

## Mueser Rutledge Consulting Engineers

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#### **MEMORANDUM**

| Date: | January, 2016  |
|-------|--|
| To:   | Office   |
| From: | Adam M. Dyer   |
| Re:   | EE Memo 1 – Estimated Settlement and Stress on MMC from Development Fill |
|       | Wills Street Wharf Building and Ramp, Baltimore, MD                      |
| File: | 12582B   |
|       |  |

MRCE has reviewed available subsurface information in the vicinity of the Wills Street Ramp and has estimated settlement resulting from fill placed for development. The purpose of these estimates is to determine if the proposed grading scheme will cause settlement or impose loads which may influence the integrity of the existing multi-media cap (MMC) and Head Maintenance System (HMS) components, including the Soil Bentonite Barrier (S-B Barrier).

#### Exhibits

Exhibits prepared to illustrate these reports are:

| Sketch 1     | Assessment of Fill Areas                              |
|--------------|---|
| Drawing GS-A | Geologic Section A-A                                  |
| Analysis 1   | Wills Street Ramp                                     |
| Analysis 2   | Wills Street Turnaround                               |
| Analysis 3   | Wills Street Turnaround in Area of Pre-Load           |
| Analysis 4   | Load impact on drainage net based on foundation type. |
| Appendix A   | Laboratory Data                                       |
| Appendix B   | Assessment of Compressibility Characteristics         |

#### **References**

- 1. "Corrective Measures Implementation Construction Completion Report, Phase I: Soil-Bentonite Hydraulic Barrier Wall, Phase II: Final Remedial Construction" prepared by Black and Veatch, Volumes I and II, February 2000.
- 2. "An Engineering Manual for Settlement Studies" by J.M. Duncan and A.L. Buchignani, June 1976, revised October 1987.
- 3. "EE Memo 1 Estimated Settlement Under Development Fill Exelon Building & Plaza Garage, Baltimore, MD" by Mueser Rutledge Consulting Engineers, December 2013.
- 4. "Manual on Estimating Soil Properties for Foundation Design", by Cornell University for the Electric Power Research Institute, August 1990.

#### Site Description

The site straddles remedy Area 1 and 2 in the footprint of the Wills Street alignment and southern Wills Street extension. Generally, the existing ground surface for the proposed development slopes gently from Elev. +10 at the southern foot of Wills Street to Elev. +15 at the south end of the Plaza Garage. The proposed development raises grades for roadway, sloping from approximately Elev. +13 at the south end to Elev. +28 at the Plaza Garage. Retaining wall structures are required at the south, west and north sides to contain the fill. The east side contained by the Wills Street Wharf Building west foundation wall. Utilities will be buried in the fill below the street.

#### **Subsurface Conditions**

The southern portion of the site is underlain by the MMC remedy component, a layer of granular fill (Stratum F), and compressible organic clay (Stratum O) ranging in thickness from 6 to 20 ft. This compressible layer is generally described as a soft brown to black organic silty clay with trace vegetation and fine sand, and is typically given a USCS designation of OH or OL. Stratum O is underlain by a series of sand and silt layers (Strata S1, S2, S3, M, and S4). Bedrock is at approximately Elev. - 80. Groundwater is controlled by pumping; for design purposes the groundwater table is assumed at approximately Elev. 0. Abandoned foundations and waterfront structures are buried within Strata F and O.

#### **Prior Remedial Earthwork**

In preparation for construction of the MMC corrective measure during the 1990s Allied Signal placed a sheet pile retaining structure at the southern foot of Wills Street, constructed a rip-rap embankment, preloaded areas of potentially high settlement, and constructed the S-B Barrier, see Sketch 1.

#### Baltimore City Pier Pre-Load c. 1996:

The Baltimore City Pier was located at the foot of Wills Street in the vicinity of the proposed Wills Street Turnaround and consisted of a timber pile supported relieving platform and headwall. To make way for the MMC, the deck was removed and the timber piles were cut at Elev +1 and abandoned in place. The area was pre-loaded to Elev. +15. Pre-loading included installation of vertical wick drains between the piles.

This analysis assumes that the combination of pile support and soil support was effectively preloaded to Elev. +15. The pre-loading is significant when determining whether Stratum O will be in a recompression or virgin compression loading condition as a result of fill placement to achieve the proposed grades. If the proposed new grade is above that of the pre-load, a significant magnitude of settlement can be expected due to virgin compression of the underlying soil material. The timber pile hard points would reduce settlement magnitude but may cause areas of high strain due to localized differential settlement. If the proposed new grades are below the historic pre-load, only a negligible amount of settlement will occur, in re-compression.

#### S-B Barrier Construction c. 1999:

The S-B Barrier underlies the center of the proposed ramp and turnaround. A reinforced concrete bridge slab will be present (either existing or new after sheet pile is placed) in all areas where street traffic can travel.

#### MMC Construction c. 1999:

After completion of the S-B Barrier, the MMC was constructed, including cover soil to the present grade. The MMC contains a 60-mil LLDPE Geomembrane that is susceptible to strain from differential settlement. The performance of the MMC has two design conditions:

- 1. The Geomembrane covers the entirety of Area 1 and at its' extents is embedded in the S-B Barrier. As described in EE Memo 1 for the Exelon Project (Ref 3), settlement of greater than 2 inches may cause strain that damages the Geomembrane. The Geomembrane is protected by the underlying crushed stone capillary break layer and the drainage net and the separation geotextile above which will help arch overburden loads over areas of soft support below. The 2 inches of allowable settlement is provided as a design guide and as a magnitude which can be practically estimated and observed.
- 2. Immediately overlying the Geomembrane is the Drainage Net which allows surface water infiltration to drain to the perimeter of the site and off of Area 1. Drainage Net flow is restricted when a stress greater 2,000 pounds per square foot (psf) is applied to it. However, reduced flow may be acceptable where the drainage basin upslope is covered by a roof or other structure which will manage storm water. As a general design guide, at final construction, total stress acting on the drainage net is limited to 2,000 psf.

#### Analysis and Assumptions

An overlay of proposed grades, existing conditions, prior remedial earthwork conditions, and buried structures was examined to analyze areas of settlement and loading concern. Three areas were identified as potentially impacting the corrective measures; areal extents are illustrated on Sketch 1.

These areas include:

- 1. Analysis 1 Wills Street Ramp: This area is outside the limits of compressible materials.
- 2. Analysis 2 Wills Street Turnaround: This area is within the limits of compressible materials and does not overlie an area of pre-loading.
- 3. Analysis 3 Wills Street Turnaround in Area of Pre-Load: This area is within the limits of compressible materials and overlies and area of pre-loading.
- 4. Analysis 4 Load impact on drainage net based on foundation type.

#### <u>Settlement</u>

In general, settlement is computed as the sum of three contributors: elastic compression, primary consolidation, and secondary compression. It was assumed that strata below the hard silty clay of Stratum M were incompressible under the potential loadings.

#### Elastic Compression

Elastic moduli of granular strata were estimated based on the EPRI *Manual on Estimating Soil Properties for Foundation Design*, Reference 4.

#### Primary Consolidation

Consolidation settlement of compressible strata were estimated using one-dimensional consolidation theory after Terzaghi (1947). Idealized profiles were determined for analysis based on the geologic sections presented on Drawing GS-A. The compressible stratum was divided into sub-layers no greater

than four feet in thickness. The groundwater table was assumed to be at El. 0. In areas where a preload was present, the maximum past pressure was calculated based on this preload. In locations where a preload was not present, the maximum past pressure  $(P'_c)$  was computed assuming existing conditions. Primary settlement was computed for each sub-layer, and a total primary settlement estimate at each section was determined.

Previous laboratory testing (Appendix A) indicates a correlation between natural water content & compression ratio and swell index & initial void ratio (Appendix B) for Stratum O Clay. Water contents reported in boring MR-505U before cap construction were used in the analyses.

#### Secondary Compression

Secondary compression was computed for a duration of 100 years after fill placement. Secondary compression was estimated in areas of compressible materials where the pre-load was not present.

#### Analysis 1: Wills Street Ramp

The area analyzed lies outside of the limits of the compressible strata and therefore settlement is expected to be less than  $\frac{1}{2}$  inch.

#### Analysis 2: Wills Street Turnaround

The area analyzed lies within the limits of compressible strata and outside the limits of pre-loading, therefore significant settlement will result from raising grades to accommodate the proposed turnaround. In this area, proposed fill height is about 3 feet and Stratum O is about 6 feet thick. The proposed fill height and stress history indicate that this area will be in virgin compression. It is estimated that total settlement,  $\delta_T$  will be on the order of 1.5 to 2.0 inches and is therefore considered acceptable.

#### Analysis 3: Wills Street Turnaround in Area of Pre-Load

The area analyzed lies within the limits of the Baltimore City Pier pre-load and proposed fill will be below the pre-load of Elev. +15, therefore settlement is expected to be less than  $\frac{1}{2}$  inch.

#### Additional Load on Drainage Net

#### Analysis 4: Load Impact on Drainage Net based on Foundation Type

The drainage net in Area 1 has a bearing capacity limit of 2,000 psf. An estimate of shallow foundations supporting the retaining structures was performed to determine how high the wall can be before the toe bearing stresses exceeded the 2,000 psf bearing pressure and what wall height deep foundations would then have to be used.

A cantilever retaining wall with 8 foot wide by 2 foot thick footing and wall with 1.25 foot thick base was analyzed using regular weight fill having a unit weight of 125 pounds per cubic foot. It was estimated that the maximum top of wall elevation is 11 feet above the drainage net elevation for toe bearing stresses to be below 2,000 psf.

#### **Recommendations**

Settlement estimates show that proposed fill will not result in settlement that is detrimental to the Geomembrane. To confirm this, two permanent settlement plates should be installed in the area of the turnaround (within the area of Analysis 2) as follows:

- 1. Centered on the turnaround; and
- 2. South end of the turnaround.

Estimated additional loads planned require retaining wall foundation types:

- 1. Retaining walls bearing on shallow foundations may be used for up to a top of wall 11 feet above the drainage net elevation;
- 2. Retaining walls bearing on deep foundations may be used for top of wall between 11 and 16 feet above the drainage net elevation; and
- 3. Concrete platform bearing on deep foundations must be used for top of wall greater than 16 feet above the drainage net elevation.

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nled by: Eugina Cherkasskaya nied an: Tuesday, Oct 20, 2015 – 03:08:07 PM it saved by: echerkasskaya an Tuesday, Oct 20, 2015 – 2:45:38 Duesd Fact Pacentors K. 44-- NOTES:

F.ST

- I. PROPOSED GRADES SHOWN ARE RASED ON GRADING PLAN BY MRA PROVIDED IN OCTOBER, 2015.
- 2. ELEVATIONS ARE BASED ON BALTIMORE CITY AND COUNTY METROPOLITAN DATUM (BEEMD).
- 3. SURCHAILGES SHOWN ARE BASED ON PHASE IT & IT CONSTRUCTION COMPLETION REPORT BY BLACK & VEATCH DATED FEBRUARY, 2000.

ANALYSES TO CHECK:

- 1. RAMP FILL OUTSIDE OF ORGANICS FALLS UNDER DRAINAGE NET LIMITATIONS, THEREFORE ASSESS RETAINING WALL PRESSURES
- 2. TURNAROUND AT FOOT OF RAMP IS INFLUENCED BY ORGANICS, THEREFORE ASSESS EXPECTED SETTLEMENT USING SECTION A:A

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|-------------------|---|
| BALTIMORE         | MARYLAND  |
| MUESER RUTLED     | GE CONSULTING ENGINEERS<br>WEST JATH STREET, NEW YORK, NY 10122 |
| WADE BY: E.C. CI  | TKD BY: G.S. DATE: MM-DD-YYYY                                   |
| THE NUMBER: 12582 | DRAWING NUMBER: SK-1  |



# ANALYSIS 1

## Settlement Estimate of Area 1

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SUBJECT SETTLEMENT CALCULATION (ANALYSIS AREA I) CALCULATION OF SETTLEMENT: ST = 81 + Sc + 85 Where: SI= DO Z HII ; "ELASTIC" COMPRESSION FOR GRANULAR, FREE DRAINING SC & SS NOT APPLICABLE SINCE THERE IS NO COMPRESSIBLE LAYER STRATUM M : ASSUMED TO BE HEAVILY CONSOLIDATED AND HENCE Pin >> Pico, Com KCCO, Com LLCSO STRATUM F. SZ: EI = 740 KSF ASSUMPTION BASED ON EPRI MANUAL ON ESTIMATING SOIL PROPERTIES FOR FOUNDATION DESIGN, TABLE 5-5 (AUGUST 1990) DEFINITIONS ST = TOTAL SETTLEMENT SI = IMMEDIATE ELASTIC SETTLEMENT 8c = CONSOLIDATION SETTLEMENT 85 = SELONDARY COMPRESSION SETTLEMENT Co = INITIAL VOID RATIO I = INFLUENCE FACTOR PC=MAXIMUM PAST VERTICAL STRESS HDE - LENGTH OF DRAINAGE PATH

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SUBJECT SETTLEMENT CALCULATION (ANALYSIS AREA I) CALCULATION OF IMMEDIATELSETTLEMENT, SI: SI= AJ-HF, SZ- I/E I= 1.0 FOR 10 LOADING HEN 25Ft :. SI = 1625 psf x 25 Ft × 1.0/740000 = 0.055 Ft = 0.66 in TOTAL SETTLEMENT, ST: 8T = 8I + 8c + 8s = 0.66 in + 0 + 0 = 0.66 in

# ANALYSIS 2

## Settlement Estimate of Area 2

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SUBJECT SETTLEMENT (ALCULATION (ANALYSIS AREA 2)

CALCULATION OF SETTLEMENT: ST = SI + SC + SS Where: SI = DO  $\sum \frac{HII}{EL}$ ; FLASTIC "COMPRESSION FOR GRANULAR, FREE DRAINING FOR J'4 C': RECOMPRESSION ONLY

 $\delta c = \underline{Hi} \left[ C_{si} \cdot \log_{10} \left[ \underbrace{Gvf}_{Vo} \right] \right];$ 

FOR JULT P'C : RECOMPRESSION & VIRGINCOMPRESSION

 $\delta c = \frac{Hi}{1+c_0} \left[ G_{si} - \log_{10} \left[ \frac{\sigma v_f}{\sigma v_0} \right] + C_{ci} - \log_{10} \left[ \frac{\sigma v_f}{\sigma v_0} \right] \right],$ 

Ss = Hi Calog. [At]; SECONDARY COMPRESSION, NEGLIGIBLE FOR RECOMPRESSION

SETTLEMENT COMPUTED AFTER :

"AN ENGINEERING MANUAL FOR SETTLEMENT STUDIES" BY J.M. DUNCAN AND ALL BU (HIGNANI (1981)

\* ASSUME & NORMALLY CONSOLIDATED, I.E OVO~ PC

COMPRESSIBILITY PARAMETERS:

STRATUM 0: Cc 2 eo are posed on correlations (see APPENDIX A)

Cc = 0.014 Wn Co = 0.0289 Wn

Wn = 44% (BASED ON BORING MR-5054)

 $Ce_i = 0.0114(44) = 0.502$   $e_i = 0.0289(44) = 1.272$ 

STRATUM M: ASSUMED TO BE HEAVILY CONSOLIDATED AND HENCE Dim >> Pico, Con << Cou, Con << Coo STRATUM F, S1: EL = 740 KSF

DEFINITIONS

ST=TOTAL SETTLEMENT CV = COEFFICIENT OF CONSOLIDATION HOR- LENGTH OF DRAINAGE PATH SI = IMMEDIATE FLASTIC SETTLEMENT TV = TIME FACTOR Sc = CONSOLIDATION SETTLEMENT U = DEGREE OF CONSCLIDATION SS = SECONDARY SETTLEMENT tD=TIME FOR PRIMARY C. = VIRGIN COMPRESSION INDEX CONSOLIDATION TO OCCUR I = INFLUENCE FACTOR t = TIME AFTER PRIMARY WN = NATURAL WATER CONTENT CONSOLIDATION CE = SWPLL INDEX · CO = INITIAL VUID RATIO PC = MAXIMUM PAST VERTICAL STRESS GX = SECONDARY COMPRESSION INDEX ED = VOID RATIO AT END OF PRIMARY CONSOLIDATION

SHEET 2 OF 4

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|  | 01                  | 3                      | 23.5                            | 2015           | 2390                     | 44                | 0.502               | 1.272     | 0.59         |     |
|  | 02                  | 3                      | - 26.5                          | 2096           | 2471                     | 44                | 0.502               | 1.272     | 0.57         |     |
|  | EXAN                | UPE (                  | fles for l                      | AYER C         | 0.                       |                   |                     | Sc=       | 1-16         |     |
|  | Sci                 | = <u>3 f</u><br>1      | t · 12 19/14<br>+ 1.272         | 0.50           | 2 log10                  | 2 <u>30</u><br>20 |                     | 0.59      | in           |     |
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|  | H.== 2.8 -          | ft                     |                                 |                |                          |                   |                     |           |              |     |
| e  | - SI =              | 375 P                  | sf>28ft×                        | 1/740          | - 000                    | 0.0               | 14ft =              | 0.17      | าท.          |     |
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SUBJECT SETTLEMENT CALCULATION (ANALYSIS AREA 2) TO TAL SETTLEMENT, Sr:  $S_T = S_T + S_C + S_S = 0.17 + 1.16 + 0.14 = .1.47$  in . TOTAL ESTIMATED SETTLEMENT AT CENTER OF TURNAROUND IS ABOUT, ST = 1.5 to 2.0 in

# ANALYSIS 3

## Settlement Estimate of Area 3

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|  |   |
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| "AN ENG NEERING MANUAL FOR SE  | TTLEMENT STUDIES"   |
| BY J.M. DUNCAN AND A.L. BUCHIG   | NANI (1981)   |
| SINCE OUF < P'C, SOIL IS UNDERE  | OING RECOMPRESSION  |
| COMPRESSIBILITY PARAMETERS   |   |
| STRATUM 0: Cs index is based on t<br>of all the consolidate<br>O stratum (see APPE<br>eo is based on cor | the average t one stand devotion<br>on tests available for the<br>NDIXA)<br>relations (see APPENDIXA) |
| Cs=0.13 Co=0.0289Wn= 0.02896   | 44) = 1.272   |
| (Based on Bonny MR-SUSU  |   |
| STRATUM M : ASSUMED TO BE HEAVILY<br>PCM >> PCO, COM LLCCO,  | CONSOLIDATED AND HENCE<br>CSM ZCCSO   |
| PROPERTIES FOR FOUNDA  | RI MANUAL ON ESTIMATING SUIL  |
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| ST = IMMEDIATE SETTIEMENT  | TU = TIME PACTOR  |
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| ST : TOTAL SETTLEMENT  | CONSULIDATION TO OCCUR  |
| I = INFLUENCE FACTOR   | E= TIME AFTER PRIMARY   |
| WN : NATURAL WATER CONTENT   | CONSOLIDATION   |
| CS = SWELL INDEX   | eo = INITIAL VOID RATIO   |
| PC = MAXIMUM PAST VERTICAL STRESS  | CEENIRGIN COMPRESSION   |
| GA = SECONDATEN COMPRESSION INDEX  | INDEX   |
| EP = VOID RATIO AT END OF PRIMARY<br>CONSOLIDATION   |   |
| CY = COEFEICLENT OF CONSULIDATION  |   |
| HOR = LENGTH OF DRAINAGE PATH  |   |
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| 01         | 3              | -23.5  | 2015           | 2890     | 44         | 0-13  | 1.272  | 0.32    |        |     |
| 02         | 3              | -26.5  | 2096           | 2971     | 44         | 0.13  | 1.272  | 0-31    |        |     |
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|            |                |  |                |          |            |       |        |         |        |     |
|            |                |  |                |          |            |       |        |         |        |     |

# ANALYSIS 4

Stress on Drainage Net

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MADE BY APS DATE 10/27/15

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| MUESER RUTLEDGE CONSULTING ENGINEERS                                  | Sh<br>Made By: <u>APS</u>   | eet No. <u>1</u> o <u>f 2</u><br>File: <u>12582</u><br>Date: 10/28/2015 |
|---|---|---|
| FOR: WILLS STREET WHARF   | Checked By:   | Date:   |
| SUBJECT: RETAINING WALL STABILITY                                     |   |   |
| <u> Wall Design - Willis St. Wharf</u>                                |   |   |
| Check Stability of Wall yc := 150pcf                                  |   |   |
|   |   |   |
| Top of Wall EL <sub>t</sub> := 24ft Bottom of Wall EL <sub>t</sub>    | <sub>b</sub> := 15ft  |   |
| <u>Self Weight of Cap</u> Width of Cap b <sub>cap</sub> := 8ft        | Height of Cap d <sub>cap</sub> := 1.5ft                                     |   |
| Weight of Cap $W_{cap} := b_{cap} \cdot d_{cap} \cdot \gamma_c$       | $W_{cap} = 1.80 \frac{kip}{ft}$   |   |
| <u>Self Weight of Wall</u> Ave. Width b <sub>w</sub> = 1.25ft         | $\begin{array}{llllllllllllllllllllllllllllllllllll$                        | h <sub>w</sub> = 7.5 ft   |
| Self Weight of Retaining Wall $W_{wall} := b_w h_w$                   | $\gamma_{c}$ $W_{wall} = 1.41 \frac{kip}{ft}$                               |   |
| <u>Self Weight of Soil</u> $\gamma_s := 125 pcf$                      | Soil Width $b_s := b_{cap} - b_w$   | b <sub>s</sub> = 6.75 ft  |
| Height of soil $h_s := h_w$ $h_s = 7.5  ft$                           | $\label{eq:self_weight} \begin{array}{llllllllllllllllllllllllllllllllllll$ | $W_s = 6.33 \frac{kip}{ft}$   |
| Check Overturning   |   |   |
| Overturning Moment from Soil Pressure Materia                         | $5.06 \frac{\text{kip} \cdot \text{ft}}{9}$                                 |   |
| Resisting Moments:  | п   |   |
| Wt of wall: Eccen. $e_w := \frac{b_w}{2}$ $e_w = 0.6 \text{ f}$       | Moment $M_{w} := e_{w} \cdot W_{wall}$                                      | $M_w = 0.9 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$                |
| Wt of cap: Eccen. $e_c := \frac{b_{cap}}{2}$ $e_c = 4.0  \text{ft}$   | Moment $M_c := e_c \cdot W_{cap}$   | $M_{c} = 7.2 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$              |
| Wt of soil: Eccen. $e_s := b_{cap} - \frac{b_s}{2}$ $e_s = 4$         | 4.6 ft <b>Moment</b> $M_s := e_s \cdot W_s$                                 | $M_s = 29.3  \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$              |
| Factor of Safety FS := $\frac{M_w + M_c + M_s}{M_a}$ FS               | S = 7.38 > 2.0 <u>OK</u>  |   |
| <u>Check Sliding</u> Friction Coeff: $\mu_f := 0.4$ (for c            | oncrete on fine sand)   |   |
| Sliding Force P <sub>s1</sub> := 1.69klf                              |   |   |
| Resisting Force w/ Passive $F_{fr} := \mu_{f'} (W_{wall} + V_{wall})$ | $W_{cap} + W_s$ ) $F_{fr} = 3.81 \text{ klf}$                               |   |
| Factor of Safety $FS := \frac{F_{fr}}{P_{sl}}$ $FS = 2.2$             | 6 > 1.5 <u>OK</u>   |   |

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| MUESER RUTLEDGE CO        | NSULTING ENGINI   | EERS  | lada Rvi                 | S  | heet No. <u>2</u> of <u>2</u><br>File: <u>12582</u><br>Date: 10/28/2015 |
|---------------------------|---|---|--------------------------|--|---|
| FOR: WILLS S              | TREET WHARF   | Che   | cked By:                 | Ars  | Date:   |
| SUBJECT: RETAINING WA     | LL STABILITY  |   | ,                        |  |   |
| Check Bearing Pressure of | n Soil Allowable  | Bearing pressure:                                       | p <sub>a</sub> := 0.8    | 75tsf  |   |
| Moments about Center o    | f Cap   |   |                          |  |   |
| Overturning Moment fi     | rom Soil Pressure   | $M_a = 5.06 \frac{\text{kip} \cdot \text{fi}}{1000}$    | -                        |  |   |
| Resisting Moments:        |   | - ft  |                          |  |   |
| Wt of wall: Eccen.        | $e_{w} := \frac{b_{cap} - b_{w}}{2}$                            | $e_{\rm W} = 3.4$ ft                                    | Moment                   | $M_{W} := e_{W} W_{WB}$  | $M_{\rm W} = 4.7 \frac{\rm kip \cdot ft}{\rm ft}$                       |
| Wt of cap: Eccen.         | $e_c := 0$ ft   | $e_c = 0.0  \mathrm{ft}$                                | Moment                   | $M_c := e_c \cdot W_{cap}$                                     | $M_c = 0  \frac{kip \cdot ft}{ft}$                                      |
| Wt of soil: Eccen.        | $e_{s} := \frac{b_{cap} - b_{s}}{2}$                            | $e_s = 0.6  \mathrm{ft}$                                | Moment                   | $M_{\mathbf{S}} \coloneqq e_{\mathbf{S}} \cdot W_{\mathbf{S}}$ | $M_s = 4 \frac{kip \cdot ft}{ft}$                                       |
| Total Moment: M           | $:= M_a + M_w - M_c - M_c$                                      | 4 <sub>s</sub> M = 5                                    | 5.85 <u>kip·ft</u><br>ft |  |   |
| Total Force on Cap        | $P := W_{wall} + W_{cap} + V$                                   | Ws  | P = 9.53 kl              | f  |   |
| Effective Eccentricity of | Load $e_{eff} := \frac{M}{P}$                                   | e <sub>eff</sub> =                                      | 0.61 ft                  | $< \frac{b_{cap}}{6}$  | = 1.33 ft   |
|                           |   | So the mome   | ent results i            | n no u <mark>plift on</mark> d                                 | one end of the footing  |
| Effective Bearing Width   | $b_{eff} := if \left[ e_{eff} > \frac{b_{cap}}{6} \right]$      | $\frac{b_{cap}}{2} - e_{eff}$                           | b <sub>cap</sub> ]       | $b_{eff} = 8.0$  | 00 ft   |
| Effective Moment          | $M_{eff} := if \left[ e_{eff} > \frac{b_{cay}}{6} \right]$      | $\frac{p}{6}$ , P· $\left(\frac{b_{eff}}{6}\right)$ , M |                          | $M_{eff} = 5.$   | 85 <del>kip∙ft</del>  |
| Bearing Pressure on Fill  | n := 1 ft (per ft wid   | dth) Cap Se   | ction Modu               | $Ius  S := \frac{1}{6} \cdot n \cdot$                          | $b_{eff}^2$ S = 10.7 ft <sup>3</sup>                                    |
| Bearing Pressures         | $p_{\max} := \frac{P \cdot n}{b_{eff} \cdot n} + \frac{M_e}{m}$ | S p <sub>max</sub>                                      | = 0.87 tsf               | ~ p <sub>a</sub> = 0.  | .88 tsf <u>OK</u>   |
|                           | $p_{\min} := \frac{P \cdot n}{b_{eff} \cdot n} - \frac{M_e}{S}$ | ff <sup>•n</sup><br>S Pmin <sup>=</sup>                 | = 0.32 tsf               |  |   |

# **APPENDIX A**

## Assessment of Compressibility Characteristics





VOID RATIO VS. NATURAL WATER CONTENT



ATTACHMENT VOID RATIO-TIME (URVE FOR MR-80]



# APPENDIX B

Boring Logs

MR-505U

BORING NO.

-

| PRCECT:         ALLED BALTIMORE WORKS         SUPACE LEV.         5.83           LOCATION:         BALTIMORE, MARYLAND         SUPACE ELV.         5.83           DAX         SAMPLE         M KOUS         M KOUS           DAX         SAMPLE         M KOUS         M KOUS           DAX         SAMPLE         SAMPLE DESCRIPTION         Start Book         M KOUS           Personal         Demit BLOWSE         SAMPLE DESCRIPTION         Start Book         M KOUS           Personal         Demit BLOWSE         SAMPLE DESCRIPTION         Start Book         DEMIX Book         M KOUS           Personal         Demit BLOWSE         SAMPLE DESCRIPTION         Start Book         DEMIX Boo  |     |                     |          |        |          |   |        | SHEET | 1 OF     | 3                    |
|---|-----|---------------------|----------|--------|----------|---|--------|-------|----------|----------------------|
| DAX         SAMPLE         SLITIMORE, MARYLAND         SUPFACE ELLY,<br>RECENT         5.89           DAX         SAMPLE         SAMPLE         SAMPLE         5.89           PCORES         No Derrin<br>15:30         No Derrin<br>15:30         SAMPLE         SAMPLE DESCRIPTION         STRATA  |     | PROJECT             | Γ:       |        | AL       | LIED BALTIMORE WORKS                            |        | F     | ILE NO   | . 6909               |
| DAX         SAMPLE         PRES. MOR         M. KOLB           PROPERS         No. BETH         BLOWSY         SAMPLE DESCRIPTION         STRATA         DEFN         RES.MAPKS           14.3         Image: Sample Strate         SAMPLE DESCRIPTION         STRATA         DEFN         RES.MAPKS           Model         Image: Sample Strate         Sample Strate         Sample Strate         Sample Strate         Sample Strate           Peaky         Image: Sample Strate         Sample Strate         Sample Strate         Sample Strate           2D         5.0         4.4         Brown sity fine to medium sand, trace         Sample Strate           2D         5.0         5.13         Gray carse to fine sand, some shells, sit, frace brick, gravel (Fill) (SM)         F         15         Model dost down hole.           07.00         3D         1.1         Gray coarse to fine sand, some shells, sit, frace brick (Fill) (SM)         Sati dark gray organic clayey sit, trace fine         Sati dark gray organic clayey sit, trace fine         Sati dark gray organic clayey sit, trace fine           5D         30.0         1.WH         Sati dark gray organic clayey sit, trace fine           6D         30.0 <td></td> <td>LOCATIC</td> <td>DN:</td> <td></td> <td>8</td> <td>BALTIMORE, MARYLAND</td> <td>୍ଞା</td> <td>URFAC</td> <td>E ELEV</td> <td></td>   |     | LOCATIC             | DN:      |        | 8        | BALTIMORE, MARYLAND                             | ୍ଞା    | URFAC | E ELEV   |                      |
| DAX         SAMPLE         SAMPLE DESCRIPTION         STATA         DEPCRES         CASES         REMARKS           15:30         0         BTM         BLOWS/F         SAMPLE DESCRIPTION         STATA         DEPCRES         DECRES         DEPCRES         DEPCRE  |     |                     |          |        |          |   |        | RES   | . ENGR   | M. KOLB              |
| PROPERS         No.         REMARK S           15.30  |     | DAILY               |          | SAMPLI | E        |   |        |       | CASING   |                      |
| 63.00       64.19.30         04.19.30       0         Perty       0         70°F       10       5.0         20       5.0         20       5.0         20       5.0         11.0       6.4         0.7.0       2.10         0.7.0       2.10         0.7.0       5.13         0.7.0       3.0         0.7.0       3.0         0.7.0       3.0         0.7.0       3.0         1.1.0       6.4         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         Trace brick, gravel (Fill) (SM)         0.4.2.3.3       17.0         1.1.0       1.1.6         Gray coarse to fine sand, some shells, sill, trace fine sand, some shells, sill, trace gravel, brick (Fill) (SM)         0.4.2.3.3       1.3.WH         0.4.2.4.3       1.3.WH         2.5.0       1.4.WH         6.1       1.4.WH         0.2.0       1.4.WH         0.3.0       1.4.WH         0.3.0       1.4.WH         0.3.0       1.4.WH         0.3.0       1.4.WH         0.3.0       1.4.WH   |     | PROGREES            | NO.      | DEPTH  | BLOWS/6" | SAMPLE DESCRIPTION                              | STRATA | DEPTH | BLOWS    | REMARKS              |
| Weiden         Brown silty fine to medium sand, trace           Party         Court         Gray salty coarse to fine sand, trace gravel,         S         DPC (-)           20         9.0         5.13         Gray silty coarse to fine sand, trace gravel,         S         DPC (-)           11.0         6.4         bricks, gravel (shells, coarse sand (Fill) (SM)         B'Over Salty coarse to fine sand, some shells, silt,         F         10         DPC (-)           17.00         11.1         Gray coarse to fine sand, some shells, silt,         F         15         Hold Sol down           0*30         3D         15.0         11.4         Gray coarse to fine sand, some shells, silt,         F         15         Hold Sol down           10         0.90         1.5.16         Gray coarse to fine sand, some shells, silt,         F         15         Hold Sol down           10         1.0         1.4         No recovery         20         casing, locaing mud           10         1.4         No recovery         No recovery         25         made to recover           10         2.0         1.4         No recovery         30         10         10           10         1.4         1.4         Solf dark gray organic fine sandy silt, trace fine sand, sine sample.   |     | 15:30               |          |        |          |   |        |       | CASING   | 12" of 1/2" gravel.  |
| Modary<br>Perty         Modary<br>Declary         Modary<br>Declary         Modary           70°F         10         5.0         4.4           70°F         10         5.0         4.4           20         9.0         5-13         Gray silly coarse to fine sand, trace gravel,<br>brick shells (Fill) (SM)         Wood obstruction<br>8°-9°.           17.00         30         15.0         11.6         Gray coarse to fine sand, some shells, sill,<br>trace brick, gravel (Fill) (SM)         S0: Wash sample.           07.00         30         15.0         11.6         Gray coarse to fine sand, some shells, sill,<br>trace brick, gravel (Fill) (SM)         S0: Wash sample.           04.00.30         15.0         15.16         Gray coarse to fine sand, some shells, sill,<br>trace gravel, brick (Fill) (SM)         S0: Wash sample.           8         20         Casing, locsing mud<br>down hole.         DPC (1)           11         Unscreassful         Trace brick, gravel (Fill) (SM)           30         15.0         15.16         Gray coarse to fine sand, some shells, sill,<br>trace brick, gravel (Fill) (SM)           30         15.0         15.16         Gray coarse sand, some shells, sill,<br>trace gravel, brick (Fill) (SM)           30         BCR.0         REC24*         Cosing sand, trace brick, gravel (Fill) (SM)           30         BCRC4*  |     | 04-19-93            |          |        |          |   |        |       |          | -                    |
| Party         D         Solution         Brown silty line to medium sand, trace bicks, gravel, shells, coarse sand (Fill) (SM)         Model obstruction           20         9.0         5-13         Gray silty coarse to fine sand, trace gravel, brick shells (Fill) (SM)         Wood obstruction           110         6-4         Brown silty line to medium sand, trace gravel, brick shells (Fill) (SM)         Borna silty line to medium sand, trace gravel, brick shells (Fill) (SM)         Borna silty line to medium sand, trace gravel, brick shells (Fill) (SM)           100         07:00         30         15.0         11-8         Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)         BD: Wash sample.           100         07:00         30         15.0         11-8         Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)         BD: Wash sample.           100         02:0         1WH         Gray coarse to fine sand, some shells, silt, trace gray organic claysy silt, trace fine fill running up casing, lossing mud down hole.         DPC (-), DPC (-)   |     | Monday              |          |        |          |   |        |       |          | -                    |
| Cloudy         TO         5.0         DPC (-)           77*         D         5.0         DPC (-)           20         9.0         5-13         Gray silly coarse to fine sand, trace gravel, brick stalls (Fill) (SM)           17.00         11.0         6-4         brick stalls (Fill) (SM)           07.00         30         15.0         11.8           07.00         30         15.0         11.8           07.00         30         15.0         11.8           07.00         30         15.0         15.1           Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)         30/Wash sample.           97.00         23.14         Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)           85*         21.0         23.14         View of trace brick, gravel (Fill) (SM)           10         DPC (-)         DPC (-)         DPC (-)           11         Coarse sand, mice, vegratic clayey silt, trace fine         DPC (-)           18         28.0         WH+1         to coarse sand, mice, vegratic fine sandy silt, trace fine           10         30.0         16-11         Brown yellow gravel and coarse to fine           30         43.0         7-10         Brecc242*         Medi  |     | Partly              |          |        |          |   |        |       |          | - 1                  |
| 70*         10         5.0         4.4         Brown silly line to medium sand, trace gravel, bricks, gravel, shells, coarse s and (Fill) (SM)           20         9.0         5.13         Gray silly coarse to fine sand, trace gravel, brick shells (Fill) (SM)         Wood obstruction           11.0         6.4         bricks, gravel (Fill) (SM)         SD: Wash sample.         10         DPC (+)           11.0         6.4         bricks, gravel (Fill) (SM)         SD: Wash sample.         11         DPC (-)           0.4.20.33         11.0         1.1         Gray coarse to fine sand, some shells, sill, trace fill         Trace brick, gravel (Fill) (SM)         SD: Wash sample.           12.0         23.14         frace gravel, brick (Fill) (SM)         DPC (-)         Trace sing, footogramud down hole.           0.4.20.3         11.0         15-16         Gray coarse to fine sand, some shells, sill, trace fill         DPC (-)           0.4.20.0         1.WH         No recovery         SD: Wash sample.         DPC (-)           24.0         1.WH         No recovery         SD: dark gray organic clayey silt, trace fine to coarse sand, trace dary gray organic fine sand, trace coarse sand, trace dary medium to fine sand, trace coarse sand, trace dary medium to fine sand, trace coarse sand, some shells, silt, gravel (SP-SM)         SD C (-)           7D         35.0         4.8         SD 45.   |     | Cloudy              |          |        |          |   |        | 5     |          |                      |
| 7.0         2-10         bricks, gravel, snells, coarse sand (Fill) (SM)           20         9.0         5-13         Gray silly coarse to fine sand, trace gravel, brick shells (Fill) (SM)           07.00         30         15.0         11-8         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         50: Wash sample.           07.00         30         15.0         11-8         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         50: Wash sample.           07.00         30         15.1         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         30:Wash sample.           07.00         23.1         15.1         Gray coarse to fine sand, some shells, sill, trace fill running up coarse gravel, brick (Fill) (SM)         30:Wash sample.           11.1         Trace gravel, brick (Fill) (SM)         40: Wesh sample.         20: Unsuccessful cash sample.           21.0         23.1         VMH-H         Vor ecovery         20: Unsuccessful cash, trace fine sample.           25.0         1WH         No recovery         Solf dark gray organic clayey sill, trace fine to carse sand, frace clay pocket (OL SP)           26.0         WH-H         to coarse sand, trace coarse scall grave fill cash, trace fill cash grave fill cash grave fill cash grave fill fill (SP)           70         35.0         REC_24*  |     | 70°F                | טו       | 5.0    | 4-4      | Brown silly fine to medium sand, trace          |        |       | └──┟─    |                      |
| 20         5.13         Gray silly coarse to fine sand, trace gravel, brick shells (Fill) (SM)         Wood obstruction           11.0         6.4         brick shells (Fill) (SM)         30: Wash sample.           07.00         30         15.0         11.8         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)           04.20.32         17.0         1.1         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         DPC (-)           10         19.0         15-18         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         DPC (-)           20.0         23.14         frace gravel, brick (Fill) (SM)         DPC (-)         30:Wash sample.           21.0         1WH         Krecovery         Soft dark gray organic clayey sill, trace fine to coarse sand, mice, vegetation (OH)         DPC (-), DH-6.37           10         30.0         WH-11         Krecovery         Soft dark gray organic clayey sill, trace fine to coarse sand, mice, vegetation (OH)         Brown reading in tst.           10         30.0         NH-10         Soft dark gray organic clayey sill, trace fine sand, some shells, sill, gray organic silly coarse sand, mice, vegetation (OH)         Brown wellow gray organic silly coarse sand, mice, some shells, sill, gray organic silly coarse sand, mice, vegetation (OH)         Brown sellow gray organic silly coarse sand, mice, some shells, sill, gray organic silly coar   |     |                     |          | 7.0    | 2-10     | bricks, gravel, snells, coarse sand (Fill) (SM) |        |       |          |                      |
| 20         9.0         5-13         Gray silly coarse to fine sand, trace gravel, brick shells (Fill) (SM)         10         DPC (+)           17:00         07:0         30         15:0         11:6         Gray coarse to fine sand, some shells, sill, trace brick, gravel (Fill) (SM)         F         15         mud lost down hole.           07:00         30         15:0         1:1-6         Gray coarse to fine sand, some shells, sill, trace gravel, brick (Fill) (SM)         F         15         mud lost down hole.           04:0:03         19:0         15:16         Gray coarse to fine sand, some shells, sill, trace gravel, brick (Fill) (SM)         30!Wash sample.         F         15           0         19:0         15:16         Gray coarse to fine sand, some shells, sill, trace fine gray coarse to fine sand, some shells, sill, trace fine gray organic clayey sill, trace fine gray organic sill, brace gray organic sill, down hole.         0         0         20         casing. 90 go do down hole.           10         30:0         1WH         No recovery         Soft dark gray organic files andy sill, trace fine gray organic sill, dark gray organic files andy sill, trace fine darger organic sill, dark gray organic files andy sill, trace fine darger organic sill, dark gray organic files and, sill gray organic sill, grayel (SP-SM)         Soft dark gray organic sill, grayel (SP-SM)           10         30:0         1:0         1         1:0         1:0 </td <td></td> <td></td> <td>4.<br/></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Wood obstruction</td>  |     |                     | 4.<br>   |        |          |   |        |       |          | Wood obstruction     |
| Image: Product of the stand, trace gravel, including the stand, trace stand, tra |     |                     |          |        | 5 4 6    |   |        |       |          | 89.                  |
| 11.0       0-4       Drick snews (Fill) (SM)         17.00       07.00       3D       15.0         07.00       3D       11.6       Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)         07.00       3D       15.0       11.1         17.00       1.1       trace brick, gravel (Fill) (SM)         07.00       3D       15.16         07.00       3D       15.16         07.00       23.14       frace brick, gravel (Fill) (SM)         Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)       3D:Wash sample, Dark gray coganic gray coarse, to fine sand, some shells, silt, trace silt, trace silt, some sand, some shells, silt, trace fine sand, some shells, silt, trace silt, some sand, some shells, silt, trace silt, trace silt, some sand, some shells, silt, trace fine sand, some shells, silt, trace silt, some sand, some shells, silt, trace silt, soperocket (CLSP)   |     | .                   | 20       | 9.0    | 5-13     | Gray silly coarse to tine sand, trace gravel,   |        | 10    |          |                      |
| 17:00         11:0         Gray coarse to fine sand, some shells, silt, race fine sand, some shells, silt, race silt, race sine sand, some shells, silt, race sine, some shells, silt, race sine, some shells, silt, race sine, race stand, race silt, race silt, race sine, some shells, silt, race fine sand, some shells, silt, race fine sand, race sine, race stand, race silt, race sine, race sine, race sine, sangle.         90 At 50 Bt Silt dark gray organic clayey silt, trace fine sand, silt, race fine sand, silt, race sine, sangle. Dark sample.         90 At 50 Bt Silt dark gray organic clayey silt, trace fine sand, silt, race fine sand, silt, race same same, race sand, race clay pockets (OL8SP)         90 At 50 Bt Silt dark gray organic clayey silt, trace fine sand, silt, gravel (SP-SM)           8D 40.0         16-11         Brown yellow gravel and coarse to fine sand, trace silt, coarse sand (SP-SM)         Solt Silt Silt Silt Silt Silt Silt Silt Si   |     |                     |          | 11.0   | 6-4      | orick shells (Pill) (SM)                        |        |       |          | OD: West servels     |
| 17.00       11.8         07.00       3D       15.0         04.20.93       17.0         17.00       11.8         17.00       17.0         04.20.93       17.0         17.01       15.16         Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)       DPC (-)         97.00       20.10         19.01       15.16         Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       DPC (-)         19.01       15.16         Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       DPC (-), pH-6.37         10.01       1.WH         28.0       WH-1         29.0       20         11.WH       No recovery         20.1       1.WH         21.0       1.WH         22.0       WH-1         23.0       1.WH         6U 33.0       PUSH=24*         Medium gray organic file sandy silt, trace file       0         29.0       Gray medium to fine sand, trace clay cockets (OL&SP)         7D       35.0       4.8         30.7       7.10       Gray medium to fine sand, trace clay         80       40.0   |     |                     |          |        |          |   |        |       |          | 3D: wash sample.     |
| 17:00       Casing. 30 yal. 01         07:00       30         07:00       30         17:00       11.8         Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)       hole.         Party       4D         Party       23.14         Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       30:Wash sample.         Party       23.14         Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       4D:Wash sample.         28.0       WH-1         28.0       WH-1         28.0       WH-1         28.0       WH-1         60:22.0       withWH         60       30.0         WH-WH       Soft dark gray organic fine sandy silt, trace fine to coarse sand, mica, vegetation (OH)         60       32.0         WH-WH       Medium gray organic fine sandy silt, trace fine to coarse sand, mica, vegetation (OH)         60       35.0         7D       35.0         7D       35.0         7D       4.8         7D       30.16         8D       40.0         16-11       For not fine sand, trace sit, frace coarse sand, sint, gravel (SP-SM)         9D<   |     |                     |          |        |          |   |        |       |          | Fill running up      |
| 17:00       3D       15.0       11.8       Gray coarse to fine sand, some shells, silt, trace brick, gravel (Fill) (SM)         04:20:03       17.0       1.1       Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       3D:Wash sample.         Parity       Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)       20       Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)         NR       24.0       1WH       No recovery       Coorden to be.       4D: Wash sample.         SD       30.0       1WH       Soft dark gray organic clayey silt, trace fine sandy silt, trace fine sandy silt, trace fine sandy silt, trace fine coarse sand, mica, vegetation (OH)       DPC (-), pH-6.37         Gray medium to fine sand, trace clay pockets (OL&SP)       35       DPC (-), H-6.94         35.0       REC=24*       Medium gray organic time sand, trace coarse sand, mica, vegetation (OH)         Gray medium to fine sand, trace coarse sand, trace silt, gravel (SP-SM)       S-1       DPC (-), DPC (-), DPC (-)         30       16-11       Brown yellow gravel and coarse to fine sand, trace silt, gravel (SP-SM)       S-1       DPC (+)         9D       45.0       30-16       DPC (-)       S-2       44.3*.         9D       45.0       S0-10       DPC  |     |                     |          |        |          |   |        | 1.5   |          | casing. 90 gai. of   |
| 07.00         12.0         11-8         Gray Coalse to fine said, some shells, sit, trace brick, gravel (Fill) (SM)         DPC (-)           04.20-03         1         1         1         1         1         1           1         1         1         1         1         1         1         1           1  |     | 17:00               | 20       | 15.0   | 11.0     | Grou coorse to fine shad, some shalls, silt     |        | 15    |          | mud lost down        |
| 0-20-30       17/0       1-1       If all a block, glaver (Fill) (SM)         Tuesday       1       1       If all a block, glaver (Fill) (SM)         Panty       21.0       23.14       If all a block, glaver (Fill) (SM)         Soft       21.0       23.14       If all a block, glaver (Fill) (SM)         NR       24.0       1WH       No recovery         Soft dark gray organic clayey sill, trace fine       0       DPC (-), PH-6.37         Unsuccessful       25       attempt, 24'-26'         Soft dark gray organic clayey sill, trace fine       30       addum gray organic fine sandy sill, trace         Soft dark gray organic fine sand, soft, glaver (Lay, mica interlayered with gray fine to coarse sand, mica, vegetation (OH)       0         80       35.0       4.8       Gray medium to fine sand, trace coarse sand, mica, vegetation (OH)         90       45.0       30.16       Gray medium to fine sand, trace coarse sand, mica, vegetation (OH)         90       45.0       30.16       Top: Do 8D (SP)         90       45.0       30.16       Top: Do 8D (SP)         90       45.0       30.16       Top: Do 8D (SP)         90       45.0       Top: Do 8D (SP)       Soft Y         90       40.0       DPC (-)       Soft Y </td <td></td> <td>07 00</td> <td>30</td> <td>17.0</td> <td>11-8</td> <td>Gray coarse to the sand, some shells, sitt,</td> <td></td> <td></td> <td></td> <td></td>   |     | 07 00               | 30       | 17.0   | 11-8     | Gray coarse to the sand, some shells, sitt,     |        |       |          |                      |
| Particle       40       19.0       15-16       Gray coarse to fine sand, some shells, silt, trace gravel, brick (Fill) (SM)         SSP       21.0       23-14       trace gravel, brick (Fill) (SM)       20       casing, loosing mud down hole.         NR       24.0       1.WH       No recovery       25       attempt, 24'-26'         NR       24.0       1.WH       No recovery       25       attempt, 24'-26'         SD       30.0       1.WH       Soft dark gray organic clayey silt, trace fine       0       Revert pp=0.6         SD       30.0       1.WH       Soft dark gray organic clayey silt, trace fine       0       Revert pp=0.6         SD       30.0       1.WH       Soft dark gray organic clayey silt, trace fine       0       Revert pp=0.6         SD       30.0       1.WH       Modum gray organic fine sandy silt, trace fine       0       Revert pp=0.6         SD       30.0       1.WH       Modum gray organic fine sandy silt, trace fine       0       Revert pp=0.6         SD       30.0       1.WH       Soft dark gray organic clay pockets (OL&SP)       0       0         Gray medium to fine sand, trace coarse sand, sand, silt, gravel (SP-SM)       S-1       0       0         BD       40.0       0       0PC (+)   |     | 04-20-93<br>Tuesday |          | 17.0   | 1-1      | Hace brick, glaver (Fill) (SWI)                 |        |       |          |                      |
| Centry<br>GSF         4D         19.0         15-16         Gray coarse to fine sand, some shells, silt,<br>trace gravel, brick (Fill) (SM)         20         Casing, toosing mud<br>down hole.           MR         24.0         1WH         No recovery         4D         4D. Wash sample.           MR         24.0         1WH         No recovery         4D         4D         Wash sample.           Soft dark gray organic clayey silt, trace fine<br>32.0         WH-H         Soft dark gray organic clayey silt, trace fine<br>32.0         MH-H         242.6         Soft dark gray organic clayey silt, trace fine<br>32.0         Soft dark gray organic clayey silt, trace fine<br>33.0         Soft dark gray organic clayey silt, trace fine<br>33.0         Soft dark gray organic gray fine to<br>coarse sand, trace clay pockets (OL&SP)<br>Gray medium to fine sand, trace coarse<br>sand, silt, gravel (SP-SM)         Soft dark gray organic file<br>33.0         Soft dark gray organic file<br>33.0         Soft dark gray organic file<br>33.0         Soft dark gray organic file<br>34.0         Soft dark gray organic file<br>34.0         DPC (-),<br>34.0           Modum gray organic gray organic file<br>33.0         The point of fine sand, trace coarse<br>34.0         Soft dark gray organic gray or   |     | Destlu              |          |        |          |   |        |       |          | SU.wash sample.      |
| cbdsy       1210       1313       trace gravel, brick (Fill) (SM)         csvF       20       cbsv, m. hole.         1       1-WH       trace gravel, brick (Fill) (SM)         NR       24.0       1-WH         26.0       WH-1         25.0       30.0         1-WH       Soft dark gray organic clayey silt, trace fine         32.0       WH-WH         6U 33.0       PUSH-24*         MR 24.0       NH         WH-WH       Soft dark gray organic clayey silt, trace fine         10       clay, mica interlayered with gray fine to         coarse sand, mica, vegetation (OH)       Medium gray organic tine sandy silt, trace         10       16-11         16       16-11         42.0       7-7         30-16       27-41         9D 45.0       30-16         147.0       27-41         9D 45.0       30-16         147.0       27-41         8D tWhite medium to fine sand, trace silt, coarse sand (SP-SM)         5D 9C (+)       9D-1 Jar.         5D 9C (+)       9D-1 Jar. <td></td> <td>Cloudy</td> <td></td> <td>19.0</td> <td>15-16</td> <td>Gray coarse to fine sand, some shells, silt</td> <td></td> <td>20</td> <td></td> <td>casing loosing mud</td>   |     | Cloudy              |          | 19.0   | 15-16    | Gray coarse to fine sand, some shells, silt     |        | 20    |          | casing loosing mud   |
| BF       2110       2011       Index graden, biole (in) (cm) (cm)         BF       40. With         R       24.0         WH-1       No recovery         Soft dark gray organic clayey silt, trace fine         5D       30.0         Soft dark gray organic clayey silt, trace fine         Soft dark gray organic clayey silt, trace fine         Soft dark gray organic fine sandy silt, trace         Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace coarse         Soft dark gray organic silt, gravel (SP-SM)         Soft dark gray organic silt, gravel (SP-SM)         Soft dark gravel and coarse to fine         Soft dark gravel and coarse to fine         Soft dark gravel and (SP-SM)         Soft dark gravel and (SP-SM)         Soft dark gravel and (SP-SM)         Soft dark gravel (SP-SM)   |     | CIOUDY              | 40       | 21.0   | 23-14    | trace gravel brick (Fill) (SM)                  |        | 20    | <b>]</b> | down bole            |
| NR     24.0     1-WH     No recovery     DPC (-), pH=6.37       Unsuccessful     attempt, 24'-26'       made to recover     sample. Dark       SD     30.0     1-WH       6U     33.0     PUSH=24'       Medium gray organic clayey silt, trace fine     clay in wash at 28'.       35.0     REC=24'     Medium gray organic fine sandy silt, trace for       7D     35.0     A-8       37.0     7-10       35.0     A-8       37.0     7-10       SD     4.8       Gray medium to fine sand, trace coarse sand, silt, gravel (SP-SM)       SD     40.0       DPC (+)       Penetrometer       39     reading in tst.       40     DPC (+)       24.3'.       40     DPC (+)       25.2     44.3'.       41     Top: Do 8D (SP)       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       50     Y       Sol 45.0     30-16       Top: Do 8D (SP-SM)       Sol 45.0       Sol 47.0       27.41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       50     Y       Sol 45.0       Sol 45.0       Sol 45.0       Sol 45.0 <td></td> <td>0.5 F</td> <td></td> <td>21.0</td> <td>20-14</td> <td></td> <td></td> <td></td> <td></td> <td>4D: Wash sample</td>  |     | 0.5 F               |          | 21.0   | 20-14    |   |        |       |          | 4D: Wash sample      |
| NR       24.0       1-WH       No recovery         26.0       WH-1       No recovery       Unsuccessful         26.0       WH-1       No recovery       Unsuccessful         26.0       WH-1       Soft dark gray organic clayey silt, trace fine       25       attempt, 24'-26'         30       1-WH       Soft dark gray organic clayey silt, trace fine       28       gray organic silty         30       30.0       1-WH       Soft dark gray organic tine sandy silt, trace fine       30         31.0       PUSH-24'       Relum gray organic tine sandy silt, trace fine       28       gray organic silty         31.0       PUSH-24'       Clay mica interlayered wilk gray fine to       coarse sand, trace clay pockets (OL&SP)       DPC (-),         32.0       4-8       Sray medium to fine sand, trace coarse       35       DPC (-)         33.0       16-11       Brown yellow gravel and coarse to fine       39       reading in tsl.         40       DPC (+)       20-16       S-2       44.3'.       40       DPC (+)         9D       45.0       30-16       Top: Do 8D (SP)       Sol 4.35'       -       44.3'.       -         9D       45.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM) <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>DPC (.) pH_6 37</td></t<>   |     |                     |          |        |          |   |        |       |          | DPC (.) pH_6 37      |
| Image: Second strip       Image: Second strip         Image: Second strip       Image: Second strip <td>6</td> <td></td> <td>NR</td> <td>24.0</td> <td>1.WH</td> <td>No recovery</td> <td></td> <td></td> <td></td> <td>Unsuccessful</td>   | 6   |                     | NR       | 24.0   | 1.WH     | No recovery                                     |        |       |          | Unsuccessful         |
| Image is recover   | -   | a - A               |          | 26.0   | WH.1     |   |        | 25    |          | attempt 24'-26'      |
| Soft dark gray organic clayey silt, trace fine       sample. Dark         Soft dark gray organic clayey silt, trace fine       clay in wash at 28'.         Soft dark gray organic fine sandy silt, trace       a         Soft dark gray organic fine sandy silt, trace       a         Soft dark gray organic fine sandy silt, trace       b         BU 40.0       4-8         Soft dark gray organic fine sand, trace clay pockets (OL8SP)       Coarse sand, trace clay pockets (OL8SP)         Gray medium to fine sand, trace coarse       Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace coarse       Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace coarse       Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace coarse       Soft dark gray organic fine sand, trace coarse         Soft dark gray organic fine sand, trace silt (SP)       Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)         Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)       Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)         Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)       Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)         Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)       Soft dark gray organic fine sand, trace silt, toarse sand (SP-SM)         Soft dark gray   |     |                     |          | 20.0   | •••••    |   |        |       |          | made to recover      |
| 28       gray organic silty         5D       30.0       1-WH         5D       30.0       1-WH         6U       33.0       PUSH=24*         Medium gray organic fine sandy silt, trace fine       addition (OH)         6U       33.0       PUSH=24*         Medium gray organic fine sandy silt, trace       clay, mica interlayered with gray fine to         carse sand, trace clay pockets (OLSSP)       DPC (-),         7D       35.0       4-8         Gray medium to fine sand, trace coarse       Soft dark gravel (SP-SM)         7D       16-11       Brown yellow gravel and coarse to fine         8D       40.0       16-11         9D       45.0       30-16         9D       45.0       30-16         47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         Solution       Solution       Solution         9D       45.0       30-16         9D       47.0       27-41         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       Solution         Solution       Solution       Solution         Solution       Solution       Solution         Solution       Solution       Solution  |     |                     |          |        |          | ×   |        |       |          | sample. Dark         |
| SD       30.0       1-WH       Soft dark gray organic clayey silt, trace fine         SD       30.0       1-WH       Soft dark gray organic clayey silt, trace fine         SD       30.0       WH-WH       to coarse sand, mica, vegetation (OH)         GU       33.0       PUSH=24*         Medium gray organic fine sandy silt, trace       DPC (-),         ST       REC=24*         Clay, mica interlayered with gray fine to coarse sand, trace clay pockets (OL&SP)         7D       35.0         4-8       Gray medium to fine sand, trace coarse         ST       DPC (-),         33.0       DPC (-)         90       4-8.8         Gray medium to fine sand, trace coarse       DPC (-)         S-1       Pp=Pocket         Penetrometer       39         reading in tsf.       40         40.0       16-11         42.0       7-7         sand, trace silt (SP)       Cobble 43.5' -         9D       45.0         30-16       27-41         9D       45.0         9D       27-41         Coarse sand (SP-SM)         SO       Y         SO       Y         SO       Y   |     |                     | <u> </u> |        |          |   |        | 28    |          | oray organic silty   |
| 5D       30.0       1-WH       Soft dark gray organic clayey silt, trace fine         32.0       WH-WH       Hocurse sand, mica, vegetation (OH)         6U       33.0       PUSH=24*         35.0       REC=24*       clay, mica interlayered with gray fine to coarse sand, trace clay pockets (OL&SP)         7D       35.0       4-8         37.0       7-10       Gray medium to fine sand, trace coarse sand, silt, gravel (SP-SM)       DPC (-)         38D       40.0       16-11         42.0       7-7       Sand, trace silt (SP)         30       45       DPC (+)         30       Top: Do 8D (SP)         80       47.0       27-41         47.0       27-41         50       V         80       White medium to fine sand, trace silt, coarse sand (SP-SM)         80       40.0         16.11       Top: Do 8D (SP)         80: White medium to fine sand, trace silt, coarse sand (SP-SM)         50       V         9D       45.0         9D       10.14         9D       11.02         47.0       27-41         80: White medium to fine sand, trace silt, coarse sand (SP-SM)         50       V  |     | 1                   |          |        |          |   | 1      |       |          | clay in wash at 28'. |
| 5D       30.0       1-WH       Soft dark gray organic clayey silt, trace fine       0       REVERT       pp=0.6 tsf         32.0       WH-WH       Medium gray organic fine sandy silt, trace       0       REVERT       pp=0.6 tsf         33.0       PUSH=24*       Medium gray organic fine sandy silt, trace       0       0       0       0         35.0       REC=24*       clay, mica interlayered with gray fine to coarse sand, trace clay pockets (OL&SP)       0       0       0       0         7D       35.0       4-8       Gray medium to fine sand, trace coarse sand, silt, gravel (SP-SM)       0 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1.1.</td> <td>30</td> <td></td> <td></td>  |     |                     |          |        |          |   | 1.1.   | 30    |          |                      |
| 32.0       WH-WH       to coarse sand, mica, vegetation (OH)         6U       33.0       PUSH=24*         35.0       REC=24*         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         37.0       7-10         BD       40.0         16-11       Brown yellow gravel and coarse to fine sand, trace silt (SP)         30-16       27-41         9D       45.0         30-16       27-41         9D       47.0         27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         9D       45.0         30-16       27-41         9D       45.0         30-16       27-41         9D       45.0         9D       45.0         9D       47.0         27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         9D       1 Jar.         50       Y         9D   |     |                     | 5D       | 30.0   | 1-WH     | Soft dark gray organic clayey silt, trace fine  | 10     |       | REVERT   | pp=0.6 tsf           |
| 6U       33.0       PUSH=24*       Medium gray organic fine sandy silt, trace clay, mica interlayered with gray fine to coarse sand, trace clay pockets (OL&SP)       34       WC=44%, pH=6.94         7D       35.0       4-8       Gray medium to fine sand, trace coarse sand, silt, gravel (SP-SM)       35       DPC (-),         8D       40.0       16-11       Brown yellow gravel and coarse to fine sand, trace silt (SP)       S-1       DPC (+)         9D       45.0       30-16       Top: Do 8D (SP)       DPC (+)       S-2       44.3'.         9D       45.0       30-16       Top: Do 8D (SP)       DPC (+)       S-2       44.3'.         9D       45.0       30-16       Top: Do 8D (SP)       DPC (+)       S-2       44.3'.         9D       47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       S0C (Y)       S0C (Y)         9D       45.0       30-16       DPC (-)       S-2       S-2         9D       47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       S0C (Y)       S0C (Y)         9D       1       S0C (Y)       S0C (Y)       S0C (Y)       S0C (Y)         9D       S0C (Y)       S0C (Y)       S0C (Y)       S0C (Y)       S0C (Y) <tr< td=""><td></td><td>2</td><td></td><td>32.0</td><td>WH-WH</td><td>to coarse sand, mica, vegetation (OH)</td><td>1</td><td></td><td></td><td></td></tr<>  |     | 2                   |          | 32.0   | WH-WH    | to coarse sand, mica, vegetation (OH)           | 1      |       |          |                      |
| 35.0       REC=24*       clay, mica interlayered with gray fine to coarse sand, trace clay pockets (OL&SP)         7D       35.0       4.8       Gray medium to fine sand, trace coarse sand, trace coarse sand, silt, gravel (SP-SM)       35         8D       40.0       16-11       Brown yellow gravel and coarse to fine sand, trace silt (SP)       5-1       Penetrometer reading in tsf.         9D       45.0       30-16       Top: Do 8D (SP)       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       S-2       445.0         9D       47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       DPC (+)         9D       45.0       30-16       Top: Do 8D (SP)       DPC (+)         9D       47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       DPC (+)         9D       45.0       30-16       DPC (-)       DPC (+)         9D       47.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       DPC (+)         9D       40.0       DPC (+)       DPC (+)       DPC (+)         9D       45.0       DPC (+)       DPC (+)       DPC (+)         9D       1       DPC (+)       DPC (+)       DPC (+)       DPC (+)       DPC (+)   |     |                     | 6U       | 33.0   | PUSH≞24" | Medium gray organic fine sandy silt, trace      |        |       |          | DPC (-),             |
| 7D       35.0       4-8         37.0       7-10         37.0       7-10         Sand, silt, gravel (SP-SM)       S-1         BD       40.0         16-11       Brown yellow gravel and coarse to fine sand, trace silt (SP)         9D       45.0         9D       45.0         30-16       Top: Do 8D (SP)         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         S-2       44.3'.         9D       45.0         30-16       Top: Do 8D (SP)         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         S-2       44.3'.         9D       9D: 1 Jar.         50       V         BORING NO.       MP-505U   |     |                     |          | 35.0   | REC=24"  | clay, mica interlayered with gray fine to       | /      | 34    |          | WC=44%, pH=6.94      |
| 7D       35.0       4-8       Gray medium to fine sand, trace coarse       DPC (-)         37.0       7-10       sand, silt, gravel (SP-SM)       S-1       DPC (-)         8D       40.0       16-11       Brown yellow gravel and coarse to fine       39       reading in tsf.         40       7-7       sand, trace silt (SP)       DPC (+)       DPC (+)         42.0       7-7       sand, trace silt (SP)       Cobble 43.5' -         9D       45.0       30-16       Top: Do 8D (SP)       S-2       44.3'.         9D       45.0       30-16       Top: Do 8D (SP)       DPC (+)       9D: 1 Jar.         50       V       Source sand (SP-SM)       Source sand (SP-SOL)       Source sand (SP-SOL)   |     |                     |          |        |          | coarse sand, trace clay pockets (OL&SP)         |        | 35    |          |                      |
| 37.0       7-10       sand, silt, gravel (SP-SM)       S-1       pp=Pocket         39       reading in tsf.       90       16-11       Brown yellow gravel and coarse to fine       39       reading in tsf.         40       16-11       Brown yellow gravel and coarse to fine       40       0       0         42.0       7-7       and, trace silt (SP)       5-2       44.3'.       0         9D       45.0       30-16       Top: Do 8D (SP)       S-2       44.3'.       0         9D       47.0       27-41       Top: Do 8D (SP)       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       9D: 1 Jar.       9D: 1 Jar.         50       Y       9D: 1 Jar.       50       Y  |     |                     | 7D       | 35.0   | 4-8      | Gray medium to fine sand, trace coarse          |        |       |          | DPC (·)              |
| Image: state stat         |     |                     |          | 37.0   | 7-10     | sand, silt, gravel (SP-SM)                      | S-1    |       |          | pp=Pocket            |
| 8D       40.0       16-11       Brown yellow gravel and coarse to fine sand, trace silt (SP)       0PC (+)         40       0       0PC (+)         40       0       0PC (+)         42.0       7-7       sand, trace silt (SP)       0PC (+)         9D       45.0       30-16       Top: Do 8D (SP)       S-2       44.3'.         9D       45.0       27-41       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       0PC (+)         9D: 1 Jar.       50       V       0       0         9D: 1 Jar.       50       V       0       0  |     | 3                   |          |        |          |   |        |       |          | Penetrometer         |
| 8D       40.0         42.0       7-7         42.0       7-7         50       44.3'.         9D       45.0         30-16       27-41         50: White medium to fine sand, trace silt, coarse sand (SP-SM)         50       V         50       V         BORING NO.       MP-505U   |     |                     |          |        |          |   |        | 39    |          | reading in tsf.      |
| 8D       40.0       16-11       Brown yellow gravel and coarse to fine         42.0       7-7       sand, trace silt (SP)         9D       45.0       30-16         9D       45.0       27-41         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       9D: 1 Jar.         9D       45.0       9D: 1 Jar.         9D       45.0       S-2         9D       45.0       Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)         9D       45.0       ME-505U   |     |                     |          |        |          |   |        | 40    |          |                      |
| 42.0       7-7       sand, trace silt (SP)         9D       45.0       30-16         9D       45.0       27-41         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       0         50       V         BORING NO.       MP-505U  |     |                     | 8D       | 40.0   | 16-11    | Brown yellow gravel and coarse to fine          |        |       |          | DPC (+)              |
| 9D       45.0       30-16       Top: Do 8D (SP)         9D       47.0       27-41       Top: Do 8D (SP)         Bot: White medium to line sand, trace silt, coarse sand (SP-SM)       DPC (+)         50       V         BORING NO.       MF-505U   |     |                     |          | 42.0   | 7-7      | sand, trace silt (SP)                           |        |       |          |                      |
| 9D       45.0       30-16       Top: Do 8D (SP)         47.0       27-41       Top: Do 8D (SP)         Bot: White medium to fine sand, trace silt, coarse sand (SP-SM)       9D: 1 Jar.         50       V         BORING NO.       MF-505U   |     |                     |          |        |          |   |        |       |          | Cobble 43.5' ·       |
| 9D         45.0         30-16         Top: Do 8D (SP)           47.0         27-41         Top: Do 8D (SP)         DPC (+)  |     |                     |          |        |          |   | S-2    |       |          | 44.3'.               |
| 9D       45.0       30-16       10p. DF BD (SP)         47.0       27-41       Bot: White medium to line sand, trace silt, coarse sand (SP-SM)       9D: 1 Jar.         50       ▼         BORING NO.      MF-505U  | 2   |                     | 00       | 45.0   | 00.40    |   |        | 45    |          |                      |
| BORING NOMP-505U  |     | 1 3                 | 90       | 45.0   | 30-16    | Rot: White medium to line coord, trace cilt     |        |       |          |                      |
|   |     |                     |          | 47.U   | 21-41    | coarse sand (SP.SM)                             |        |       |          | su: i jar.           |
| 50 V<br>BORING NOMF-505U  | 6 . |                     |          |        |          | Composition (or comp                            |        |       |          | -                    |
| BORING NO   | -   |                     |          |        |          |   |        | 60    |          | - (                  |
| BORING NOMR-505U  |     | 3                   |          |        |          |   |        | 30    | ¥.       |                      |
| BORING NOMR-505U  | 2   |                     |          |        |          |   |        |       |          | -                    |
|   | 1   |                     |          | L      |          |   |        | BORI  | NG NO    | MR-505U              |

6'->0

|   |                       |      |       |                                       | BORING LOG                                   |        | BOR       | NG NO.   | MR-505U               |
|---|-----------------------|------|-------|---------------------------------------|--|--------|-----------|----------|-----------------------|
|   |                       |      |       |                                       |  | :      | SHEET     | 2 OF     | 3                     |
|   | PROJECT               |      |       | AL                                    | LIED BALTIMORE WORKS                         | -      | F         | ILE NO.  | 6909                  |
|   | LOCATIC               | DN:  |       | E                                     | BALTIMORE, MARYLAND                          | . SI   | URFAC     | E ELEV.  | 5.89                  |
| 6 | DANY                  |      | SAMO  | c                                     | · · · · · · · · · · · · · · · · · · ·        | }      | HES       | CASING   | M. KULD               |
|   | PROGRESS              | NO   | DEPTH | BLOWS/6                               | SAMPLE DESCRIPTION                           | STRATA | DEPTH     | BLOWS    | REMARKS               |
|   | Cont'd                | 10D  | 50.0  | 54-37                                 | Top: White red brown fine sandy silt, some   |        |           | REVERT   | DPC (+)               |
|   | Tuesday               |      | 51.8  | 53-75/3*                              | clay, tr medium sand (ML)                    |        |           |          | 10D Top: WC=13%       |
|   | Partly                |      |       |                                       | Bot: Hard white and red clayey silt, trace   |        |           |          | 10D Bot: WC=13%,      |
|   | Cloudy                |      |       |                                       | lfine sand (MH)                              |        |           |          | pH=7.11               |
|   | 65"F                  | 44.8 |       |                                       |  |        | 55        |          |                       |
|   |                       | טוו  | 55.0  | 22-31                                 | Mard write sill, some line sand, trace clay  |        |           | <u> </u> | UPC (-), VVC=14%      |
|   |                       |      | 50.0  | 34-100/4                              |  | M      |           |          |                       |
|   |                       |      |       |                                       |  |        |           |          |                       |
|   |                       |      |       |                                       |  |        | 60        |          |                       |
|   |                       | 12D  | 60.0  | 15-22                                 | Hard pink white clayey silt, trace fine sand |        |           |          | DPC (•),              |
|   | 17:00                 |      | 62.0  | 29-49                                 | (MH)   |        |           |          | WC=21%, pH=6.45       |
|   | 07:00                 |      |       |                                       |  |        |           |          |                       |
|   | 04-21-93<br>Wodgesday |      |       |                                       |  |        | 65        |          |                       |
|   | Light                 | 13D  | 65.0  | 31-67                                 | Yellow brown coarse to fine sand, trace      |        | 65.4      |          | DPC (+)               |
|   | Rain                  |      | 66.4  | 75/5*                                 | gravel, silt (SP-SM)                         |        |           |          |                       |
|   | 60 F                  |      |       |                                       |  |        |           |          |                       |
|   |                       |      |       |                                       |  |        |           |          |                       |
|   | ,                     |      |       |                                       |  | S-4    | 70        |          |                       |
|   |                       | 14D  | 70.0  | 92-100/5*                             | Do 13D, some gravel (SP-SM)                  |        |           |          | OPC (+), pH=7.51      |
| 2 |                       |      | 70.9  |                                       |  |        |           |          |                       |
| 6 |                       |      |       |                                       |  |        | 73.8      |          |                       |
|   |                       |      |       |                                       |  |        | 75        |          |                       |
|   |                       | 15D  | 75.0  | 18-34                                 | White tan silty fine to medium sand, some    |        |           |          | DPC (-), WC=26%       |
|   |                       |      | 76.5  | 100                                   | silt, trace mica seams (SM)                  | DR     |           | 4        |                       |
|   |                       |      |       |                                       |  |        |           | 7*       |                       |
|   | 13:00                 | 10   | 77.0  | HUN=24"                               | to medium cand, trace coarce cand, clay      |        | 79        | 10-      | DPC (-)               |
|   |                       |      | 79.0  | REU=24                                | (ML)   |        | 80        | 0        | minutes per foot      |
|   |                       |      |       | :                                     | Bot 7": Yellow silty fine to medium sand,    |        |           |          | Bot: 1.5" crystalline |
|   |                       |      |       |                                       | trace gravel, coarse sand, clay (SM)         |        |           |          | rock.                 |
|   |                       |      |       |                                       |  |        |           |          | End of Boring at      |
|   |                       |      |       |                                       |  |        | 85        |          | 79'.                  |
|   |                       |      |       |                                       |  |        |           |          | MC_Motor Contact      |
|   |                       |      |       | i i i i i i i i i i i i i i i i i i i |  |        |           |          | in percent of dov     |
|   |                       |      |       |                                       |  |        |           |          | weight.               |
|   |                       |      |       |                                       |  |        | 90        |          | 3                     |
|   |                       |      |       |                                       |  |        |           |          | pH=Soil pH by         |
|   |                       |      |       |                                       |  |        |           |          | Method 9045           |
|   |                       |      |       |                                       |  |        |           |          | (EPA-SW846)           |
|   |                       |      |       |                                       |  |        | 0.5       |          |                       |
|   |                       |      |       |                                       |  |        | 30        |          |                       |
|   |                       |      |       |                                       |  |        |           |          |                       |
|   |                       |      |       |                                       |  |        |           |          |                       |
| 6 |                       |      |       |                                       |  |        |           |          |                       |
| - | E.                    |      |       |                                       |  |        | 100       |          |                       |
|   |                       |      |       |                                       |  |        |           |          |                       |
|   |                       |      |       |                                       |  |        |           |          | MR-50511              |
|   |                       |      |       |                                       |  |        | - u U MII |          |                       |

|           |       |              | <u>R</u>            | ORING LOG   |            | BOR               | ING NO       | MR-713            |
|-----------|-------|--------------|---------------------|---|------------|-------------------|--------------|-------------------|
|           |       |              |                     |   | SHEET 1 OF |                   |              | 4                 |
|           |       |              | HARBOR POINT AREA 2 |   | F          | ILE NO            | . 1009A      |                   |
| LOCATIO   | UN:   |              |                     | BALTIMORE, MD   |            | SURFAC            | e elev       | . 13.1            |
| DAN M     | Т     | CAN          |                     |   |            | RES               | . ENGR.      | M. QUASARAN       |
| DALT      | NO    | DEDTU        | PLE                 |   |            |                   | CASING       |                   |
| 11:30     | I NO. | UEPIR        | BLUWSIG             | SAMPLE DESCRIPTION  | STRAT/     | DEPTH             | BLOWS        | REMARKS           |
| 05-10-06  | 1D    | 10           | 2_4                 | Brown clavau fine to modium send some                                       | 1          | $\vdash$ $\dashv$ | DRILLED      |                   |
| Vednesdav |       | 3.0          | 11-7                | dravel trace coarse cand (Fill) (SC)  |            |                   | AHEAD        | DPC=-, 11:30      |
| Clear     | 2D    | 3.0          | 7-16                | Brown silty fine to coarse sand, some gravel                                | 1          |                   | 4            |                   |
| 75°F      |       | 5.0          | 46-52               | trace brick, cinder, wood (Fill) (SM)                                       |            | 5 1               |              | DPC=-, 11:45      |
|           | 3D    | 5.0          | 17-100/5"           | Gray gravelly coarse to fine sand, trace brick.                             |            |                   |              | DPC=+ 12:00       |
| 3         |       | 5.9          | ]                   | silt (Fill) (SP-SM)   | E          |                   |              | 010 112.00        |
|           | 4D    | 7.0          | 5-10                | Black silty fine to coarse sand, trace gravel,                              | 1          |                   |              | DPC=-, 12:15      |
| 1         |       | 9.0          | 9-10                | brick (Fill) (SM)   |            |                   |              |                   |
| 1         | 50    | 40.0         |                     |   |            | 10                |              |                   |
| 1         | 50    | 10.0         | 0-7                 | Brown silty fine to medium sand, some gravel,                               |            |                   |              | DPC=-, 12:30      |
|           |       | 12.0         | 9-10                | trace brick (FIII) (SM)   |            |                   |              |                   |
|           |       |              | -                   |   | 1          | Frant             |              |                   |
|           |       |              | 1                   |   | 1          | 13.0              |              |                   |
| 1         | 6D    | 15.0         | 12-21               | Brown coarse to fine sand, some gravel, trace                               |            | 19                | 100 - 10 - 7 | DDC- 44:00        |
|           |       | 17.0         | 27-23               | silt (SP-SM)  |            |                   |              | DPC=-, 14:00      |
|           |       |              |                     | 1   | 1          |                   |              |                   |
|           |       |              |                     |   | S2         |                   |              |                   |
|           | -     |              |                     |   | 1          | 20                |              |                   |
| 1         | 7D    | 20.0         | 15-17               | Brown fine to medium sand, trace silt (SP)                                  |            |                   |              | DPC=-, 14:45      |
| -         |       | 22.0         | 21-27               |   |            |                   |              |                   |
| 9         |       |              |                     |   |            |                   |              |                   |
| h         |       |              |                     |   |            | 23.5              |              |                   |
| 1         | 8D    | 25.0         | 17-32               | Ton: Stiff white clavey silt, trace fine cand                               |            | 25                |              |                   |
|           |       | 27.0         | 57-77               | seams, brown fine to medium sand laver (ML)                                 | M          |                   |              | Top DPC=-, 15:30  |
| [         |       |              |                     | Bot: Stiff white fine sandy silt (ML)                                       |            | +                 |              | BUI DPC=+, 15:30  |
|           |       |              |                     |   |            | 28.5              |              |                   |
| <u>_</u>  |       |              |                     |   |            | 30                |              |                   |
| -         | 9D    | 30.0         | 19-30               | Brown fine to medium sand, trace silt (SP)                                  |            |                   |              | DPC=-, 16:15      |
| -         |       | 32.0         | 53-67               |   |            |                   |              |                   |
| -         |       |              |                     |   |            |                   |              |                   |
| -         |       |              |                     |   |            |                   |              |                   |
|           | 10D   | 35 0         | 34-100/6"           | Light brown and tan fine to modium agent                                    | i          | 35                |              |                   |
| F         |       | 36.0         | 01 100/0            | trace silt (SP-SM)  |            |                   |              | DPC=-, 16:40      |
|           |       |              |                     |   |            |                   | - +          |                   |
| 2         |       |              |                     |   | S3         | - +               |              |                   |
| 17:00     |       |              |                     |   |            | 40                |              |                   |
| 07.30     | 11D   | 40.0         | 21-36               | Tan fine to medium sand, trace silt (SP)                                    |            |                   |              | DPC=+, 08:30      |
| -11-06    |       | 42.0         | <b>47-</b> 89       |   | 2          |                   |              |                   |
|           | -+    |              |                     |   |            |                   |              |                   |
|           |       | _            |                     |   |            | 48 +              |              |                   |
| 65°F      |       | 45.0         | 19-21               | Tap: Do 11D (SP)  | ÷          | 45                |              |                   |
| 65°F      | 12D   |              | 400/48              | Bot: Red silty fine to medium sand, some red                                | - 1        |                   |              | op DPC=+, 09:15   |
| 65°F      | 12D   | 46.3         | 100/4"              |   |            |                   |              | SOLDER: 24 09:15  |
| 65°F      | 12D   | 46,3         | 100/4"              | silty clay layers (SM)  |            |                   |              | JOC DI 0-1, 03,15 |
| 65°F      | 12D   | 46.3         | 100/4*              | silty clay layers (SM)  |            | 48.5              |              | Jor Di 0-1, 03,15 |
| 65°F      | 12D   | 46.3         | 100/4"              | silty clay layers (SM)  |            | 48.5              |              | 0.010-1,03.13     |
| 65°F      | 12D   | 46.3<br>50.0 | 5-B                 | silty clay layers (SM)<br>Stiff red brown and white mottled silty clay (CL) | M          | 48.5<br>50        |              | DPC=+, 10:00      |

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| BORING LOG    |          |       |          |  |            | BOF           | RING NO                               | . MR-713                |
|---------------|----------|-------|----------|--|------------|---------------|---------------------------------------|-------------------------|
|               | <b>.</b> |       |          |  |            | SHE           | EET 2 OF                              | 4                       |
|               |          |       |          | HARBOR POINT AREA 2                                  |            |               | FILE NO.                              | 1009A                   |
| LOCATI        | ON:      |       |          | BALTIMORE, MD  | 5          | SURFAC        | E ELEV.                               | 13.1                    |
| r=            |          |       |          |  |            | RES           | . ENGR.                               | M. QUASARANO            |
| DAILY         |          | SAM   |          |  |            | 1             | CASING                                |                         |
| PROGRESS      | NO.      | DEPTH | BLOWS/6" | SAMPLE DESCRIPTION                                   | STRAT      | DEPTH         | BLOWS                                 | REMARKS                 |
| Conl'd        |          |       |          |  |            |               | DRILLED                               |                         |
| 05-11-06      | L        |       |          |  | [          |               | AHEAD                                 | 1                       |
| Thursday      |          |       |          | 1  |            |               | 4"                                    |                         |
| Cloudy        |          |       | Ĵ.       |  |            |               |                                       | 5                       |
| 65°F          | 121.52   |       |          |  |            | 55            |                                       | i l                     |
|               | 14D      | 55.0  | 8-10     | Stiff white clayey silt, trace red silty clay layers |            |               |                                       | DPC=+, 10:45            |
| 1             |          | 57.0  | 21-38    | (ML)   |            | 1             |                                       | pp=2.5                  |
|               |          |       | ]        |  |            |               | —   — — — — — — — — — — — — — — — — — | /rr                     |
| į             |          |       |          |  |            |               |                                       |                         |
|               |          |       | ]        |  | M          | 60            |                                       |                         |
| 1             | 15D      | 60.0  | 5-8      | Medium white fine sandy silt, trace fine sand        |            |               |                                       | DPC= 11.20              |
|               |          | 62.0  | 11-17    | seams (ML)   |            |               |                                       | pp=2.0                  |
|               |          |       |          |  | [          |               |                                       | Sample recovered on     |
|               |          |       |          |  |            |               |                                       | 2nd atternot            |
|               |          |       | ]        |  |            | 65            |                                       |                         |
|               | 16D      | 65.0  | 4-7      | Medium white and fine sandy silt, trace red          | 28         |               |                                       | DPC=+ 11.50             |
|               |          | 67.0  | 9-17     | brown clayey silt layer (ML)                         | 1          |               |                                       | (Very faint color, near |
| P             |          |       |          |  | 1          |               |                                       | red brown clay)         |
| 4             |          |       |          |  |            | 68.5          |                                       | pp=100                  |
|               |          |       | 1        |  |            | 70            |                                       | FF                      |
|               | 17D      | 70.0  | 9-12     | Light brown coarse to fine sand, some gravel,        |            |               |                                       | DPC=+, 12:15            |
|               |          | 72.0  | 41-51    | trace silt (SP-SM)                                   |            |               |                                       | 1 8                     |
|               | i        |       |          |  |            | · · · · · · · |                                       |                         |
|               |          |       |          | 2  | <b>S</b> 4 |               | -   -                                 |                         |
| ×.            |          |       | 1        |  |            | 75            |                                       | I                       |
|               | 18D      | 75 0  | 19-27    | Yellow brown coarse to fine sand, some               |            |               |                                       | DPC=+, 12.45            |
|               |          | 77.0  | 37-23    | gravel, silt (SM)                                    |            |               |                                       |                         |
| Î I           |          |       |          |  |            |               | - 22                                  |                         |
|               |          |       |          | 1  |            | 78.5          |                                       |                         |
|               | 400      | 00.0  |          |  |            | 80            |                                       |                         |
|               | 190      | 80.0  | 9-36     | Light gray clayey silt, some gravel, trace brown     |            |               |                                       | DPC=+, 13:45            |
|               | I        | 82.0  | 35-55    | fine to medium sand (ML)                             | <b>DD</b>  |               |                                       | (Faint color)           |
| 1             |          |       |          |  | DR         |               |                                       | 1                       |
|               |          | - 10  |          |  |            |               |                                       |                         |
| E .           | 200      | 85.0  | 100/2"   |  |            | 85            |                                       |                         |
| 15:30         | 200      | 85.3  | 100/3    | sm tan sitty alay live (December of Bask) (00)       |            | 86            | l                                     | DPC=+, 14:20            |
| 08:00         | 210      | 87 0  | 36-54    | Green grav clavey fine to modium cond. (SC)          |            |               | m                                     |                         |
| 05-12-06      |          | 89.0  | 72-73    | clav pockets (Decomposed Rock) (SC)                  |            | 8 <u>8</u>    |                                       | DPC=-, 08:30            |
| Friday        | 10       | 89.0  | REC=53%  | Green gray clavey fine to medium sand /SC)           |            | <u>ά</u> η    | <u> </u>                              |                         |
| Clear         | 1        | 92.0  | RQD=0%   |  |            | 30            |                                       |                         |
| 75°F          | 227      |       |          |  | TZ         |               |                                       |                         |
|               | 2C       | 92.0  | REC=33%  | Do 1C (SC)   |            |               |                                       | 1                       |
| l l           |          | 95.0  | RQD=0%   |  |            |               |                                       |                         |
| l             |          |       |          |  |            | 95            |                                       |                         |
|               | 3C       | 95.0  | REC=96%  | Top 1': Do 1C (SC)                                   |            | 96            |                                       |                         |
| Ĩ             |          | 100.0 | RQD=75%  | Bot 3.8': Intermediate moderately weathered          |            |               |                                       |                         |
| ľ             |          |       |          | green gray gneiss, jointed, weathered joints         | _          |               |                                       |                         |
|               |          |       |          |  | к          | -  -          |                                       |                         |
| 18:00         |          |       |          |  |            | 100           | IE                                    | End of boring at 100'.  |
| -             |          |       |          | i  |            |               |                                       |                         |
|               | <u> </u> |       |          |  |            |               | 12                                    | (1)                     |
| MRCE Form 8L- | 1        |       |          |  |            |               |                                       | MD 742                  |

BORING NO.

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