	19	5	SC-SM	Gray, Silty, clayey sand	5/1/2013
■	24.4			NP	SM	Brown, Silty sand	5/1/2013
○	22.7	43	21	22	CL	Brown, Lean clay	4/30/2013

Symbol	□	■	○
Boring	GR-3	GR-3	GR-3
Sample			
Depth	13-19	31-37	53-57
% +3"	0.0	0.0	0.0
% Gravel	2.3	0.0	0.0
% SAND	50.4	87.5	12.6
%C SAND	2.8	0.8	0.0
%M SAND	10.4	19.9	1.5
%F SAND	37.2	66.7	11.1
% FINES	47.3	12.5	87.4
% -2μ	7	0	36
D_{100} (mm)	9.50	4.75	2.00
D_{60} (mm)	0.14	0.29	0.01
D_{30} (mm)	0.04	0.15	0.00
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0		
4	97.7	100.0	
10	94.8	99.2	100.0
20	91.5	94.8	99.6
40	84.4	79.3	98.5
60	74.7	53.6	97.5
100	62.4	28.8	94.9
200	47.3	12.5	87.4

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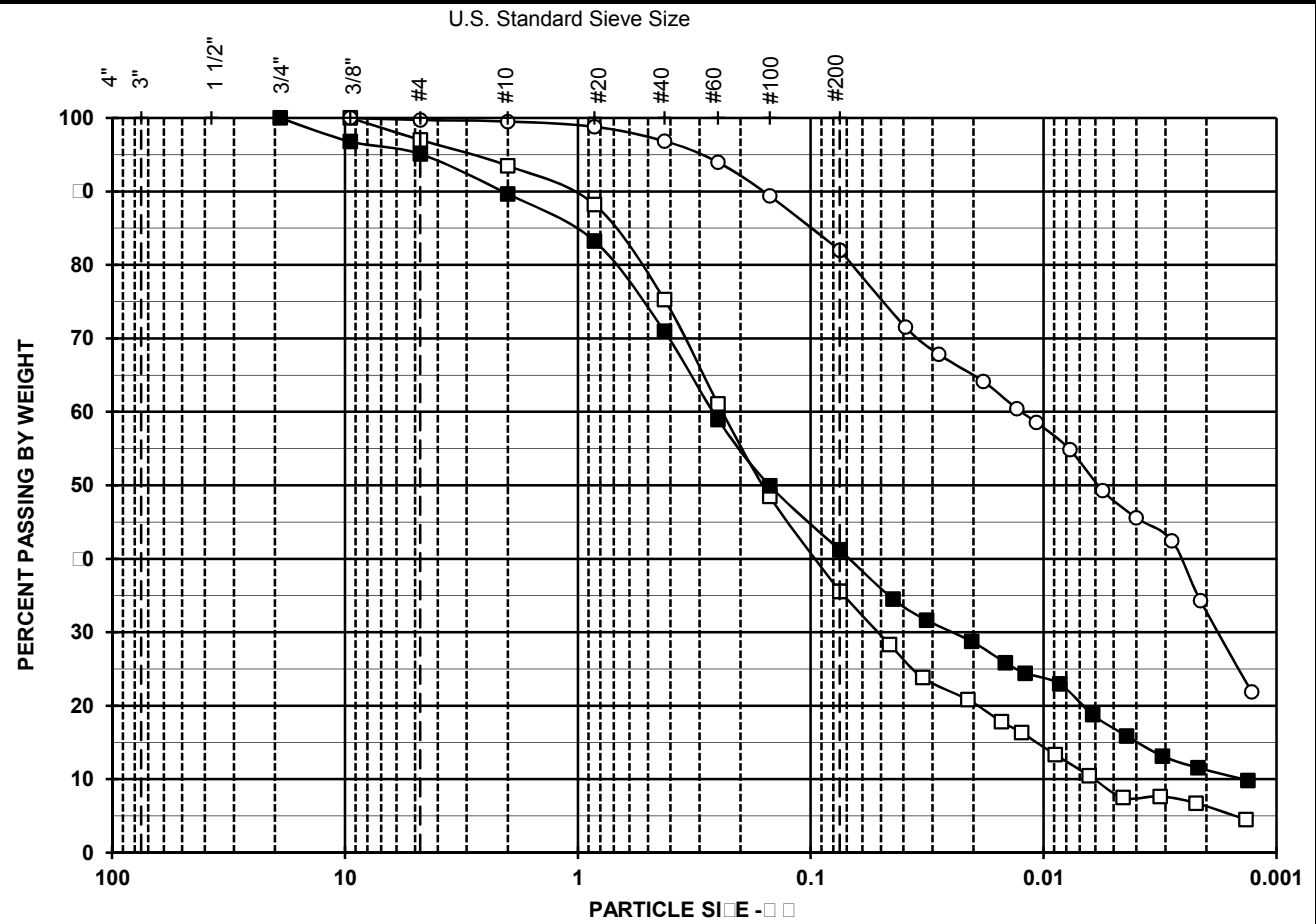
PARTICLE SIZE DISTRIBUTION

National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	16.5	25	15	10	SC	Gray, Clayey sand	5/1/2013
■	13.7	26	16	10	SC	Gray, Clayey sand	5/1/2013
○	21.7	40	21	19	CL	Brown, Lean clay with sand	4/30/2013

Symbol	□	■	○
Boring	GR-4	GR-4	GR-4
Sample			
Depth	7-13	35-41	53-57
% +3"	0.0	0.0	0.0
% Gravel	3.0	4.9	0.3
% SAND	61.5	53.9	17.7
%C SAND	3.5	5.4	0.2
%M SAND	18.2	18.7	2.7
%F SAND	39.7	29.8	14.8
% FINES	35.5	41.2	82.0
% -2μ	6	11	33
D_{100} (mm)	9.50	19.00	9.50
D_{60} (mm)	0.24	0.27	0.01
D_{30} (mm)	0.05	0.03	0.00
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"		100.0	
3/8"	100.0	96.8	100.0
4	97.0	95.1	99.7
10	93.5	89.7	99.5
20	88.2	83.3	98.8
40	75.3	71.0	96.8
60	61.1	58.9	94.0
100	48.5	49.9	89.4
200	35.5	41.2	82.0

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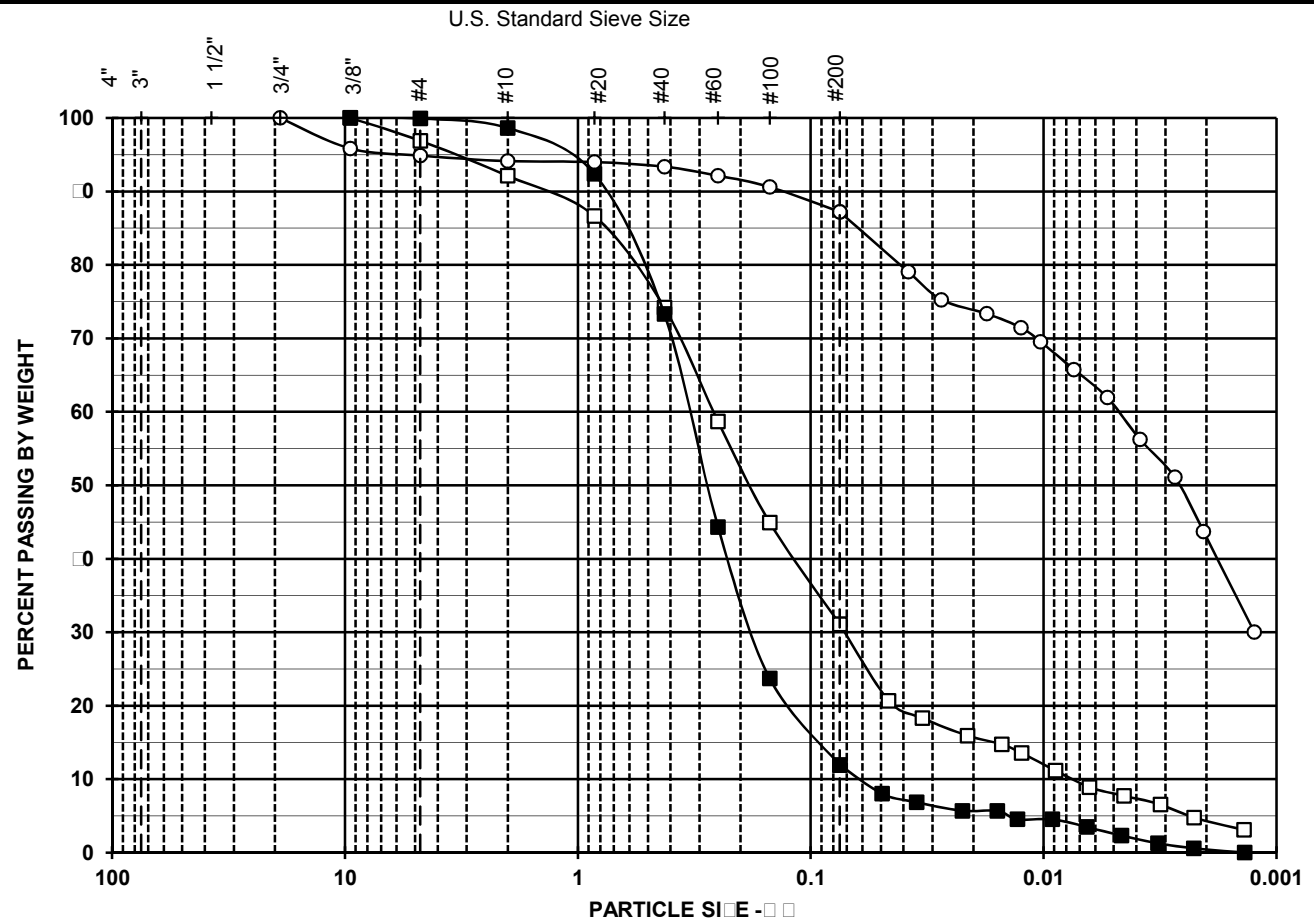
PARTICLE SIZE DISTRIBUTION

National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	14.0	25	17	8	SC	Brown , Clayey sand	4/29/2013
■	20.5			NP	SP-SM	Brown, Poorly-graded sand with silt	5/1/2013
○	23.8	51	25	26	CH	Brown, Fat clay	4/30/2013

S ol	□	■	○
Boring	GR-5	GR-5	GR-5
Sample			
Depth	17-23	39-43	61-65
% +3"	0.0	0.0	0.0
% Gravel	3.1	0.1	5.1
% SAND	65.8	88.0	7.7
%C SAND	4.8	1.3	0.7
%M SAND	17.9	25.3	0.8
%F SAND	43.1	61.4	6.1
% FINES	31.1	11.9	87.2
% -2μ	4	0	43
D_{100} (mm)	9.50	9.50	19.00
D_{60} (mm)	0.26	0.34	0.00
D_{30} (mm)	0.07	0.18	0.00
D_{10} (mm)		0.06	
Cc		1.5	
Cu		5.5	

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			100.0
3/8"	100.0	100.0	95.8
4	96.9	99.9	94.9
10	92.1	98.6	94.1
20	86.7	92.4	94.0
40	74.2	73.3	93.4
60	58.7	44.3	92.1
100	44.9	23.7	90.6
200	31.1	11.9	87.2

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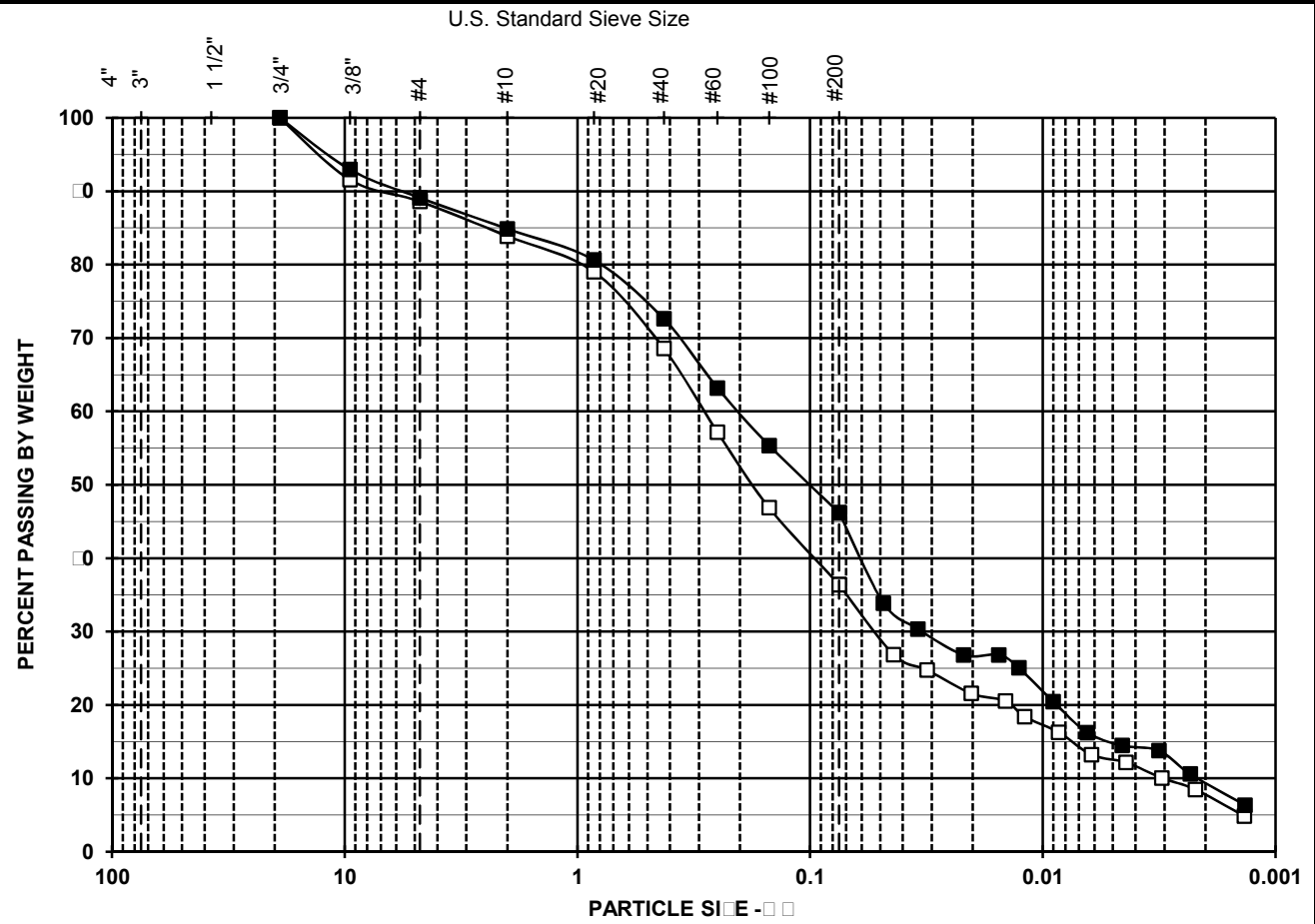
PARTICLE SI E DISTRIBUTION

National Grid Williamsburg - Supplemental PDI

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	15.0	24	16	8	SC	Brown , Clayey sand	4/29/2013
■	15.2	30	15	15	SC	Gray, Clayey sand	4/30/2013
○							

Symbol	□	■	○
Boring	GR-6	GR-6	
Sample			
Depth	13-17	29-35	
% +3"	0.0	0.0	
% Gravel	11.4	10.9	
% SAND	52.2	42.9	
%C SAND	4.7	4.2	
%M SAND	15.3	12.3	
%F SAND	32.2	26.4	
% FINES	36.4	46.2	
% -2μ	8	9	
D_{100} (mm)	19.00	19.00	
D_{60} (mm)	0.29	0.21	
D_{30} (mm)	0.05	0.03	
D_{10} (mm)			
Cc			
Cu			

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"	100.0	100.0	
3/8"	91.6	93.0	
4	88.6	89.1	
10	83.9	84.9	
20	79.0	80.6	
40	68.6	72.6	
60	57.1	63.2	
100	46.9	55.4	
200	36.4	46.2	

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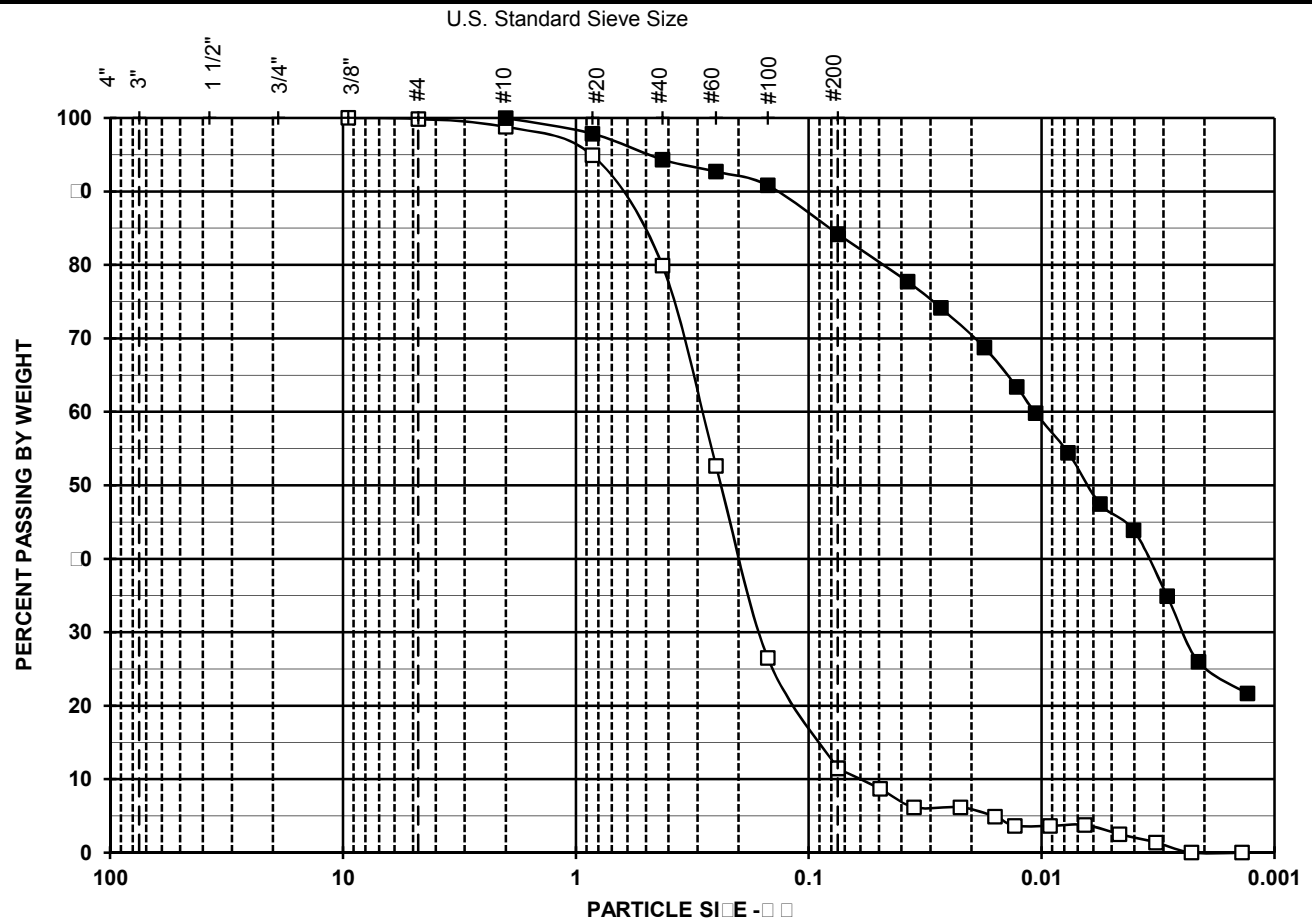
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	19.9			NP	SP-SM	Brown, Poorly-graded sand with silt	5/1/2013
■	23.9	46	23	23	CL	Red, Lean clay with sand	4/29/2013
○							

S ol	□	■	○
Boring	GR-6	GR-6	
Sample			
Depth	45-49	65-69	
% +3"	0.0	0.0	
% Gravel	0.1	0.0	
% SAND	88.4	15.8	
%C SAND	1.1	0.0	
%M SAND	18.9	5.7	
%F SAND	68.4	10.1	
% FINES	11.5	84.2	
% -2μ	0	25	
D_{100} (mm)	9.50	4.75	
D_{60} (mm)	0.30	0.01	
D_{30} (mm)	0.16	0.00	
D_{10} (mm)	0.06		
Cc	1.5		
Cu	4.8		

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			
3/4"			
3/8"	100.0		
4	99.9		
10	98.8	100.0	
20	94.9	97.9	
40	79.9	94.3	
60	52.6	92.7	
100	26.5	90.8	
200	11.5	84.2	

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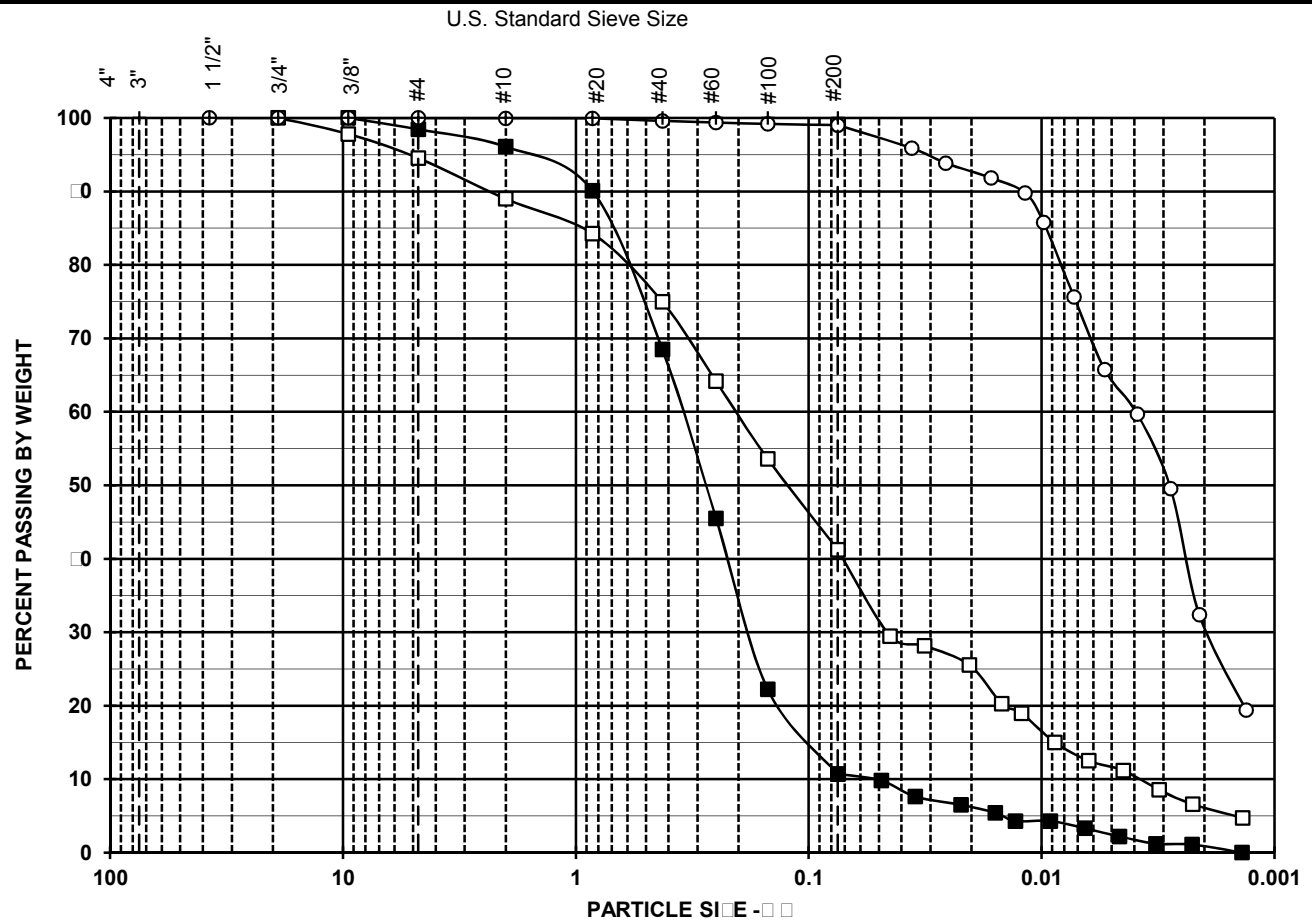
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	19.2	31	17	14	SC	Brown , Clayey sand	4/29/2013
■	20.0			NP	SW-SM	Brown, Well-graded sand with silt	5/1/2013
○	29.6	49	27	22	CL	Brown, Lean clay	4/29/2013

S ol	□	■	○
Boring	GR-7	GR-7	GR-7
Sample			
Depth	17-23	33-39	61-65
% +3"	0.0	0.0	0.0
% Gravel	5.5	1.5	0.0
% SAND	53.3	87.8	1.0
%C SAND	5.6	2.4	0.1
%M SAND	14.0	27.6	0.3
%F SAND	33.8	57.8	0.6
% FINES	41.2	10.7	99.0
% -2μ	6	1	31
D_{100} (mm)	19.00	9.50	4.75
D_{60} (mm)	0.21	0.36	0.00
D_{30} (mm)	0.05	0.18	0.00
D_{10} (mm)		0.05	
Cc		1.7	
Cu		6.7	

Particle Size	PERCENT FINER		
(Sieve #)	□	■	○
4"			
3"			
1 1/2"			100.0
3/4"	100.0		100.0
3/8"	97.8	100.0	100.0
4	94.5	98.5	100.0
10	89.0	96.1	99.9
20	84.3	90.1	99.9
40	75.0	68.5	99.6
60	64.2	45.5	99.4
100	53.6	22.2	99.2
200	41.2	10.7	99.0

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PARTICLE SI E DISTRIBUTION

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