APPENDIX A

SEDIMENT CONSOLIDATION AREA (SCA) CIVIL AND GEOTECHNICAL TECHNICAL MEMORANDUM

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Alexander B. Grannis
Commissioner

August 12, 2009

Mr. John P. McAuliffe, P.E.
Program Director, Syracuse
Honeywell
5000 Brittonfield Parkway, Suite 700
East Syracuse, NY 13057

Re: Onondaga Lake Bottom Subsite Onondaga County, NY
SCA Technical Memorandum, Dated August 11, 2009 (734030)(SCA-14a)

Dear Mr. McAuliffe:

We have received and reviewed the above-referenced document, which was transmitted by Laura Brussel's (Parsons) August 11, 2009 email to my attention, and find that the revised document has satisfactorily addressed our previous comments. Therefore, the August 11, 2009 version of the SCA Technical Memorandum, is approved.

It is my understanding that this document will be included as an appendix to the SCA IDS and will therefore be distributed to the various document repositories, as discussed in the governing consent decree, when the SCA IDS is distributed to the various document repositories.

Sincerely,

Timothy J. Larson, P.E.
Project Manager

cc: T. Milch, Esq, - Arnold & Porter
ecc: J. Gregg - NYSDEC
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MEMORANDUM

August 11, 2009

To: Tim Larson, NYSDEC

From: Ed Glaza, Parsons

Subject: Sediment Consolidation Area (SCA) Civil and Geotechnical Technical Memorandum

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This Sediment Consolidation Area (SCA) Civil and Geotechnical Technical Memorandum (Technical Memorandum) has been prepared on behalf of Honeywell International Inc. in accordance with the Remedial Design Work Plan (RDWP) for the Onondaga Lake Bottom Subsite (Parsons, 2009). The RDWP presents the activities necessary to complete design of the remedy selected in the Record of Decision issued by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency Region 2 in 2005, and as set forth in the Consent Decree (United States District Court, Northern District of New York, 2007) (89-CV-815).

This Technical Memorandum is being submitted in advance of the SCA Civil and Geotechnical Initial Design Submittal (IDS) to facilitate NYSDEC's review of the IDS and achievement of the overall project schedule. Preparation and submission of this Technical Memorandum allows NYSDEC the opportunity to review and provide comments on the following documents prior to their inclusion in the IDS:

- Attachment A – Basis of Design
- Attachment B – Subsurface Stratigraphy Model of Wastebed 13 for the Design of Sediment Consolidation Area (i.e., the Data Package).

To further facilitate NYSDEC's IDS Review, the SCA Dewatering Evaluation Report will be submitted in advance of the IDS. The content and submittal schedule for the IDS will be in accordance with the RDWP.

REFERENCES

NYSDEC and USEPA. 2005. Record of Decision Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site. Town of Geddes and Salina, Villages of Solvay and Liverpool, and City of Syracuse, Onondaga County, New York.

Parsons, 2009. Remedial Design Work Plan for the Onondaga Lake Bottom Subsite Prepared for Honeywell. March 2009.

United States District Court, Northern District of New York. 2006. State of New York and Denise M. Sheehan against Honeywell International, Inc. Consent Decree Between the State of New York and Honeywell International, Inc. Senior Judge Scullin. Dated October 11, 2006. Filed January 4, 2007. Order Number 89-CV-815. Syracuse, New York.

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ATTACHMENT A

CIVIL AND GEOTECHNICAL BASIS OF DESIGN

ONONDAGA LAKE
SEDIMENT CONSOLIDATION AREA

CIVIL AND GEOTECHNICAL
BASIS OF DESIGN

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AUGUST 2009

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CIVIL AND GEOTECHNICAL
BASIS OF DESIGN

1.0 PURPOSE AND ORGANIZATION

This Basis of Design (BOD) has been prepared on behalf of Honeywell International Inc. (Honeywell). The purpose of this document is to define the requirements and criteria under which the civil and geotechnical aspects of the Onondaga Lake Sediment Consolidation Area (SCA) will be designed. Additionally, the SCA design will incorporate criteria from the dredging, SCA operations, and water treatment designs. As additional information is gained or project requirements change, this BOD will be revised accordingly.

The remainder of this document is organized as follows:

- Section 2: Regulatory Requirements
- Section 3: Design Objectives
- Section 4: Design Criteria
- Section 5: References

2.0 REGULATORY REQUIREMENTS

The remedial design of the SCA will be executed in accordance with the Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) Region 2 in 2005 for the Onondaga Lake Bottom subsite. The design requirements for the SCA are further set forth in the Consent Decree - United States District Court, Northern District of New York, 89-CV-815 (CD). Additional design considerations will be selected based on relevant guidance documents from the United States Army Corp of Engineers (USACE) and the USEPA.

The CD states, “Honeywell shall design, operate and maintain the SCA in accordance with the substantive requirements of NYSDEC Regulations Part 360, Section 2.14(a), (industrial monofills)”. In addition, the SCA will meet the requirements of NYSDEC Regulations Part 373-2.19 as set forth herein. The ROD identifies NAPL as the Principal Threat Waste and therefore any pooled NAPL encountered or collected as part of the water treatment process would be treated to meet the minimum treatment requirements defined in Part 373-2.19 or disposed at an off-site permitted facility. The CD and ROD state the following additional requirements related to the SCA design:

- "The SCA shall be constructed on Solvay Wastebed 13, located south of Ninemile Creek and west of Geddes Brook."
- "*Impermeable Liner* – Honeywell shall design and install an impermeable liner system. The grading design for the SCA shall utilize the existing surface topography of Wastebed 13 as much as possible so as to limit wastebed cut and fill requirements and the associated need for a large volume of imported soil fill. Preloading and stabilization of the wastebed shall only be required to the extent necessary to ensure the integrity of the SCA components and underlying Solvay waste foundations, based upon the remedial design."
- "*Leachate Collection* – The impermeable liner shall be overlain by a leachate collection system. The type of system will be determined during Remedial Design. A laterally-transmissive sand or geosynthetic liquid collection layer may be considered by DEC for inclusion in the system. The system shall convey leachate by gravity drainage to collection sumps where the leachate will be pumped via force main to a water treatment plant."
- "*SCA Cover* – The SCA cover shall be designed pursuant to applicable regulations and guidance including the U.S. EPA Alternative Cover Assessment Program ("ACAP"). If appropriate based upon the Remedial Design, the SCA cover may utilize a soil layer and ecological plant community to produce evapotranspiration rates sufficient to reduce precipitation infiltration rates to acceptably low levels."

3.0 DESIGN OBJECTIVES

The SCA design objectives are:

- Design the SCA for the efficient and secure containment of sediments dredged as part of the Onondaga Lake remedy in a manner protective of human health and the environment and consistent with applicable regulations and codes.
- Incorporate dredging, SCA operations, and water treatment into the SCA civil and geotechnical design.
- Incorporate stakeholder (i.e., regulatory agencies and the community) input in the process to identify design criteria (e.g., odor mitigation, groundwater monitoring, redundancy of operations, leachate containment, dewatering, traffic, beneficial use, etc.).
- Incorporate value engineering and constructability into the design process from the earliest stages to assure overall value in the facility.

4.0 DESIGN CRITERIA

This section presents the criteria for the major aspects of the SCA civil and geotechnical design. Design criteria for the SCA operations are addressed in a separate document.

SCA Purpose

The purpose of the SCA is to receive dredged sediment from the Onondaga Lake remedial action. In addition to settling basins, alternate methods of dewatering were evaluated during the conceptual design of the SCA. As discussed in the Remedial Design Work Plan (RDWP), this evaluation included "the feasibility of using Geotube™ technology as both structural and containment elements in basin layout development." Based on the evaluation presented in the SCA Dewatering Evaluation Report (Parsons, 2009), geotextile tubes were selected as the dewatering method for the dredged sediment within the SCA.

Location

The Onondaga Lake SCA Siting Evaluation (Parsons, 2006) was prepared to describe and evaluate potential locations for building and operating a SCA, which included Honeywell's Wastebed B and Wastebeds 1 through 15. Based on that evaluation, Wastebed 13 was selected as the SCA location. Wastebed 13 occupies approximately 163 acres and is bordered to the north by Ninemile Creek and CSX Railroad tracks; to the west by an Onondaga County Garage property, a former gravel excavation owned by Honeywell, and residential properties; and to the east and south by Wastebeds 12 and 14, respectively. Because of off-site public access areas and residences, a 500-ft buffer between active SCA operations and the western limit of existing Wastebed 13 will be considered during SCA design.

Capacity

The required capacity of the SCA has not been determined yet. For preliminary design purposes, it is assumed that the SCA will contain up to 2,653,000 cubic yards (in-lake volume) of sediment. This may be revised as the design progresses and final dredge volumes are established. Capacity will be determined based on the following design assumptions:

- Dredged slurry will be 10% solids by weight on average.
- Sediment will achieve a 1.0 bulking factor following self-weight consolidation.

Phased Construction

The SCA design will consider the potential for phased construction to facilitate the dredging schedule, odor mitigation, underlying Solvay waste consolidation, and/or enhanced final closure. The SCA design will incorporate the construction schedule necessary to meet the remedial action timing requirements of the CD.

Geotechnical Stability

Static slope stability analyses will be performed as part of the SCA design. A series of analyses will be performed to evaluate the stability of the SCA and its components (e.g., stacked geotextile tubes, perimeter dikes, final cover) for interim (i.e., during SCA construction and operation) and long-term (i.e., post-closure) conditions. The degree of stability of a slope is reported in geotechnical engineering in terms of the slope stability factor of safety. A factor of safety of at least 1.0 is required for a slope to be stable. Due to the inherent variability in the engineering properties of soils, slopes are typically designed with a factor of safety greater than 1.0. Minimum acceptable factors of safety for a given set of conditions were developed for the SCA considering the criticality of the facility, the consequences of failure, and guidance provided by:

- U.S. Army Engineer Waterways Experiment Station Technical Report D-77-9 (Hammer and Blackburn, 1977); and
- U.S. Army Corps of Engineers Engineering Manual EM 1110-2-1902 (USACE, 2003).

Based on these guidance documents, a minimum acceptable factor of safety of 1.3 will be used for interim conditions (i.e., during construction and operation). In addition, a minimum acceptable factor of safety of 1.5 will be used for long-term conditions (i.e., post-closure). This factor of safety for long-term conditions is consistent with NYSDEC Regulations Section 360-2.7(b)(6), which indicates a minimum factor of safety of 1.50 for the final cover system under long-term conditions. The site is not located in a seismic impact zone; therefore, a seismic slope stability analysis is not necessary.

In terms of the dike stability analyses, both interim and long-term conditions will be evaluated using Spencer's Method (Spencer, 1973). The critical case (e.g., cross section, water level, etc.) will be defined for each cross section, and the guidance provided in Holtz and Kovacs (1981), Duncan et al. (1987), and Kulhawy and Mayne (1990) will be followed when selecting between total-stress and effective-stress analysis approaches and between unconsolidated-undrained (UU), consolidated-undrained (CU), and consolidated-drained (CD) shear strength parameters. In establishing shear strength parameters for geosynthetic interfaces, the differences between peak and large-displacement shear strength values will be considered using proven approaches that are consistent with the requirements of NYSDEC and USEPA standards and guidelines. The resulting factors of safety from these analyses will be compared with the minimum acceptable values indicated previously. If the calculated values are not acceptable, the design will be modified as necessary to achieve the required factors of safety.

Settlement

Calculations will be performed to evaluate the magnitude of SCA foundation soil settlement. Dredged sediment loadings for these calculations will be developed based on sediment characteristics established from the pre-design investigation data. Since the consolidation of the compressible foundation soils (i.e., Solvay waste) may require significant periods to reach completion, the time rate of primary consolidation settlement will also be considered.

Conventional one-dimensional (1-D) small strain primary consolidation settlement and secondary compression settlement calculation methods, such as those presented by Holtz and

Kovacs (1981), will be used to estimate settlement due to liner construction, geotextile tube placement and filling, and final cover installation in the SCA. Secondary settlement will be calculated for 30 years after closure of the SCA.

The time rate of primary consolidation settlement will be calculated using Terzaghi's 1-D consolidation theory, as presented in Holtz and Kovacs (1981). The parameters required to perform these calculations will be established from laboratory 1-D consolidation tests, the settlement pilot study, and/or appropriate empirical correlations.

The primary settlement as a function of time and the secondary compression will be estimated. In addition, based on those settlements, the tensile strain in the geomembrane liner will be estimated and compared to the maximum recommended tensile strain of 5% (Berg and Bonaparte, 1993). If necessary, the design, construction schedule, construction methods, SCA operations, etc. will be adjusted to accommodate the settlement.

Liquids Management and Liner System

The SCA design will include a liner and a liquids management system to collect and convey liquids draining from the dredged sediment. This liner and liquids management system will be designed in accordance with the requirements of NYSDEC Regulations Part 360, Section 2.14(a).

The bottom of the SCA (i.e., bottom of the liner system) will overlie existing Solvay waste ranging in thickness from approximately 35 ft to 90 ft. Existing site topography indicates elevation changes of up to 10 ft within the Wastebed 13 limits (i.e., the SCA site). The SCA design will use the existing site topography, to the extent possible, in designing the liner and liquid management systems. The bottom of the SCA will be designed to maintain a positive post-settlement slope toward the liquid withdrawal sumps so that liquid may be effectively removed from the SCA during and following active operations.

Following the requirements of the NYSDEC regulations and the specific conditions encountered in the SCA, the liner and liquids collection system for the SCA will be designed with the following general considerations:

- The liner system will include a geomembrane compatible with the materials to be contained within the SCA. A 24-inch (on average) gravel layer will be used for drainage and geotextile tube bedding.
- Consistent with Part 360, Section 2.14a, the intent of the design is to achieve a head no greater than 1 ft in the liquids management system; however, the facility design may allow for heads greater than 1 ft for some interim periods if it can be demonstrated that the overall performance objectives are met.
- The liner system will include a low permeability soil component immediately underlying the geomembrane. This soil component will vary in thickness to achieve

appropriate bottom slopes with the existing topography of the site, but it will not be less than 12 inches at any location and will be a minimum of 18 inches in critical areas such as sumps and drainage corridors. The soil component will exhibit a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec in its uppermost layer (i.e., top 6 inches).

- If necessary, preloading will be used to establish or maintain positive drainage toward the sump areas. Preloading requirements will be developed using the results of the settlement evaluations.

The quantity and rate of liquids generated will be estimated for each representative step in the filling of the SCA cell, and each representative phase of the SCA development (i.e., construction, operation, closure, and post-closure). In addition, surface water run-off from active portions of the facility for the 25-year, 24-hour storm event will be considered in the liquids generation analysis. These estimates will be used to design the liquids collection system and the liquids transmission system.

Surface Water Management

Surface water management for the SCA includes the management of surface water flow over and around the SCA during construction, during operation, and after closure. The "New York State Standards and Specifications for Erosion and Sediment Control" (NYSDEC, 2005) shall be used as a guidance document for surface water design activities. Specifically, surface water management will include controlling runon, runoff, and wastewater (i.e., waters that must be contained, collected, and conveyed to the water treatment plant), as follows:

- route surface water to designated locations where it can be appropriately managed;
- protect the SCA from damage caused by precipitation and surface water runon and runoff;
- discharge surface water to existing watercourses in accordance with applicable regulatory requirements; and
- collect and route wastewater to the water treatment plant.

A surface water management system will be designed to meet the project requirements for both temporary conditions (i.e., during construction, filling, and closure of the SCA) and long-term conditions (i.e., after closure of the SCA). Design calculations for temporary and permanent surface water control structures will be performed using the 25-year, 24-hour storm event, as indicated in NYSDEC Regulations Section 360-2.7(b)(8)(ii). The system will be designed to control surface water runon to the SCA and uncontrolled surface water and wastewater runoff from the SCA, and will be integrated, to the extent possible, with existing topographic features and facilities.

Runon will be controlled and diverted away from and around the SCA using channels or diversion berms. If needed, calculations will be performed to size temporary sediment basins for each contributing drainage area during each representative phase of SCA development. As per the "New York State Standards and Specifications for Erosion and Sediment Control", runoff shall be computed by the method outlined in:

- Chapter 2, Estimating Runoff, "Engineering Field Handbook" available in the Natural Resources Conservation Service offices, or
- TR-55, "Urban Hydrology for Small Watersheds" (USDA-SCS, 1986).

Runoff computations will be based upon the worst soil cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure. An acceptable tool for performing these calculations is the computer program "*HydroCAD*^{TM} *Stormwater Modeling System*" (1998).

Final Cover System

The final cover system will accommodate the final height of the dewatered dredged material in the SCA. Changes in dredged material volume and actual SCA layout will determine the final height of the SCA. The final cover system components and slopes will be designed to account for settlement of the subgrade material, to promote positive drainage, and to minimize erosion.

The SCA cover may utilize a soil layer and ecological plant community to reduce precipitation infiltration rates to acceptably low levels. The design of the final cover system will balance the infiltration rates with the hydraulic conductivity of the contained sediment and the liquid management system.

5.0 REFERENCES

Berg, R.R. and Bonaparte, R., Long-Term Allowable Tensile Stresses for Polyethylene Geomembranes, Geotextiles and Geomembranes, Vol. 12, 1993, pp. 287-306.

Bonaparte, R. and Giroud, J.P., Waste Containment Systems for Pollution Control: Part II-Hydraulic Design and Performance, Proceedings, NATO Advanced Study Institute, Recent Advances in Ground-Water Pollution Control and Remediation, Springer-Verlag, New York, 1995.

Duncan, J.M., Buchignani, A.L., and DeWet, M., An Engineering Manual for Slope Stability Studies, Department of Civil Engineering, Virginia Polytechnic Institute and State University, March 1987.

Hammer, D.P., and Blackburn, E.D., Design and Construction of Retaining Dikes for Containment of Dredged Material, Technical Report D-77-9, U.S. Army Engineer Water Experiment Station, Vicksburg, Mississippi, August 1977, pp. 93.

Holtz, R.D., and Kovacs, W.D., An Introduction to Geotechnical Engineering, Prentice-Hall Inc., Englewood Cliffs, N.J., 1981.

HydroCAD. *HydroCAD™:* Stormwater Modeling System, Version 6, Applied Microcomputer Systems, Chocorua, New Hampshire, 1998.

Kulhawy, F.H., and Mayne, P.W., Manual on Estimating Soil Properties for Foundation Design, Report No. EL-6800 Electric Power Research Institute, Palo Alto, California, 1990.

NYSDEC and USEPA. 2005. Record of Decision Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site. Town of Geddes and Salina, Villages of Solvay and Liverpool, and City of Syracuse, Onondaga County, New York.

NYSDEC, 2005. New York State Standards and Specifications for Erosion and Sediment Control.

Parsons, 2006. Onondaga Lake Sediment Consolidation Area (SCA) Siting Evaluation. Prepared for Honeywell.

Parsons, 2009. Remedial Design Work Plan for the Onondaga Lake Bottom Subsite Prepared for Honeywell.

Parsons, 2009. Onondaga Lake Sediment Consolidation Area (SCA) Dewatering Evaluation. Prepared for Honeywell.

Spencer, E., The Thrust Line Criterion in Embankment Stability Analysis, Géotechnique, Vol. 23, No.1, pp.85-100, March 1973.

United States District Court, Northern District of New York. 2006. State of New York and Denise M. Sheehan against Honeywell International, Inc. Consent Decree Between the State of New York and Honeywell International, Inc. Senior Judge Scullin. Dated October 11, 2006. Filed January 4, 2007. Order Number 89-CV-815. Syracuse, New York.

U.S. Army Corps of Engineers (USACE), Engineering and Design – Slope Stability, Engineering Manual EM 1110-2-1902, October 2003, pp. 3-2.

U.S. Army Corps of Engineers, Settlement Analysis, Engineer Manual 1110-1-1904, Washington, DC, September 1990.

U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), Urban Hydrology for Small Watersheds, Technical Release 55 (TR55), U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 2nd Edition, 1986.

ATTACHMENT B

SUBSURFACE STRATIGRAPHY MODEL OF WASTEBED 13 FOR THE DESIGN OF SEDIMENT CONSOLIDATION AREA

SUBSURFACE STRATIGRAPHY MODEL OF WASTEBED 13 FOR THE DESIGN OF SEDIMENT CONSOLIDATION AREA

1. INTRODUCTION

This Subsurface Stratigraphy Model of Wastebed 13 for the Design of Sediment Consolidation Area (SCA) (referred to as the Data Package) was prepared in support of the design of the SCA for the Onondaga Lake Bottom Site, which will be constructed on Honeywell's Solvay Wastebed 13 (WB-13). Specifically, the purpose of the package is to provide:

- a summary of the site investigation activities conducted in WB-13 to date;
- interpretation of material characteristics and subsurface stratigraphy in WB-13 based on the results of the site investigations;
- interpretation of material properties (i.e., index properties, shear strength, and compressibility) based on the results of the laboratory tests, the field test, and the empirical correlations;
- recommendation on material properties to be used for the SCA design; and
- verification of the interpreted subsurface model and compressibility of Solvay waste (SOLW) using the field settlement test results.

2. SITE INVESTIGATIONS

Historical information indicates that three large pits (i.e., Pits A, C, and D as shown in Figure 1) were excavated in the WB-13 area. These pits, along with the entire WB-13 area contained within constructed berms, were filled with Solvay waste during the period from 1973 to 1985. Numerous site investigations were conducted at WB-13 from 1985 to 2007. This section provides a brief summary of the recent site investigations between 2004 and 2007.

2.1 <u>2004 Investigation Program</u>

The 2004 investigation was performed in June and July 2004 to characterize the geotechnical properties of the subsurface materials within and surrounding WB-12 and WB-13. Activities relevant to WB-13 included 20 cone penetration tests (CPTs) and 17 borings with standard penetration tests (SPTs). Samples were taken during the investigation for laboratory testing of material properties (see Section 5). The locations of the CPTs and borings are shown in Figure 2. A detailed description of the investigation was presented in *Appendix A – Data Summary Report Geotechnical Characterization of*

Wastebed 13 of "*Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Data Summary Report*" [Parsons and Geosyntec, 2008a]. For the remainder of this data package, this investigation will be referred to as the 2004 Investigation.

2.2 Phase I Investigation Program

The Phase I investigation was performed between August and October 2005 as a part of the pre-design investigation (PDI) program to support the WB-13 settlement pilot study. The purpose of the pilot study was to evaluate the settlement of SOLW under a constructed test fill. Activities performed during this investigation included 18 CPTs, 30 borings (10 of them with SPTs), and 2 test pits. Samples were taken during the investigation for laboratory testing of material properties (see Section 5). The locations of the CPTs and borings are shown in Figures 2 and 3. A detailed description of the investigation was presented in the report titled "*Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Data Summary Report, Onondaga County, New York*" [Parsons and Geosyntec, 2008a]. Monitoring data for 2007 is provided in "*Wastebed 13 Settlement Pilot Study Monitoring Data – Year 2*" [Parsons, 2008b]. For the remainder of this data package, this investigation will be referred to as the Phase I Investigation.

2.3 Phase II Investigation Program

The Phase II investigation was performed between September and November 2006 as a part of the PDI program to further characterize the geotechnical properties of the subsurface materials at WB-13. Activities performed during this investigation included 113 CPTs and 30 borings with SPTs. Samples were taken during the investigation for laboratory testing of material properties (see Section 5). The locations of the CPTs and borings are shown in Figure 4. A detailed description of the investigation was presented in the report titled "*Onondaga Lake Pre-Design Investigation: Phase II Data Summary Report*" [Parsons, 2008c]. For the remainder of this data package, this investigation will be referred to as the Phase II Investigation.

2.4 Phase III Investigation Program

The Phase III investigation was performed in October 2007 as a part of the PDI program to further investigate the buried berms between Pits A, C, and D and to characterize the geotechnical properties of SOLW at WB-13. Activities performed during this investigation included 28 CPTs and 23 borings with SPTs. Samples were taken during the investigation for laboratory testing of material properties (see Section 5). The locations of the CPTs and borings are shown in Figure 5. A detailed description of the investigation was presented in *Appendix E – Phase III SCA Data Summary Report* of the "*Onondaga Lake Pre-Design Investigation Phase III Data Summary Report*" [Parsons, 2009]. For the remainder of this data package, this investigation will be referred to as the Phase III Investigation.

3. SUBSURFACE STRATIGRAPHY

Schematics of the subsurface profiles at four cross sections in WB-13 were developed based on the previous site investigation results. The locations of these cross sections are shown in Figure 6 and the subsurface profiles are illustrated in Figures 7, 8, 9, and 10. The subsurface stratigraphy consists primarily of three types of material: SOLW, the dike soil, and the foundation soil. The dike was determined to be approximately 40 ft high based on topographic contours for dikes and surrounding areas outside the dikes on the north and west sides. The eastern and southern dikes of WB-13 are also the northwestern and northern dikes of Wastebeds 12 and 14, respectively. The natural soil beneath the dike and the SOLW was considered as the foundation soil.

3.1 SOLW

SOLW is a by-product of sodium carbonate (soda ash) production via the Solvay process (i.e., process by which soda ash is formed from salt, limestone, carbon dioxide, and ammonia). It is a combination of process residuals, unreacted material, and mineral salts that was deposited in slurry exhibiting a very high pH. The thickness of SOLW varies across WB-13 and is related to the shape of the three original pits. The native materials that were left in place between the pits formed “berms” that were buried during wastebed filling activities. Figure 11 shows the bottom elevation contours of SOLW that were developed based on the estimated SOLW thickness from CPTs and borings presented in Attachment 1, as well as the additional information regarding the buried berms obtained from the Phase III investigation. The SOLW thickness ranges between approximately 50 ft and 90 ft in the central areas of the three original pits.

SOLW in WB-13 can be divided into three zones based on different characteristics indicated by the results of CPTs (Figures 12, 13, and 14) and SPT blow counts (N values) (Figure 15) in different areas of WB-13:

- Zone 1 is defined as the “ring” area that is within approximately 150 ft from the inner edge of the WB-13 dike. SOLW in Zone 1 was generally described in the boring logs as gray, soft to medium dense, silt- and sand-sized particles in paste-like or semi-cemented matrix. CPT profiles of SOLW in Zone 1 show relatively high tip resistance, high sleeve friction, and small excess porewater pressure, which are characteristics of dense coarse grained material (Figure 12). Results of borings show much larger SPT N values for SOLW in Zone 1 than SOLW in the other two zones (Figure 15). During the operation of WB-13, SOLW was placed mainly from pipes placed along the dikes. The coarser particles of SOLW would have settled out first which can explain the observed matrix in Zone 1.

- Zone 2 is defined as the original Pit D area and the top 40 ft of the original Pit A and Pit C areas that are beyond the limit of Zone 1. The depth of 40 ft is selected as the boundary of

Zone 2 in the Pit A and Pit C areas because the profiles of CPT (Figure 14) and SPT N values (Figure 15) generally show sudden increase at this depth. SOLW in Zone 2 was generally described in the boring logs as white to gray, very soft to soft, silt-sized particles in paste-like matrix. CPT profiles of SOLW in Zone 2 generally show relatively low tip resistance, low sleeve friction, and large excess porewater pressure, which are characteristics of soft fine grained material (Figures 13 and 14). Results of borings indicate zero to very small SPT N values for SOLW in Zone 2 (Figure 15).

- Zone 3 is defined as the area from 40 ft below ground surface (bgs) to the top of foundation soil in the original Pit A and Pit C areas that are beyond the limit of Zone 1. Unlike SOLW in Zone 2 that is relatively uniform, SOLW in Zone 3 varied from very soft to dense silt-sized particles according to the boring logs. Inter-layered soft and hard layers of SOLW in Zone 3 result in a wider range of the tip resistance and the sleeve friction (Figure 14) and the SPT N values (Figure 15) than SOLW in Zone 2. The reason for the apparent absence of Zone 3 in Pit D is currently unknown. It is also unknown why Zone 3 material has unique characteristics as compared to Zone 2 material.

A summary of the SPT N values of SOLW in the three zones obtained from the site investigations between 2004 and 2007 is presented in Table 1. As indicated in the table, the SPT N value of SOLW in Zone 1 ranges from 0 to 74 with an average value of 17; the SPT N value of SOLW in Zone 2 ranges from 0 to 18 with an average value of 1; and the SPT N value of SOLW in Zone 3 ranges from 0 to 68 with an average value of 8. The SPT N values of SOLW in the three zones are also plotted in Figure 16 as a function of depth.

Using the correlations between the SPT N values and the consistency for cohesive soils shown in Table 2, SOLW in Zone 1, Zone 2, and Zone 3 can be classified as “very stiff”, “very soft”, and “medium stiff”, respectively, based on the calculated average SPT N values. The classification is consistent with the observations from the CPTs and the borings.

3.2 Dike Soil

Based on the observations during previous investigations, it appears that native material underneath the footprint of WB-13 was used to construct the dikes. Results of borings indicate that the dike soil consists of a mixture of clay, silt, sand, and gravel. Borings in the exterior dike of WB-13 indicate no SOLW underneath the dike. However, SOLW was encountered in borings drilled in the inter-cell dike between WB-13 and Wastebeds 12 and 14 at depths of approximately between 15 ft and 50 ft bgs as shown in Figure 17. It appears that part of the inter-cell dike was constructed on top of SOLW filled in Wastebeds 12 and 14.

A summary of the SPT N values of the dike soil (not including the SOLW under the inter-cell dike between WB-13 and Wastebeds 12 and 14) obtained from the site investigations between 2004 and 2007 is presented in Table 1. As indicated in the table, the SPT N value of the dike soil ranges from 5 to 127 with an average value of 36. The SPT N values of the dike soil are also plotted in Figure 18 as a function of depth.

Using the correlations between the SPT N values and the relative density for granular soils shown in Table 3, the dike soil can be classified as “dense” based on the calculated average SPT N value. The classification is consistent with the observations from the borings.

3.3 Foundation Soil

The foundation soil is the native material underneath the footprint of WB-13. Results of borings indicate that the foundation soil consists primarily of dense sand and gravel. A summary of the SPT N values of the foundation soil obtained from the site investigations between 2004 and 2007 is presented in Table 1. As indicated in the table, the SPT N value of the foundation soil ranges from 2 to 120 with an average value of 40, which is very similar to the value of the dike soil. The SPT N values of the foundation soil are plotted in Figure 18 as a function of depth along with the dike soil.

Using the same correlations shown in Table 3, the foundation soil can also be classified as “dense” based on the calculated average SPT N value. The classification is consistent with the observations from the borings.

4. GROUNDWATER TABLE

Information about the groundwater table (GWT) in WB-13 is available from: (i) piezometer measurements; (ii) CPT porewater dissipation tests, and (iii) borings.

4.1 GWT From Piezometers

The GWT has been monitored by the piezometers installed in November 2006. Figure 19 shows the locations of these piezometers. The data collected between November 30, 2006 and December 28, 2007 was provided to Geosyntec by Parsons and is presented in Attachment 2. The average GWT elevations and the average GWT depths during the monitoring period were calculated for each piezometer and the results are presented in Table 4. It is noted that the piezometers installed in the test pad area in September 2005 were not included in this evaluation, because the measured GWT has been affected by the excess water pressure generated due to the load of the test fill.

There are six locations inside WB-13 where the GWT has been monitored. At each location, 3 or

4 piezometers were installed and were screened at different depths ranging approximately from 15 ft to 64 ft bgs. Among these piezometers, 5 piezometers (i.e., SB915-PZ13-01N, -02N, -04N, -05N, and -06N) were screened in the natural soil underneath SOLW. The data collected from the piezometers indicate both shallow water levels recorded by the piezometers screened in SOLW and deep water levels recorded by the piezometers screened in the natural soil. Figure 20 presents the average measured groundwater table elevations with respect to the piezometer tip elevations. The average measured groundwater elevations along two cross sections shown on Figure 21 are plotted in Figures 22 and 23.

The results imply that "perched" groundwater exists in SOLW above the "real" GWT. The "perched" GWT is affected by precipitation and therefore fluctuates seasonally. In general, the seasonal high "perched" GWT occurs in April or May with depths of about 6 to 11 ft below the ground, except at the lowest point of WB-13 where the seasonal high "perched" GWT can be as high as 0.4 ft below the ground.

Three of the five piezometers screened in the natural soil indicate that the "real" GWT elevation in WB-13 is around 375 ft, while the other two (i.e., SB915-PZ13-02N and -05N, which are located near the WB-13 perimeter dike) indicate a relatively higher GWT elevation around 385 ft. A further review of the data from these two piezometers found that the measured groundwater levels by these two piezometers have experienced more fluctuation than the other three piezometers that were screened in the natural soil (See Table 4). Recently, the groundwater level at SB915-PZ13-02N has been below the piezometer tip elevation at 380.34 ft (Table 5) and the groundwater level at SB915-PZ13-05N has been below or very close to the piezometer tip elevation at 376.94 ft (Table 6). Based on the observations discussed above, the GWT in WB-13 was interpreted to be at the elevation of 375 ft. As compared to the interpreted GWT in WB-13, the water table in the adjacent Ninemile Creek is at approximately 372 ft.

The GWT in WB-13 has also been monitored by ten piezometers installed in or outside the WB-13 dike. However, the tip elevations of these piezometers are higher than the anticipated GWT elevation except for piezometer SB915-PZ13-10, which is located outside the WB-13 perimeter dike. The average GWT elevation measured by SB915-PZ13-10 is 373.2 ft, which confirms the interpretation of GWT presented in the preceding paragraph.

4.2 GWT From CPT Porewater Dissipation Tests

The GWT in WB-13 was estimated from the CPT porewater dissipation tests during the 2004, Phase I, and Phase II investigations. The test results are presented in Tables 7, 8, and 9. The GWT depth was estimated from the 2004 tests to range from 41.4 ft to 52.6 ft with an average depth of 50 ft bgs (excluding the test results at shallow depths of two CPT locations, PW-13A and PW-119). The

GWT depth was estimated from the Phase I tests to range from 41.2 ft to 59.4 ft with an average depth of 55 ft bgs (excluding the test results at shallow depths of one CPT location, SB915-CPT-A3). In the Phase II tests, only the tests with depth greater than 45 ft were considered for the estimation of the GWT. The GWT depth was estimated from the Phase II tests to range from 33.1 ft to 65.9 ft with an average depth of 51.8 ft bgs. The results of the CPT porewater dissipation tests are in general consistent with the monitoring data from the piezometers. A 50 to 55 ft depth corresponds to a GWT elevation of approximately 370 to 375 ft.

4.3 GWT From Borings

The GWT was measured during boring activities in the 2004 Investigation and the results are summarized in Table 10. Because of the existence of the "perched" groundwater in SOLW, some of the borings inside WB-13 and near the crest of WB-13 dike recorded shallow GWTs or several different GWTs. The GWTs measured in the borings at the toe of the WB-13 dike range from 44.5 ft to 63.3 ft below the WB-13 ground surface. The deep GWTs measured in the borings inside WB-13 and near the crest of WB-13 dike range between 38 ft and 73.5 ft bgs. The results are consistent with the GWTs estimated from the piezometers and the CPT pore water dissipation tests.

Based on the data collected from the piezometers, the results of the CPT porewater dissipation tests, and the measurements during borings, the "real" GWT was estimated to be at the elevation of approximately 375 ft in WB-13, which is equivalent to approximately 50 ft bgs assuming that the average elevation of the existing WB-13 ground is 425 ft, for the purpose of geotechnical analyses. The piezometer data indicates there are zones of perched water within the wastebed.

5. MATERIAL PROPERTIES

Material properties were obtained from laboratory tests or empirical correlations. Laboratory tests were performed on samples taken during the site investigations.

Laboratory tests include:

- Index property tests (i.e., water content, grain size, Atterberg limits, specific gravity, and density); and
- Performance tests (i.e., unconsolidated undrained (UU) triaxial compression tests, consolidated undrained (CU) triaxial compression tests with porewater pressure measurement, one-dimensional consolidation tests, and hydraulic conductivity tests).

Summary tables of the lab test results were provided to Geosyntec by Parsons and are presented in Attachment 3.

5.1 Index Properties

5.1.1 Water Content

Water contents were measured for the index property tests performed during the 2004, Phase I, Phase II, and Phase III investigations, and for the UU tests, and the CU tests performed during the 2004, Phase I, and Phase II investigations. The data is plotted with respect to depth in Figure 24 for SOLW in three zones and in Figure 25 for the dike soil and the foundation soil. The results of the measured water contents are summarized in Table 11. As indicated in the table, the water content of SOLW covers a wide range between 5% and 912%. The average water content was calculated to be 166%, 227%, and 172% for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The dike soil and the foundation soil, which consist primarily of sand and gravel, have much lower water contents than SOLW. The average water content was calculated to be 13% and 16% for the dike soil and the foundation soil, respectively. The calculated average water content for each material is recommended to be used for design.

5.1.2 Grain Size

The fine size particle content (i.e., clay size and silt size particles) was measured as part of the laboratory index property tests during all four investigations. Hydrometer tests were performed during the Phase II and Phase III investigations to further measure the clay size particle content (i.e., particle size less than 0.002 mm). Based on the lab results, the average fine size particle content was calculated to be 50.5%, 83.6%, and 65.7% for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The average clay size particle content was calculated to be 4.9%, 15.9%, and 8.7% for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The average fine size particle content was calculated to be 63.1% and 33.3% for the dike soil and the foundation soil, respectively. The average clay size particles content was calculated to be 21.8% and 7.7% for the dike soil and the foundation soil, respectively.

5.1.3 Atterberg Limits

The Atterberg limits were measured from the index property tests performed during all four investigations. The results of the plastic limit, the liquid limit, and the plasticity index are summarized in Table 12.

As indicated in Table 12, the plastic limit of SOLW ranges from 62 to 245. The average plastic limit was calculated to be 109, 139, and 130 for SOLW in Zone 1, Zone 2, and Zone 3, respectively.

The plastic limit of the dike soil ranges from 11 to 49 with a calculated average value of 20. The plastic limit of the foundation soil ranges from 10 to 53 with a calculated average value of 26.

The liquid limit of SOLW ranges from 80 to 241. The average liquid limit was calculated to be 145, 168, and 150 for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The liquid limit of the dike soil ranges from 10 to 66 with a calculated average value of 19. The liquid limit of the foundation soil ranges from 13 to 57 with a calculated average value of 29.

The results of the plasticity index (i.e., the difference between the liquid limit and the plastic limit) are plotted with respect to depth in Figure 26 for SOLW in three zones and in Figure 27 for the dike soil and the foundation soil. The plasticity index of SOLW ranges from 12 to 138. The average plasticity index was calculated to be 36, 55, and 69 for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The dike soil and the foundation soil, which consist primarily of sand and gravel, have much lower plasticity indices than SOLW. The plasticity index of the dike soil ranges from 6 to17 with a calculated average of 10. The plasticity index of the foundation soil ranges from 3 to 30 with a calculated average of 11.

The calculated average plastic limit, liquid limit, and plasticity index for each material are recommended to be used for design.

5.1.4 Specific Gravity

The specific gravity was measured as part of the index property tests performed during all four investigations. The average specific gravity was calculated to be 2.57, 2.50, and 2.47 for SOLW in Zone 1, Zone 2, and Zone 3, respectively. Because these three average values are very close, a uniform specific gravity of 2.51 is recommended for design, which represents the average specific gravity of SOLW in all three zones. The average specific gravity was calculated to be 2.71 and 2.65 for the dike soil and the foundation soil, respectively. It is noted that the unit weights of the materials were measured from bulk density tests or calculated using measured water content and dry density. Therefore, the specific gravity values were not used to estimate any design parameters.

5.1.5 Unit Weight

The total unit weight of SOLW was measured from the index property tests performed during the 2004, Phase I, Phase II, and Phase III investigations or calculated using the initial water content and the dry density measured from the UU and CU tests performed during the 2004, Phase I, and Phase II investigations. The data is plotted with respect to depth in Figure 28. The results of the measured total unit weight are summarized in Table 13. As indicated in the table, the total unit weight of SOLW ranges from 55 pcf to 139 pcf. The average total unit weight was calculated to be 84 pcf, 82 pcf, and 82 pcf for SOLW in Zone 1, Zone 2, and Zone 3, respectively. Because these three average values are very close, a uniform total unit weight of 82 pcf is recommended for design, which represents the average total unit weight of SOLW in all three zones.

The total unit weight of the foundation soil was calculated using the initial water content and the dry density measured from the Phase II CU tests. The results are presented in Table 13 and also plotted in Figure 28. The total unit weight of the foundation soil ranges from 118 to 124 with a calculated average of 121. A value of 120 pcf is recommended for design.

Since undisturbed samples of dike material could not be collected in the field, the total unit weight of the dike soil could not be measured in the lab. The total unit weight of the dike soil is assumed to be 120 pcf.

5.2 Compressibility Parameters

5.2.1 Preconsolidation Pressure and Overconsolidation Ratio

The preconsolidation pressure ($p_c^{'}$) of SOLW was estimated from the 2004, Phase I, Phase II, and Phase III one-dimensional consolidation test results. The results of $p_c^{'}$ (see Attachment 3) are plotted with respect to depth in Figure 29. The profile of the in-situ vertical effective stress is also plotted in the same figure using the total unit weight of 82 pcf for SOLW and the GWT at 50 ft bgs as discussed in the previous sections. Figure 29 shows a wide scatter of $p_c^{'}$ values. However, the profiles of $p_c^{'}$ and the in-situ vertical effective stress are consistent with overconsolidation of soil in shallow depths by desiccation.

The overconsolidation ratio (OCR), which is the ratio of $p_c^{'}$ to the in-situ vertical effective stress, was calculated and is plotted in Figure 30 as a function of depth. Based on the plot, SOLW above 20 ft is considered to be overconsolidated and SOLW below 20 ft is considered to be normally consolidated. The average OCR above 10 ft was calculated to be 4.5. The average OCR between 10 ft and 20 ft was calculated to be 2.0. The OCR for the normally consolidated SOLW below 20 ft is 1.0. The recommended OCR for design is also plotted in Figure 30.

5.2.2 Modified Compression Index

The modified compression index ($C_{c\varepsilon}$) of SOLW was measured from the 2004, Phase I, Phase II and Phase III one-dimensional consolidation test results. The results of $C_{c\varepsilon}$ are plotted with respect to depth in Figure 31. A summary of the test results are presented in Table 14.

The $C_{c\varepsilon}$ for SOLW in Zone 1 ranges between 0.15 and 0.50 with an average value of 0.34 based on seven consolidation tests. The $C_{c\varepsilon}$ for SOLW in Zone 2 ranges between 0.21 and 0.71 with an average value of 0.46 based on twenty-five consolidation tests. The $C_{c\varepsilon}$ for SOLW in Zone 3 ranges between 0.21 and 0.46 with an average value of 0.38 based on five consolidation tests. The results indicate the compressibility of SOLW in Zone 2 is in general greater than the compressibility of SOLW in Zone 1 and Zone 3.

The calculated average $C_{c\varepsilon}$ of SOLW in each zone is recommended to be used for design.

5.2.3 Modified Recompression Index

The modified recompression index ($C_{r\varepsilon}$) of SOLW was measured from the 2004, Phase I, Phase II, and Phase III one-dimensional consolidation tests. The results of $C_{r\varepsilon}$ are plotted with respect to depth in Figure 32. A summary of the test results are presented in Table 15.

The $C_{r\varepsilon}$ for SOLW in Zone 1 ranges between 0.01 and 0.02 with an average value of 0.015 based on seven consolidation tests. The $C_{r\varepsilon}$ for SOLW in Zone 2 ranges between 0.004 and 0.025 with an average value of 0.014 based on twenty-five consolidation tests. The $C_{r\varepsilon}$ for SOLW in Zone 3 ranges between 0.003 and 0.034 with an average value of 0.021 based on five consolidation tests.

The calculated average $C_{r\varepsilon}$ of SOLW in each zone is recommended for SCA design.

5.2.4 Modified Secondary Compression Index

The modified secondary compression index ($C_{a\varepsilon}$) of SOLW was interpreted from the 2004, Phase I, Phase II, and Phase III one-dimensional consolidation tests. The results of $C_{a\varepsilon}$ are plotted as a function of the stress ratio $\sigma_v^{'}/P_c^{'}$, where $\sigma_v^{'}$ is the vertical effective stress, in Figures 33, 34, and 35 for SOLW in Zone 1, Zone 2, and Zone 3, respectively. The plots indicate that the values of $C_{a\varepsilon}$ are affected by the stress history. Larger values of $C_{a\varepsilon}$ were obtained for stress levels greater than $p_c^{'}$ (i.e., at stresses corresponding to virgin compression).

The average value of $C_{a\varepsilon}$ for SOLW in Zone 1 was calculated to be 0.13% for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.83% for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on seven consolidation tests. The average value of $C_{a\varepsilon}$ for SOLW in Zone 2 was calculated to be 0.11% for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.91%

for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on twenty-five consolidation tests. The average value of $C_{a\varepsilon}$ for SOLW in Zone 3 was calculated to be 0.07% for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.70% for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on five consolidation tests.

The calculated average value of $C_{a\varepsilon}$ for SOLW in each zone is recommended to be used for design. The final effective stress in SOLW after primary consolidation is completed should be evaluated in order to assess the value of $C_{a\varepsilon}$, because the $C_{a\varepsilon}$ is dependent on the stress level.

5.2.5 Coefficient of Consolidation

The coefficient of consolidation (c_v) of SOLW was interpreted from the 2004, Phase I, Phase II, and Phase III laboratory one-dimensional consolidation tests as well as the Phase I field settlement test.

c_v from Laboratory Tests

The coefficient of consolidation (c_v) of SOLW was interpreted from the 2004, Phase I, Phase II, and Phase III one-dimensional consolidation tests. The results of c_v are plotted as a function of the stress ratio $\sigma_v^{'}/P_c^{'}$ in Figures 36, 37, and 38 for SOLW in Zone 1, Zone 2, and Zone 3, respectively. Similar to the $C_{a\varepsilon}$, the plots indicate that the values of c_v are also affected by the stress history. Larger values of c_v were obtained for stress levels smaller than $p_c^{'}$ (i.e., at stresses corresponding to recompression).

The average value of c_v for SOLW in Zone 1 was calculated to be 0.047 cm^2/s for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.029 cm^2/s for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on seven consolidation tests. The average value of c_v for SOLW in Zone 2 was calculated to be 0.046 cm^2/s for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.009 cm^2/s for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on twenty-five consolidation tests. The average value of c_v for SOLW in Zone 3 was calculated to be 0.024 cm^2/s for $\sigma_v^{'}/P_c^{'}$ less than or equal to 1 and 0.008 cm^2/s for $\sigma_v^{'}/P_c^{'}$ greater than 1 based on five consolidation tests.

The calculated average value of c_v for SOLW in each zone is recommended to represent the c_v from the lab test. The final effective stress in SOLW under the load should be evaluated in order to assess the value of c_v, because the c_v is dependent on the stress level.

c_v from Field Settlement Test

The WB-13 settlement pilot study was conducted in 2005 to evaluate the settlement of SOLW under the constructed test fill. Field monitoring data collected by the piezometers and the settlement plates installed in the test pad were interpreted, and the results are presented in Attachment 4 of this package. The c_v of SOLW obtained from the field settlement test is plotted in Figure 39 as a function of time. The results indicate that the c_v of SOLW decreases with time from an upper range of 0.2 to 0.76 cm^2/s to a lower range of 0.06 to 0.13 cm^2/s. The average value of the c_v after 40 days, i.e., the relatively flat portion of the curve in Figure 39, was calculated to be 0.14 cm^2/s and is recommended to represent the c_v for SOLW in all three zones based on the field settlement test.

Comparison of c_v from Field Settlement Test and Lab Test

The results of c_v of SOLW from the field settlement test are about an order of magnitude higher than the lab values. The difference may be attributed to the fact that in the field test the drainage of water from SOLW may have been in both vertical and horizontal directions, while in the lab test the water was only allowed to drain vertically. The quicker the water was drained, the larger the value of c_v. Therefore, use of the c_v from the field test or the lab test in design depends on the actual loading condition. If the footprint of the load is relatively large and the consolidation of SOLW under the load can be considered one-dimensional (i.e., vertical drainage only), the c_v from the lab test is recommended for use in design. On the other hand, if the load is applied to a relatively small footprint and the drainage of water from SOLW can take place both vertically and horizontally, the c_v from the field test is recommended for use in design.

5.3 Shear Strength Parameters

5.3.1 Undrained Shear Strength Ratio

The undrained shear strength ratio (S_u/σ_3'), where σ_3' is the effective confining stress, was calculated based on the 2004, Phase I, and Phase II CU tests for SOLW. The results of S_u/σ_3' are plotted with respect to σ_3' measured from the lab in Figure 40. The lower bound of the S_u/σ_3' is estimated to be approximately 0.3 and the upper bound is estimated to be approximately 0.8 for SOLW in the three zones.

5.3.2 Undrained Shear Strength

The undrained shear strength (S_u) of SOLW was measured from the 2004, Phase I, and Phase II UU tests. The measured S_u is plotted with respect to depth in Figure 41 for SOLW in the three zones. The results are summarized in Table 16.

The S_u varies with depth. As indicated in Table 16, the average S_u was calculated to be 592 psf and 633 psf for SOLW in Zone 1 and Zone 2, respectively, at depths above 20 ft. The average S_u was calculated to be 1113 psf and 780 psf for SOLW in Zone 1 and Zone 2, respectively, at depths between 20 ft and 40 ft. The average S_u was calculated to be 719 psf and 899 psf for SOLW in Zone 2 and Zone 3, respectively, at depths below 40 ft. It is noted that the S_u values greater than 2000 psf were conservatively not included in the calculation of the average values.

An empirical correlation was also used to estimate the S_u. The equation of this empirical correlation [Kulhawy and Mayne, 1990] can be written as:

$$S_u = \left(\frac{S_u}{\sigma_v^{'}}\right)_{NC} \cdot OCR^{0.8} \cdot \sigma_v^{'}$$

where, $\left(\frac{S_u}{\sigma_v^{'}}\right)_{NC}$ is the undrained shear strength ratio for normally consolidated soil. Using the OCR recommended in the previous section and $\left(\frac{S_u}{\sigma_v^{'}}\right)_{NC}$ equal to 0.3, it appears that this empirical correlation predicts the measured S_u well for SOLW above approximately 45 ft, but it over-predicts the S_u below 45 ft.

Based on the measured S_u from the UU tests and the estimated S_u from the empirical correlation, the S_u for design (as shown in Figure 41) is recommend to be 600 psf for SOLW above 20 ft and 700 psf for SOLW between 20 ft and 30 ft. The S_u increases linearly to 1200 psf at a depth of 50 ft and 1400 psf at a depth of 80 ft.

5.3.3 Effective Stress Friction Angle

The effective stress friction angle ($\phi^{'}$) was measured from the 2004, Phase I, and Phase II CU tests for SOLW. The calculated average $\phi^{'}$ based on the lab test results is presented in Table 17. The effective stress cohesion c' was conservatively considered to be zero for SOLW. Based on the calculated average ϕ', a uniform value of ϕ' equal to 34° is conservatively recommended for design for SOLW in all three zones.

Only one CU test was performed on the foundation soil. The ϕ' was reported to be 18° and the c' was reported to be 1420 psf as shown in Table 17. As an alternative method, the empirical relationship between the ϕ' and the SPT N value shown in Table 18 [Kulhawy and Mayne, 1990] was used to estimate the ϕ'. Using an average SPT N value of 40 recommended in the previous section, the ϕ' of the foundation soil was estimated to be approximately 37°.

The ϕ' for the dike soil was also estimated by the same empirical relationship shown in Table 18. Using an average SPT N value of 36 recommended in the previous section, the ϕ' of the dike soil was estimated to be approximately 37°.

5.4 Hydraulic Conductivity

Five laboratory hydraulic conductivity tests were performed on SOLW samples during the 2004 investigation. In addition, four in-situ permeability tests (slug tests) were conducted in WB-13 during the 2004 investigation. The lab and field test results are presented together in Table 19.

The measured hydraulic conductivities for SOLW in Zone 2 and Zone 3 vary from 1.30×10^{-6} cm/s to 1.83×10^{-5} cm/s and the values are within the typical range of hydraulic conductivity for silt and silty clay materials (i.e., 10^{-7} to 10^{-9} m/s or 10^{-5} to 10^{-7} cm/s) as shown in Table 20. The average hydraulic conductivity was calculated to be 4.3×10^{-6} cm/s and 2.2×10^{-6} cm/s for SOLW in Zone 2 and Zone 3, respectively, based on the test results. The hydraulic conductivity of SOLW in Zone 1 is not available. Based on the observation that SOLW in Zone 1 consists of coarse particles and the excess water pressure dissipates relatively quickly during CPT, its hydraulic conductivity was estimated to be 10^{-5} cm/s, which is the lower bound for the silty sand material as shown in Table 20.

5.5 Recommended Material Properties For Design

Based on the discussion of material properties presented above, the recommended index properties, compressibility parameters, shear strength parameters, and hydraulic conductivity of SOLW, the dike soil, and the foundation soil for the SCA design are summarized in Table 21.

6. VERIFICATION OF SUBSURFACE MODEL AND DESIGN PARAMETERS

The subsurface model and the design material properties (i.e., unit weight and compressibility parameters) of SOLW were verified using the results of the WB-13 settlement pilot test performed in 2005.

The predicted primary consolidation settlement is plotted in Figure 42 with respect to the settlement measured on January 10, 2008 (i.e., approximately 2.3 years after the placement of the test fill) from the field test as presented in Attachment 4. The plotted data points are in general close to the 45 degree line, indicating a good agreement between the predicted settlement and the settlement from the field test. In addition, the time rate of the consolidation settlement was also evaluated using the average c_v value from the field measurements. It is noted that this value is an order of magnitude higher than the c_v values from lab tests. The results of the predicted primary settlement are plotted with respect to time and compared with the field monitoring data in Figures 43, 44, 45, and 46 at four different locations. The comparison also shows a good agreement between the predicted and field measured time rate of the consolidation settlement. Detailed descriptions of the methodology and the engineering calculation of the primary consolidation settlement and the time rate consolidation are presented in Attachment 4.

7. REFERENCE

AASHTO (1988). "Manual on Subsurface Investigations", Washington, D.C., American Association of State Highway Transportation Officials.

Kulhawy, F.H. and Mayne, P.W. (1990). "Manual on Estimating Soil Properties for Foundation Design", EPRI EL-6800, Project 1493-6, August 1990.

Parsons and Geosyntec (2008a). "Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Data Summary Report", Onondaga County, New York.

Parsons (2008b). "Wastebed 13 Settlement Pilot Study Monitoring Data – Year 2".

Parsons (2008c). "Draft Onondaga Lake Pre-Design Investigation: Phase II Data Summary Report".

Parsons (2009). "Draft Onondaga Lake Pre-Design Investigation Phase III Data Summary Report".

Tables

Table 1. Summary of SPT N Values

Material		SPT N Values		
		Range	Average	Standard Deviation
SOLW	Zone 1	0 - 74	17	16
	Zone 2	0 - 18	1	2
	Zone 3	0 - 68	8	11
Dike Soil		5 - 127	36	22
Foundation Soil		2 - 120	40	23

Table 2. Correlation of Consistency for Cohesive Soils [AASHTO, 1988]

SPT N Value	Consistency
0~1	Very soft
2~4	Soft
5~8	Medium Stiff
9~15	Stiff
16~30	Very Stiff
31~60	Hard
>60	Very hard

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

Table 3. Correlation of Relative Density for Granular Soils [AASHTO, 1988]

SPT N Value	Relative Density
0~4	Very loose
5~10	Loose
11~24	Medium Dense
25~50	Dense
>50	Very dense

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

Table 4. Summary of GWT Data from Piezometers
[Based on data provided in Attachment 2]

Piezometer Location	Serial Number	Date Installed	Depth to Piezometer Tip from Ground Surface (ft)	Initial Ground Surface Elevation (ft)	Piezometer Tip Elevation (ft)	Type	Average GWT Depth (ft, bgs)	Average GWT Elevation (ft)	GWT Variation (ft)
Wastebed Piezometers									
SB915-PZ13-01S	06-20309	11/10/2006	19.5	430.89	411.39	Typ VW	16.4	414.5	>9.5
SB915-PZ13-01D	06-19784	11/10/2006	39.5	430.89	391.39	Typ VW	30.8	400.1	N/A
SB915-PZ13-01N	06-19773	11/9/2006	63.5	430.89	367.39	Typ VW	57.4	373.5	3.6
SB915-PZ13-02I	06-20310	11/8/2006	19.9	430.34	410.44	Typ VW	16.4	414.0	>11.4
SB915-PZ13-02D	06-20305	11/8/2006	36.5	430.34	393.84	Typ VW	35.7	394.7	>1.5
SB915-PZ13-02N	06-19778	11/7/2006	50	430.34	380.34	Typ VW	44.3	386.0	>10.6
SB915-PZ13-03S	06-20308	11/14/2006	20.5	429.17	408.67	Typ VW	11.1	418.1	>12.3
SB915-PZ13-03I	06-19786	11/13/2006	40.2	429.17	388.97	Typ VW	24.8	404.3	23.8
SB915-PZ13-03D	06-19775	11/13/2006	59.5	429.17	369.67	Typ VW	28.8	400.3	29.2
SB915-PZ13-04S	06-19781	11/20/2006	15.5	419.10	403.60	Typ VW	6.1	413.0	>14.1
SB915-PZ13-04I	06-19774	11/20/2006	35.5	419.10	383.60	Typ VW	11.8	407.3	25.4
SB915-PZ13-04D	06-19776	11/17/2006	52.5	419.10	366.60	Typ VW	14.2	404.9	24.6
SB915-PZ13-04N	NA	11/16/2006	113	418.6	305.6	SP	44.2	374.4	3.1
SB915-PZ13-05S	06-20311	11/6/2006	14.8	432.94	418.14	Typ VW	11.8	421.1	N/A
SB915-PZ13-05I	06-19785	11/3/2006	35	432.94	397.94	Typ VW	30.8	402.1	>6.8
SB915-PZ13-05N	06-19772	11/3/2006	56	432.94	376.94	Typ VW	47.4	385.5	>13.4
SB915-PZ13-06S	06-20307	11/7/2006	19.5	428.67	410.5	Typ VW	13.4	415.2	>9.1
SB915-PZ13-06I	06-20306	11/6/2006	34.5	428.67	395.5	Typ VW	19.7	409.0	>10.7
SB915-PZ13-06D	06-19771	11/6/2006	49.5	428.67	380.5	Typ VW	28.6	400.1	29.7
SB915-PZ13-06N	06-19769	11/3/2006	64	428.67	366	Typ VW	53.8	374.8	4.6
Dike Piezometers									
SB915-PZ13-07	06-19782	11/14/2006	54	438.23	384.23	Typ VW	53.1	385.1	0.8
SB915-PZ13-08	NA	11/27/2006	40	431.35	391.35	SP	39.8	391.5	>0.0
SB915-PZ13-09	06-19783	11/16/2006	36.5	432.48	395.98	Typ VW	36.1	396.4	>0.8
SB915-PZ13-10	NA	11/29/2006	32	397.45	365.45	SP	24.3	373.2	4.0
SB915-PZ13-11	06-19787	11/17/2006	41	432.44	391.44	Typ VW	40.7	391.7	>0.4
SB915-PZ13-12	NA	11/28/2006	25	431.51	406.51	SP	22.9	408.7	>9.9
SB915-PZ13-13	06-19779	11/21/2006	30	434.26	404.26	Typ VW	26.2	408.0	5.2
SB915-PZ13-14	06-19780	11/27/2006	30	443.67	413.67	Typ VW	19.8	423.9	15.1
SB915-PZ13-15	06-19770	11/29/2006	30	446.56	416.56	Typ VW	22.6	423.9	13.1
SB915-PZ13-16	NA	11/22/2006	30	441.08	411.08	SP	17.1	424.0	10.4

Notes:
Typ VW = Typical Vibrating Wire Piezometer (GeoKon model 4500S)
SP = Standpipe
NA = Not Applicable

Notes:

1. Piezometers inside WB-13 that were screened in natural soil underneath SOLW are highlighted in the table.
2. Piezometers inside WB-13 with S (shallow), I (intermediate), and D (deep) at the end of their names were screened in SOLW and with N (native) at the end of their names were screened in the natural soil underneath SOLW.
3. Results of GWT depths and elevations presented in this table were calculated based on the piezometer data as of December 28, 2007.

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
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Table 5. Record of Groundwater Level Elevations Measured at Piezometer SB915-PZ13-02N

SB915-PZ13-02N Serial # 06-19778
Typical Vibrating Wire Piezometer
Date Installed: 11/7/2006

Bentonite Seal =	0 to 48.1	ft
Sandpack =	48.1 to 50.5	ft
Depth to Piezometer Tip from Ground Surface =	50	ft
Ro =	8954.3	
To =	11.6	degrees Celsius
Linear Gage Factor (psi) =	0.01583	psi/digit
Thermal Factor =	0.00182	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	430.34	ft
Piezometer Tip Elevation =	380.34	ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 13:16	8921	11.9	0.5	1.2	48.8	381.6
12/14/06 11:21	8900	11.9	0.9	2.0	48.0	382.3
12/21/06 12:01	8863.5	11.9	1.4	3.3	46.7	383.7
12/28/06 11:56	8839.3	11.9	1.8	4.2	45.8	384.5
1/11/07 13:08	8786.6	11.9	2.7	6.1	43.9	386.5
2/8/07 11:49	8807.4	11.9	2.3	5.4	44.6	385.7
3/9/07 9:48	8811.7	11.8	2.3	5.2	44.8	385.5
4/12/07 10:26	8643.3	11.8	4.9	11.4	38.6	391.7
5/10/07 14:41	8630.8	11.7	5.1	11.8	38.2	392.2
6/21/07 11:43	8755	11.7	3.2	7.3	42.7	387.6
7/12/07 11:24	8769.5	11.7	2.9	6.8	43.2	387.1
8/15/07 11:46	8847.2	11.7	1.7	3.9	46.1	384.2
9/21/07 11:31	8977.5	11.7	-0.4	-0.8	>=50 ft	
10/26/07 11:55	8981.5	11.7	-0.4	-1.0	>=50 ft	
11/28/07 10:16	8982.7	11.7	-0.4	-1.0	>=50 ft	
12/28/07 11:30	8966.1	11.7	-0.2	-0.4	>=50 ft	

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Table 6. Record of Groundwater Level Elevations Measured at Piezometer SB915-PZ13-05N

SB915-PZ13-05N Serial # 06-19772
Typical Vibrating Wire Piezometer
Date Installed: 11/3/2006

Bentonite Seal =	0 to 54	ft
Sandpack =	54 to 56.5	ft
Depth to Piezometer Tip from Ground Surface =	56	ft
Ro =	9073.3	
To =	6	degrees Celsius
Linear Gage Factor (psi) =	0.01666	psi/digit
Thermal Factor =	0.01085	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	432.94	ft
Piezometer Tip Elevation =	376.94	ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 14:03	8837.8	11.3	4.0	9.2	46.8	386.1
12/14/06 11:53	8814.6	11.3	4.4	10.1	45.9	387.0
12/21/06 12:44	8818.3	11.3	4.3	9.9	46.1	386.9
12/28/06 12:24	8797.6	11.3	4.7	10.7	45.3	387.7
1/11/07 13:42	8696	11.5	6.3	14.6	41.4	391.6
2/8/07 12:03	8713.2	11.3	6.1	14.0	42.0	390.9
3/9/07 10:04	9034.3	11.3	0.7	1.6	54.4	378.6
4/12/07 10:46	8735.7	11.3	5.7	13.1	42.9	390.1
5/10/07 15:05	8733	11.3	5.7	13.2	42.8	390.2
6/21/07 12:32	8978.9	11.3	1.6	3.8	52.2	380.7
7/12/07 12:27	9044.4	11.3	0.5	1.2	54.8	378.2
8/15/07 12:36	9118.5	11.3	-0.7	-1.6	>=56 ft	
9/21/07 12:02	9117	11.3	-0.7	-1.5	>=56 ft	
10/26/07 12:23	9121.3	11.1	-0.7	-1.7	>=56 ft	
11/28/07 10:46	9126.1	11.1	-0.8	-1.9	>=56 ft	
12/28/07 10:55	9034.2	11.1	0.7	1.6	54.4	378.6

Table 7. Summary of 2004 CPT Porewater Dissipation Tests [Parsons and Geosyntec, 2008a]

ESTIMATED WATER TABLE ELEVATIONS FROM PORE WATER DISSIPATION TESTS

CPT Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)	CPT Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)
PW-128	68.9	49.6	**PW-13D**	86.5	49.6
PW-107	67.1	49.6	**PW-12B**	66.4	49.6
PW-140	49.4	49.6	**PW-131**	79.4	49.6
PW-13A	14.3 35.3 80.2	8 18.1 52.6	**PW-12E**	61.7	49.6
PW-11D	78.7	49.6	**PW-113**	Not Available	Not Available
PW-10B	Not Available	Not Available	**PW-119**	20.5 36.6 50.0 56.0	9.3 15.6 46.2 48.5
PW-122	52.8	41.4	**PW-10A**	64.0	52.1
PW-11F	64.6	50.4	**PW-11C**	Not Available	Not Available
PW-134	44.3	49.6	**PW-125**	75.1	50.8
PW-116	Not Available	Not Available	**PW-137**	80.2	51.9

Note: The water table depths listed were estimated by ConeTec, and at many locations the depth to water represents perched water, and not the regional water table.

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Table 8. Summary of Phase I CPT Porewater Dissipation Tests [Parsons and Geosyntec, 2008a)]

Phase I Pre-Design Investigation
Estimated Water Table Levels from CPT Pore Water Pressure Dissipation Tests

CPTu Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)
SB915-CPT-2	80.05	58.59
SB915-CPT-3	80.05	58.96
SB915-CPT-A3	15.09	16.58
	27.07	21.93
	30.02	26.54
	79.4	58.98
SB915-CPT-A4	80.05	59.04
SB915-CPT-A5	45.44	41.27
SB915-CPT-A7	73.82	59.37
SB915-CPT-A8	80.05	57.69
SB915-CPT-A9	80.05	58.56
SB915-CPT-A11	46.42	41.22

Note:
The water table depths listed were estimated by ConeTec, and at many locations the depth to water represents perched water, and not the regional water table.

Table 9. Summary of Phase II CPT Porewater Dissipation Tests [Parsons, 2008c]

Phase II Pre-Design Investigation
Estimated Water Table Elevations from Pore Water Pressure Dissipation Tests

Location	Dissipation Test Depth (ft)	Estimated Water Head at Equilibrium (ft)	Estimated Water Table Depth (ft)[1]
SB915-CPT-17	15.42	0.00	15.42
SB915-CPT-17	30.68	0.00	30.68
SB915-CPT-17	40.52	0.00	40.52
SB915-CPT-22	15.09	0.83	14.26
SB915-CPT-22	30.02	0.60	29.42
SB915-CPT-22	45.11	4.73	40.38
SB915-CPT-22	54.79	7.37	47.42
SB915-CPT-27	15.09	0.61	14.48
SB915-CPT-27	30.02	2.42	27.6
SB915-CPT-27	41.5	NA[2]	NA[2]
SB915-CPT-28	16.57	0.00	16.57
SB915-CPT-28	27.89	0.00	27.89
SB915-CPT-33	15.09	0.00	15.09
SB915-CPT-33	30.02	0.72	29.3
SB915-CPT-33	45.11	NA[2]	NA[2]
SB915-CPT-33	54.63	0.30	54.33
SB915-CPT-40	15.09	0.00	15.09
SB915-CPT-40	30.02	NA[2]	NA[2]
SB915-CPT-40	46.1	NA[2]	NA[2]
SB915-CPT-45	15.09	NA[2]	NA[2]
SB915-CPT-45	30.02	1.06	28.96
SB915-CPT-45	45.11	5.00	40.11
SB915-CPT-45	65.29	3.60	61.69
SB915-CPT-49	15.09	1.21	13.88
SB915-CPT-49	30.02	4.00	26.02
SB915-CPT-49	45.11	9.00	36.11
SB915-CPT-49	73.98	16.06	57.92
SB915-CPT-50	78.25	18.20	60.05
SB915-CPT-51	15.58	NA[2]	NA[2]
SB915-CPT-51	31.17	1.05	30.12
SB915-CPT-51	49.21	0.00	49.21
SB915-CPT-51	55.77	NA[2]	NA[2]
SB915-CPT-51	65.62	7.58	58.04
SB915-CPT-53	73.82	17.00	56.82
SB915-CPT-55	91.86	32.76	59.1
SB915-CPT-59	25.43	2.63	22.8
SB915-CPT-59	40.35	6.00	34.35
SB915-CPT-59	55.94	6.67	49.27
SB915-CPT-59	89.73	24.09	65.64
SB915-CPT-59A	93.5	27.58	65.92
SB915-CPT-64	15.09	0.60	14.49
SB915-CPT-64	30.18	10.00	20.18
SB915-CPT-64	45.11	12.00	33.11
SB915-CPT-64	73.65	21.52	52.13
SB915-CPT-71	15.09	0.00	15.09
SB915-CPT-71	30.02	10.00	20.02
SB915-CPT-71	45.11	NA[2]	NA[2]
SB915-CPT-71	67.42	21.82	45.6
SB915-CPT-74	80.54	22.42	58.12
SB915-CPT-78	15.09	1.43	13.66
SB915-CPT-78	30.02	3.00	27.02
SB915-CPT-78	45.11	8.00	37.11
SB915-CPT-78	75.79	21.25	54.54
SB915-CPT-80	63.16	13.75	49.41
SB915-CPT-81	55.12	0.00	55.12
SB915-CPT-82	15.09	NA[2]	NA[2]
SB915-CPT-82	30.02	1.52	28.5
SB915-CPT-82	45.6	0.00	45.6
SB915-CPT-82	62.01	8.40	53.61
SB915-CPT-86	64.3	8.03	56.27
SB915-CPT-87	74.31	17.27	57.04

Notes:

1. The water table depths were estimated from the water heads at equilibrium, which were interpreted from the pore water dissipation tests. It should be noted that in many cases a perched water zone, not the regional water table, is identified through this interpretation process.

2. NA indicates the water table depth is not available because the pore water pressure did not reach equilibrium within a reasonable timeframe (i.e., by the end of the test) or the water head at equilibrium was negative (i.e., the probe was above the water table).

Table 10. Summary of GWT Data Measured from Borings in WB-13 during 2004 Investigation

Boring ID	Boring Location	Boring Depth (ft, bgs)	GWT Depth (ft, bgs)[1]
SB915-SB-01	Toe of WB-13 dike	30	4.5
SB915-SB-02	Crest of WB-13 dike	50	18, 28, 36, 38
SB915-SB-03	Toe of WB-13 dike	30	23.3
SB915-SB-04	Crest of WB-13 dike	66	4, 54
SB915-SB-05	Toe of WB-13 dike	62	N/A
SB915-SB-06	Crest of WB-13 dike	68	38, 56
SB915-SB-07	Toe of WB-13 dike	30	6, 20
SB915-SB-08	Crest of WB-13 dike	68	28, 56.6
SB915-SB-09	Toe of WB-13 dike	30	18
SB915-SB-10	Crest of WB-13 dike	68	60
SB915-SB-21	In WB-13	52.4	N/A
SB915-SB-22	In WB-13	76	1
SB915-SB-23	Crest of WB-13 dike	50	N/A
SB915-SB-24	Crest of WB-13 dike	46	N/A
SB915-SB-25	Crest of WB-13 dike	50	N/A
SB915-PZ-01	In WB-13	60	10
SB915-PZ-02	In WB-13	86	10, 73.5

Note:

[1]. The GWT depth at the toe of WB-13 dike is measured with respect to the ground surface at the toe, which is approximately 40 ft lower than the ground surface at the crest of WB-13 and in WB-13. Therefore, for an example, the GWT depth measured at Boring SB915-SB-01 (i.e., 4.5 ft) would become 44.5 ft with respect to ground surface in WB-13.

Table 11. Summary of Water Content

Material		Water Content (%)		
		Range	Average	Standard Deviation
SOLW	Zone 1	64 - 367	166	80
	Zone 2	10 - 912	227	103
	Zone 3	5 - 294	172	63
	All 3 Zones	5 - 912	212	99
Dike Soil		3 - 83	13	10
Foundation Soil		4 - 66	16	12

Note:

The water contents in this table include the water contents from the index property tests, the UU tests, and the CU tests.

Table 12. Summary of Atterberg Limits

Material		Plastic Limit			Liquid Limit			Plasticity Index		
		Range	Average	Standard Deviation	Range	Average	Standard Deviation	Range	Average	Standard Deviation
SOLW	Zone 1	68 - 167	109	27	80 - 241	145	41	12 -74	36	16
	Zone 2	62 - 245	139	36	89 - 227	168	35	27 - 127	55	20
	Zone 3	89 - 199	130	38	91 - 234	150	53	22 - 138	69	41
	All 3 Zones	62 - 245	131	36	80 - 241	160	40	12 - 138	53	26
Dike Soil		11 - 49	20	8	10 - 66	19	11	6 - 17	10	3
Foundation Soil		10 - 53	26	11	13 - 57	29	15	3 - 30	11	7

Table 13. Summary of Total Unit Weight from Lab Tests

Soil		Total Unit Weight (pcf)		
		Range	Average	Standard Deviation
SOLW	Zone 1	69 - 108	84	10
	Zone 2	55 - 139	82	13
	Zone 3	68 - 101	82	8
	All 3 Zones	55 - 139	82	12
Foundation Soil		118 - 124	121	3

Table 14. Summary of Modified Compression Index of SOLW ($C_{c\varepsilon}$)

SOLW	Modified Compression Index		
	Number of tests	Range	Average
Zone 1	7	0.15~0.50	0.34
Zone 2	25	0.21~0.71	0.46
Zone 3	5	0.21~0.46	0.38

Table 15. Summary of Modified Recompression Index of SOLW ($C_{r\varepsilon}$)

SOLW	Modified Recompression Index		
	Number of tests	Range	Average
Zone 1	7	0.010~0.020	0.015
Zone 2	25	0.004~0.025	0.014
Zone 3	5	0.003~0.034	0.021

Table 16. Summary of Undrained Shear Strength of SOLW from UU Tests

Depth	Undrained Shear Strength of SOLW (psf)					
	Zone 1		Zone 2		Zone 3	
	Range	Average	Range	Average	Range	Average
0~20 ft	444~767	592	527~748	633	N/A	
20~40 ft	916~1431	1113	419~1353	780	N/A	
>40 ft	N/A		719	719	320~1479	899

Note:

Undrained shear strength values that are greater than 2000 psf are not included in this table.

Table 17. Summary of Average Effective Stress Friction Angles

Material		Effective Stress Friction Angle (degree)	Effective Stress Cohesion (psf)
SOLW (Lab Tests)	Zone 1	34	0
	Zone 2	42	0
	Zone 3	46	0
Foundation Soil	Lab (one test)	18	1420
	Correlation (SPT N)	37 (N=40)	0
Dike Soil	Correlation (SPT N)	37 (N=36)	0

Table 18. Empirical Relationship Between ϕ' and SPT N value [Kulhawy and Mayne, 1990]

N Value (blows/ft or 305 mm)	Relative Density	Approximate $\bar{\phi}_{tc}$ (degrees) (a)	(b)
0 to 4	very loose	< 28	< 30
4 to 10	loose	28 to 30	30 to 35
10 to 30	medium	30 to 36	35 to 40
30 to 50	dense	36 to 41	40 to 45
> 50	very dense	> 41	> 45

a - Source: Peck, Hanson, and Thornburn (12), p. 310.
b - Source: Meyerhof (13), p. 17.

Table 19. Hydraulic Conductivity of SOLW [Parsons and Geosyntec, 2008a]

		Boring Location	Sample Depth (ft)	Hydraulic Conductivity (cm/s)	Average Hydraulic Conductivity[1] (cm/s)
Zone 2	Lab Test	PZ-01	10 - 12	1.54E-05	4.3E-06
		PZ-02	56 - 58	3.34E-06	
		SB-21	10 - 12	8.58E-06	
		SB-22	20 - 22	1.83E-05	
	Field Test	PZ-02 I	N/A	1.30E-06	
		PZ-02 D	N/A	1.30E-06	
		PZ-13 P3-1	N/A	1.40E-06	
		PZ-13 C-1	N/A	6.30E-06	
Zone 3	Lab Test	PZ-01	44 - 46	2.24E-06	2.2E-06

Note:
[1]. Logarithmic average value was calculated.

Table 20. Typical Value of Hydraulic Conductivity [Kulhawy and Mayne, 1990]

COEFFICIENT OF PERMEABILITY

Soil	Coefficient of Permeability, k (m/sec)	Relative Permeability
gravel	$> 10^{-3}$	high
sandy gravel, clean sand, fine sand	10^{-3} to 10^{-5}	medium
sand, dirty sand, silty sand	10^{-5} to 10^{-7}	low
silt, silty clay	10^{-7} to 10^{-9}	very low
clay	$< 10^{-9}$	practically impermeable

Source: Based on Terzaghi and Peck (1).

Note: The unit of hydraulic conductivity in this table is m/s.

Table 21. Recommended Material Properties for SCA Design

Material		Index Property						Shear Strength		Compressibility						SPT N Value	Hydraulic Conductivity (cm/s)
		Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Total Unit Weight (pcf)	Effective Stress Friction Angle (degree)	Undrained Shear Strength (psf)	Overconsolidation Ratio	Modified Compression Index	Modified Recompression Index	Coefficient of Secondary Compression	Coefficient of Consolidation (cm^2/s) [1]			
														From Lab Tests	From Field Test		
SOLW	Zone 1	166	145	109	36	2.51	82	34	600 for D ≤ 20 ft 700 for D=20-30 ft Increases linearly to 1,200 at D=50 ft and 1,400 at D=80 ft	4.5 for D=0~10 ft 2.0 for D=10~20 ft 1.0 for D>20 ft	0.34	0.015	0.13% for $\sigma_v'/P_c' \le 1.0$ 0.83% for $\sigma_v'/P_c' > 1.0$	0.047 for $\sigma_v'/P_c' \le 1.0$ 0.029 for $\sigma_v'/P_c' > 1.0$	N/A	17	1.0x10^{-5} [2]
	Zone 2	227	168	139	55						0.46	0.014	0.11% for $\sigma_v'/P_c' \le 1.0$ 0.91% for $\sigma_v'/P_c' > 1.0$	0.046 for $\sigma_v'/P_c' \le 1.0$ 0.009 for $\sigma_v'/P_c' > 1.0$	0.14	1	4.3x10^{-6}
	Zone 3	172	150	130	69						0.38	0.021	0.07% for $\sigma_v'/P_c' \le 1.0$ 0.70% for $\sigma_v'/P_c' > 1.0$	0.024 for $\sigma_v'/P_c' \le 1.0$ 0.008 for $\sigma_v'/P_c' > 1.0$		8	2.2x10^{-6}
Dike Soil		13	19	20	10	2.71	120	37	N/A	N/A	N/A	N/A	N/A	N/A		36	N/A
Foundation Soil		16	29	26	11	2.65	120	37	N/A	N/A	N/A	N/A	N/A	N/A		40	N/A

Notes:

[1]. Coefficient of consolidation obtained from the lab tests are recommended to be used for loading with relatively large footprint compared to the thickness of SOLW, where consolidation of SOLW can be considered as one-dimensional (for example, under dredged material placed across the wastebed); Coefficient of consolidation obtained from the field tests are recommended to be used for loading with relatively small footprint compared to the thickness of SOLW, where consolidation of SOLW can be considered to take place in both vertical and horizontal directions (for examples, under berms and pre-load areas).

[2]. No test results are available for the hydraulic conductivity of SOLW in Zone 1. This value was estimated based on typical range of hydraulic conductivity for silty sand.

Figures

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

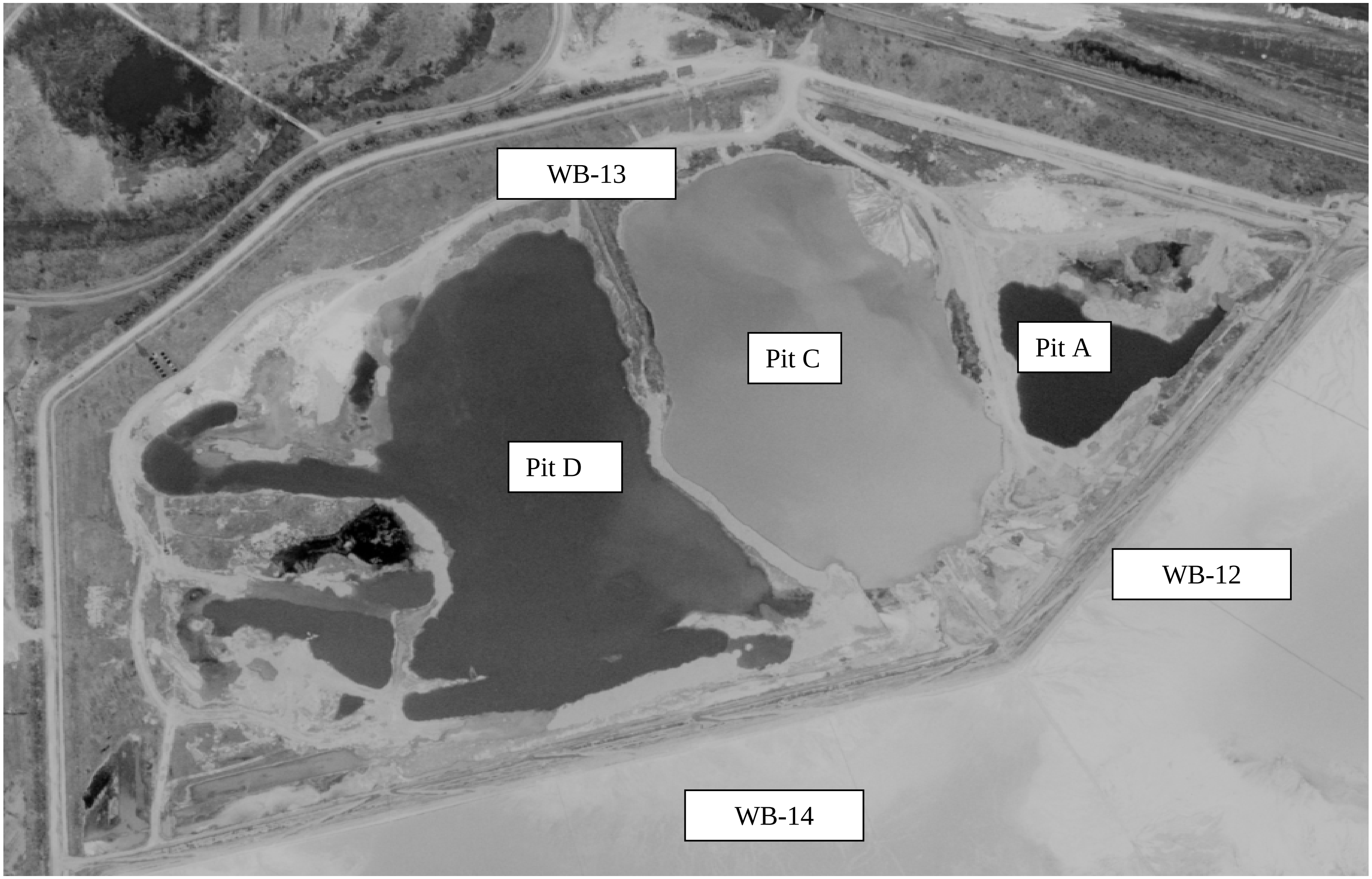


Figure 1. 1972 Aerial Photo Showing Three Pits

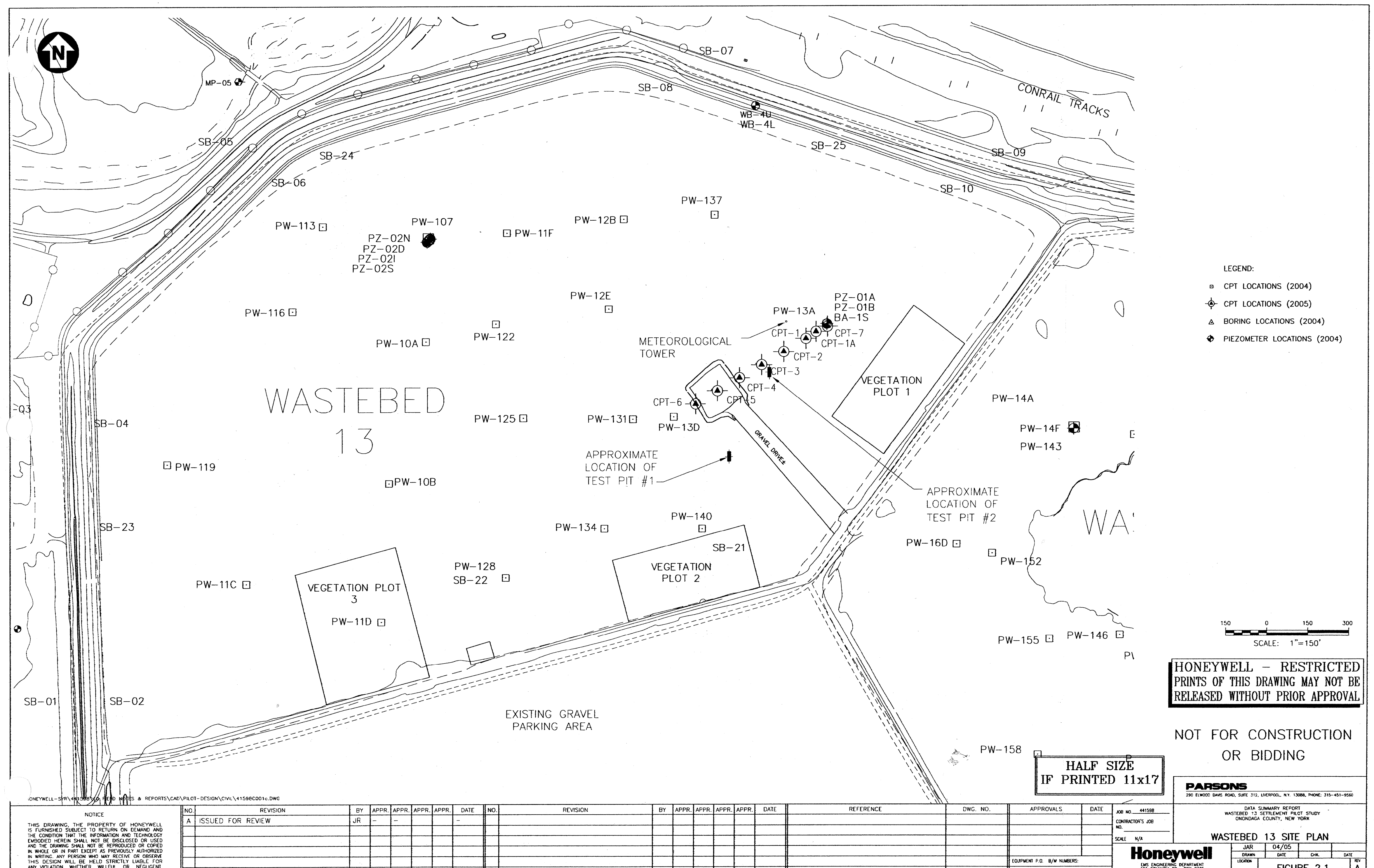
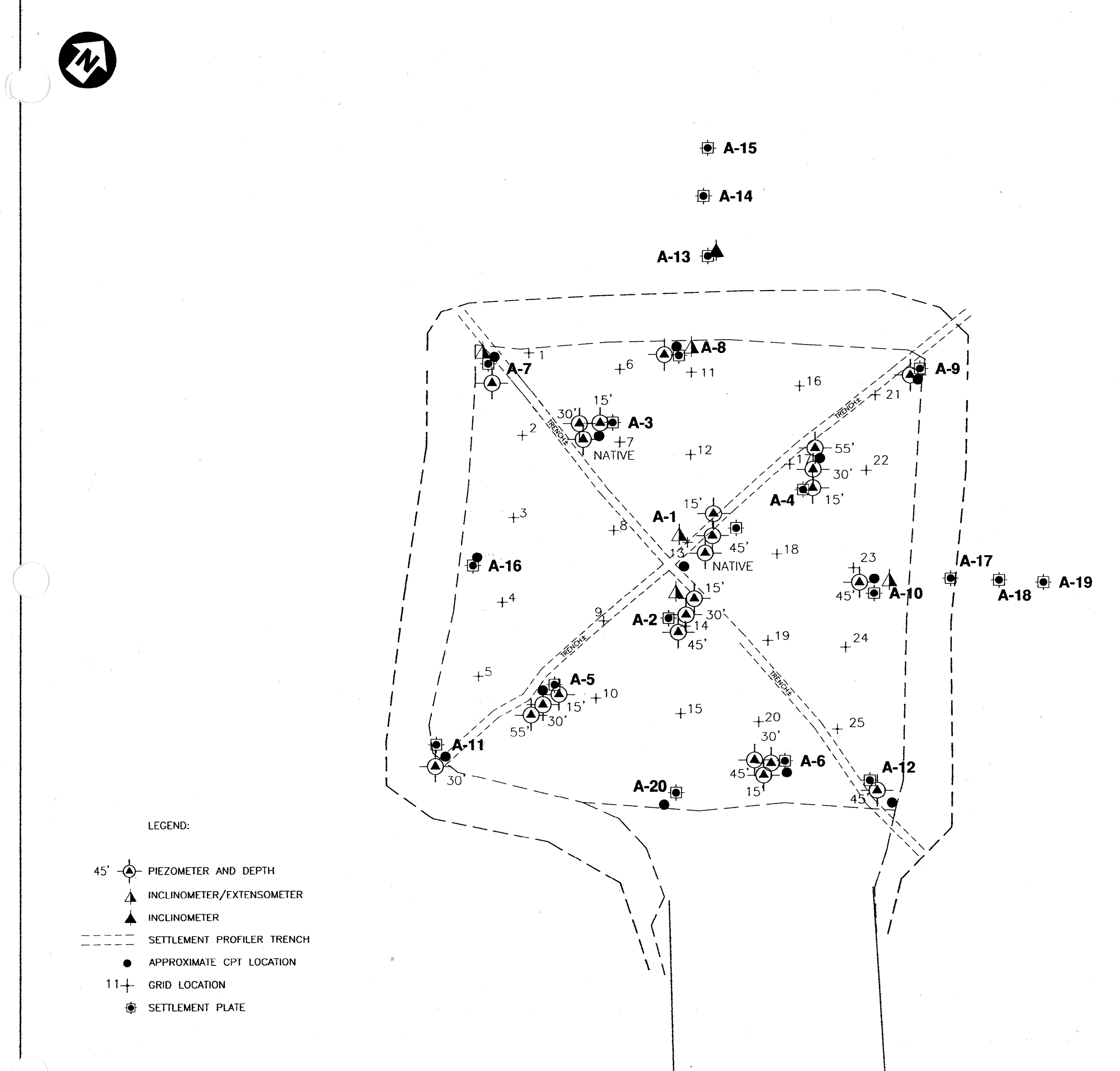


Figure 2. Locations of CPTs and Borings in 2004 and Phase I Site Investigations [Parsons and Geosyntec, 2008a]

Written by: Ming Zhu Date: 03/06/2008 Reviewed by: R. Kulasingam/Jay Beech Date: 03/06/2008

Client: Honeywell Project: Onondaga Lake SCA IDS Project/ Proposal No.: GD3944 Task No.: 04



LOCATION	CPT ID	INCLINOMETER/ EXTENSOMETER ID	PIEZOMETER ID [2]	SETTLEMENT PLATE
A-1	SB915-CPT-5	SB915-INEX-A1	SB915-PZ-A1(15') SB915-PZ-A1(45') SB915-PZ-A1(NATIVE)	SP-1
A-2		SB915-INEX-A2	SB915-PZ-A2(15') SB915-PZ-A2(30') SB915-PZ-A2(45')	SP-2
A-3	SB915-CPT-A3		SB915-PZ-A3(15') SB915-PZ-A3(30') SB915-PZ-A3(NATIVE)	SP-3
A-4	SB915-CPT-A4		SB915-PZ-A4(15') SB915-PZ-A4(30') SB915-PZ-A4(55')	SP-4
A-5	SB915-CPT-A5		SB915-PZ-A5(15') SB915-PZ-A5(30') SB915-PZ-A5(55')	SP-5
A-6	SB915-CPT-A6		SB915-PZ-A6(15') SB915-PZ-A6(30') SB915-PZ-A6(45')	SP-6
A-7	SB915-CPT-A7	SB915-INEX-A7	SB915-PZ-A7(15')	SP-7
A-8	SB915-CPT-A8	SB915-INEX-A8	SB915-PZ-A8(30')	SP-8
A-9	SB915-CPT-A9		SB915-PZ-A9(15')	SP-9
A-10	CB-915-CPT-4	SB915-INEX-A10	SB915-PZ-A10(45')	SP-10
A-11	SB915-CPT-A11		SB915-PZ-A11(30')	SP-11
A-12	SB915-CPT-A12		SB915-PZ-A12(45')	SP-12
A-13		SB915-IN-A13 [1]		SP-13
A-14				SP-14
A-15				SP-15
A-16	SB915-CPT-6			SP-16
A-17				SP-17
A-18				SP-18
A-19				SP-19
A-20	S915-CPT-A20			SP-20

NOTES:

1. ONLY AN INCLINOMETER WAS INSTALLED AT THIS LOCATION.

2. NUMBERS IN PARENTHESES AFTER IDs INDICATE THE PIEZOMETER TIP INSTALLATION DEPTH (i.e., FEET BELOW INITIAL GROUND SURFACE). NATIVE INDICATES PIEZOMETERS WERE INSTALLED IN THE NATIVE SOIL BENEATH THE SOLVAY WASTE.

SCALE: 1"=20'

HONEYWELL – RESTRICTED PRINTS OF THIS DRAWING MAY NOT BE RELEASED WITHOUT PRIOR APPROVAL

NOT FOR CONSTRUCTION OR BIDDING

HALF SIZE IF PRINTED 11x17

PARSONS

TEST PLOT INSTRUMENTATION LAYOUT

Honeywell

FIGURE 2.2

Figure 3. Locations of CPTs and Borings in Test Pad in Phase I Site Investigation [Parsons and Geosyntec, 2008a]

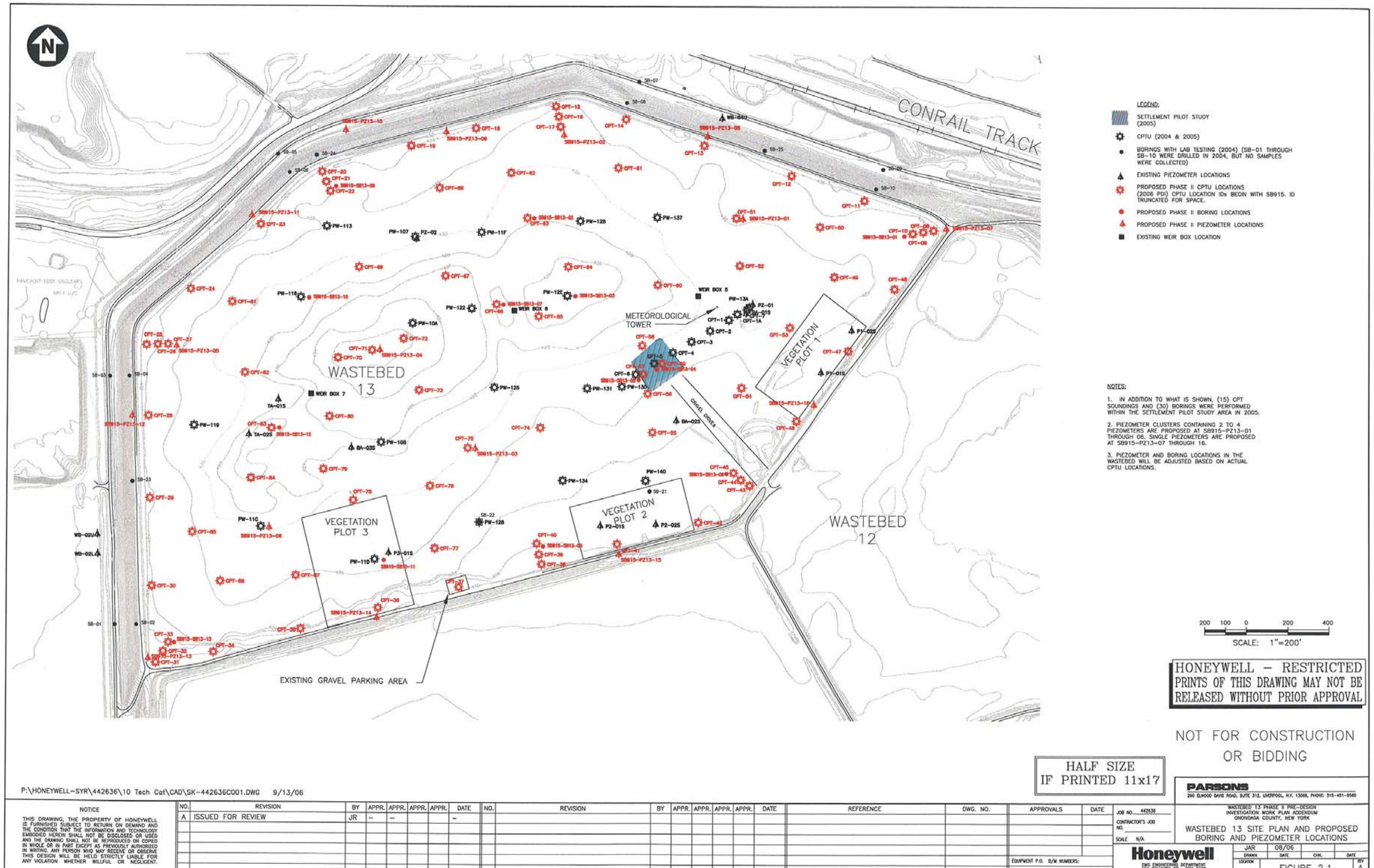


Figure 4. Locations of CPTs and Borings in Phase II Investigation [Parsons, 2008c]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

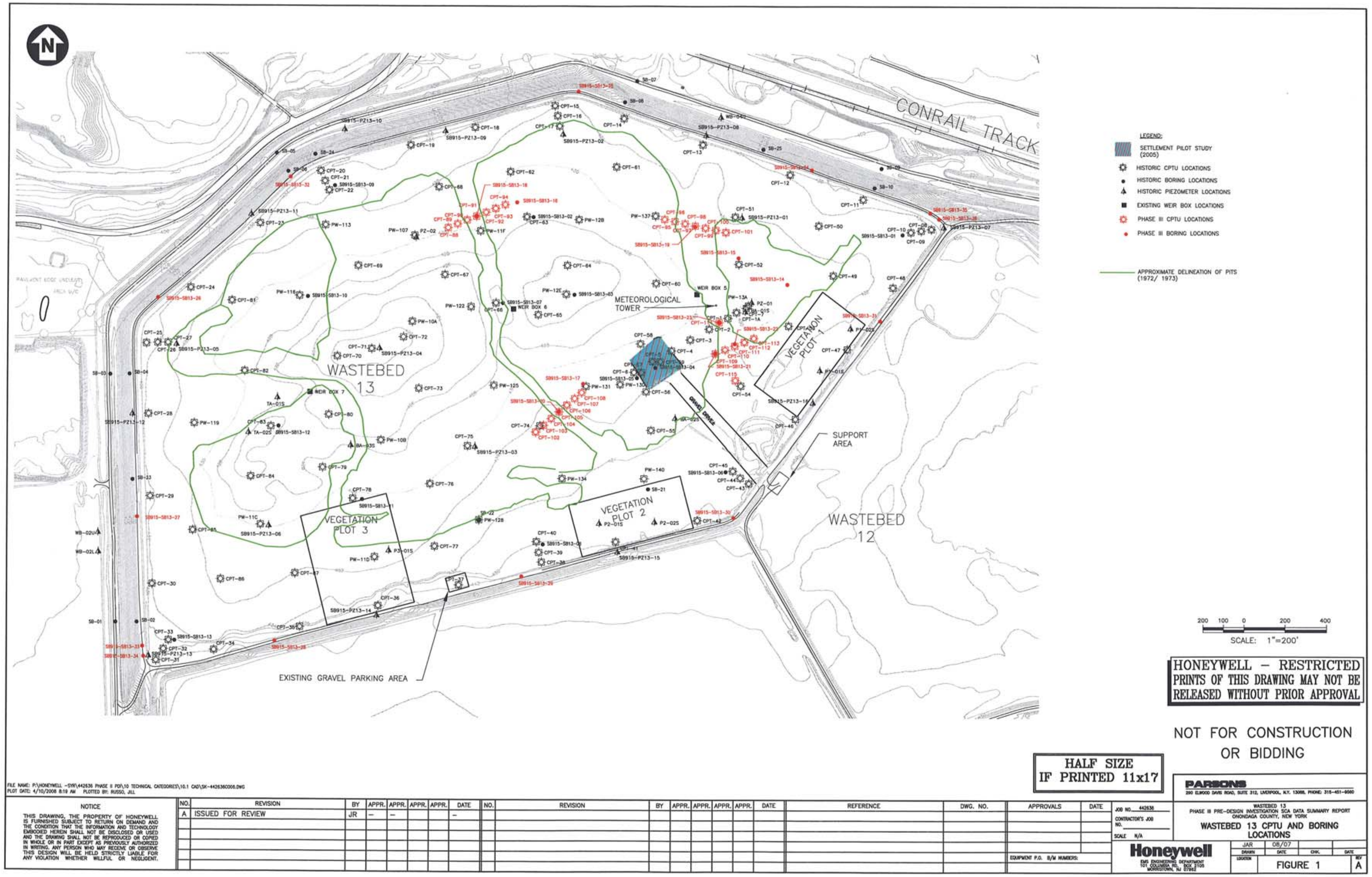


Figure 5. Locations of CPTs and Borings in Phase III Site Investigation
(in addition to the CPTs and borings from Phase I and II site investigations) [Parsons, 2009]

Written by: Ming Zhu Date: 03/06/2008 Reviewed by: R. Kulasingam/Jay Beech Date: 03/06/2008

Client: Honeywell Project: Onondaga Lake SCA IDS Project/ Proposal No.: GD3944 Task No.: 04

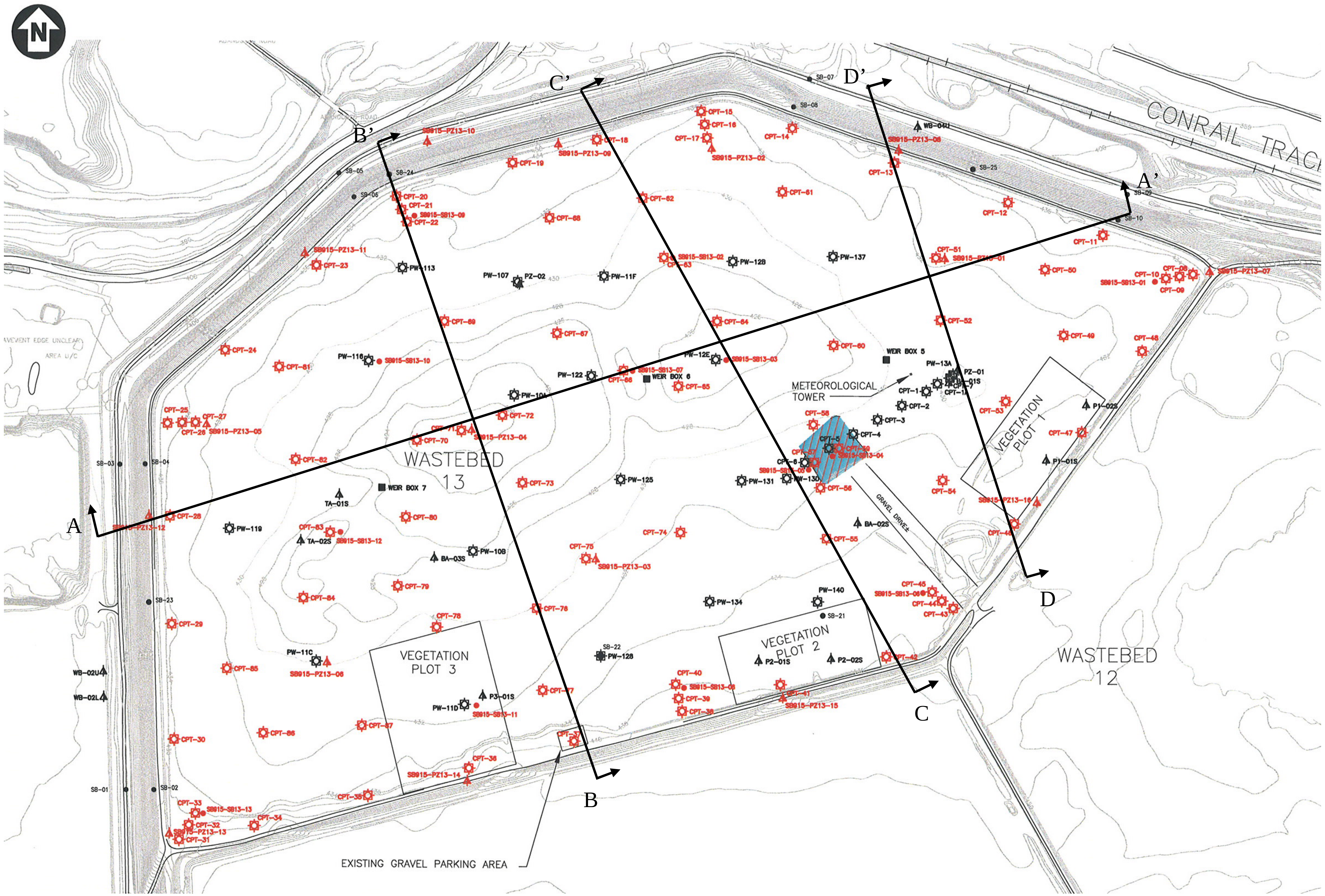


Figure 6. Locations of Cross Sections A-A' to D-D'

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

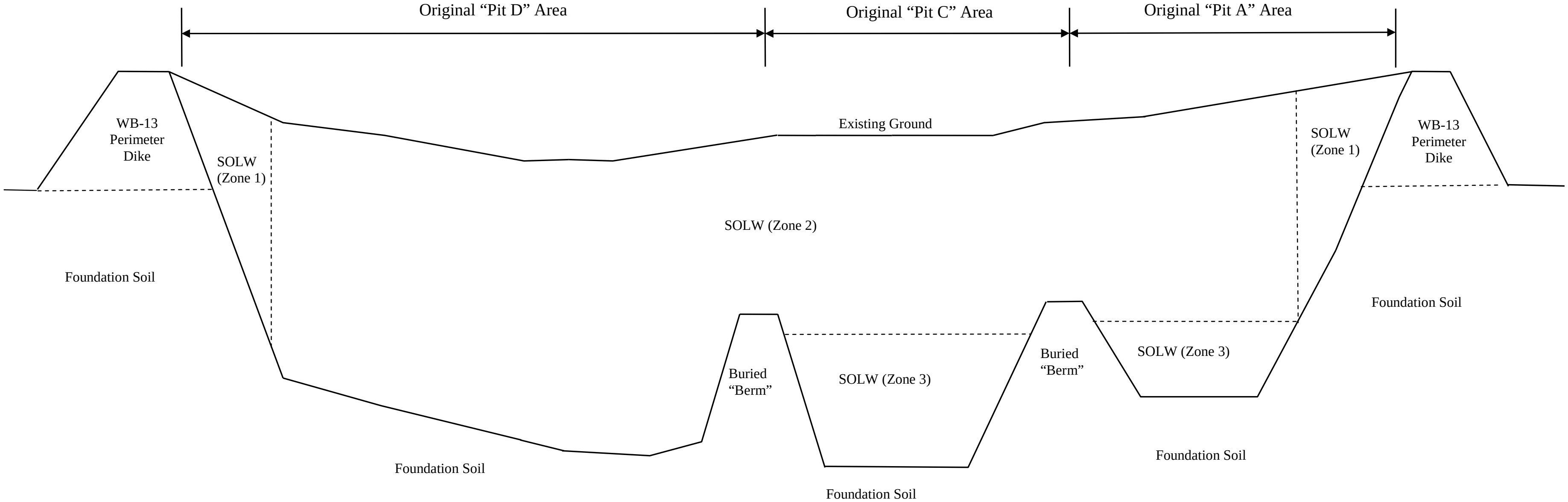


Figure 7. Schematic of Subsurface Profile at Cross Section A-A'

[Not to scale; for purpose of showing subsurface stratigraphy only]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

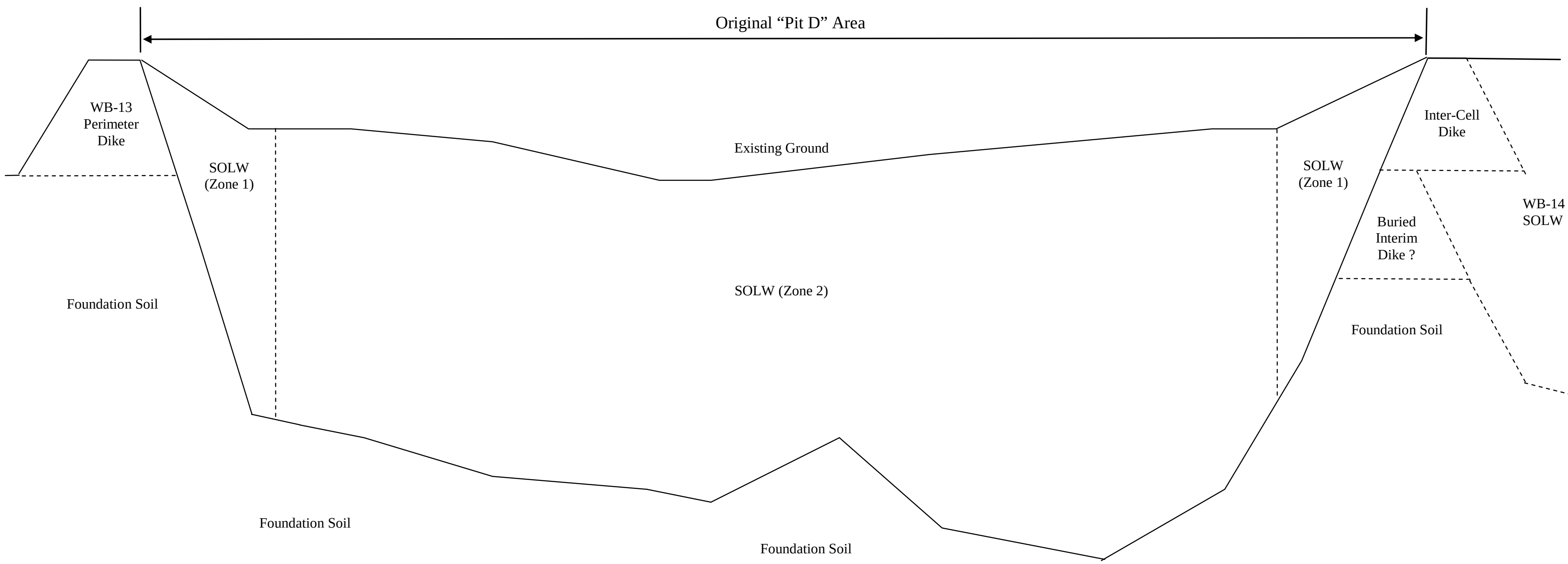


Figure 8. Schematic of Subsurface Profile at Cross Section B-B'

[Not to scale; for purpose of showing subsurface stratigraphy only]

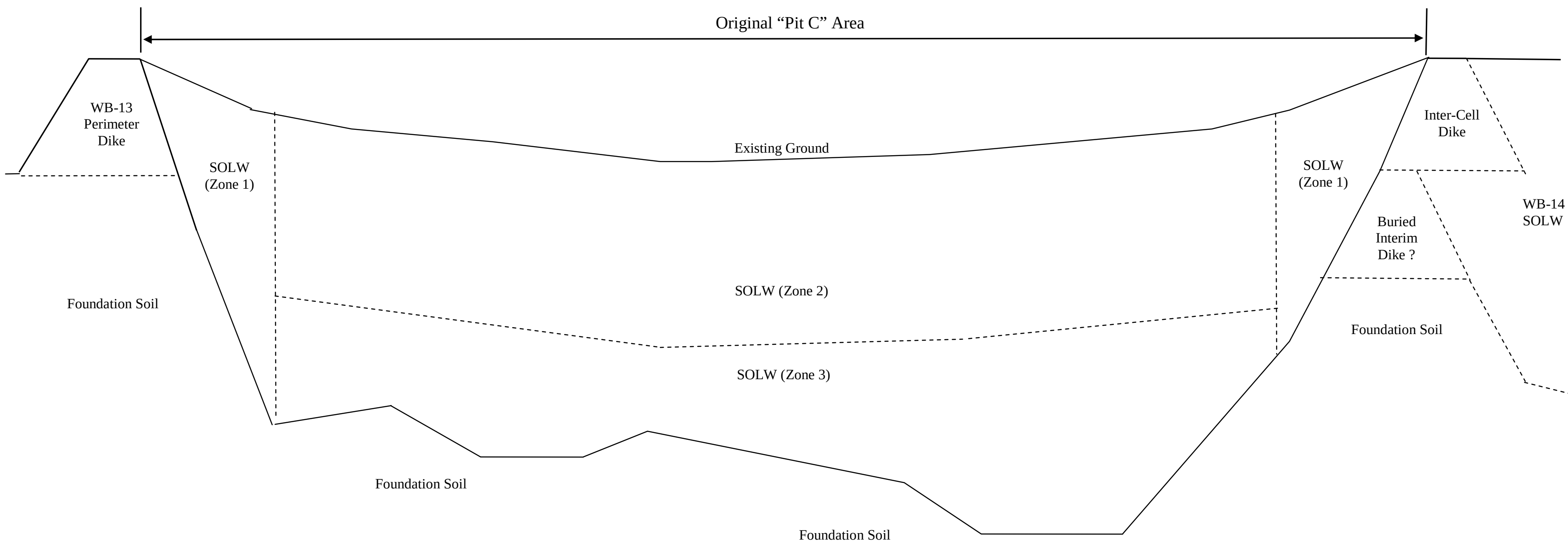


Figure 9. Schematic of Subsurface Profile at Cross Section C-C'

[Not to scale; for purpose of showing subsurface stratigraphy only]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

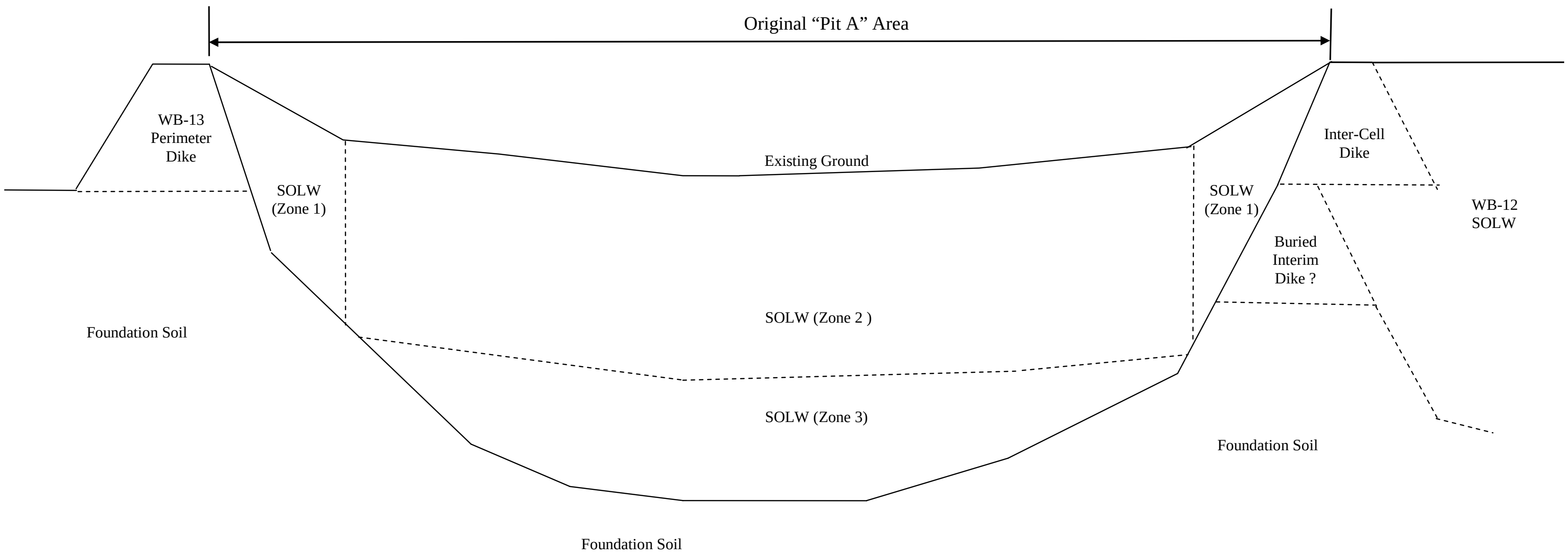


Figure 10. Schematic of Subsurface Profile at Cross Section D-D'

[Not to scale; for purpose of showing subsurface stratigraphy only]

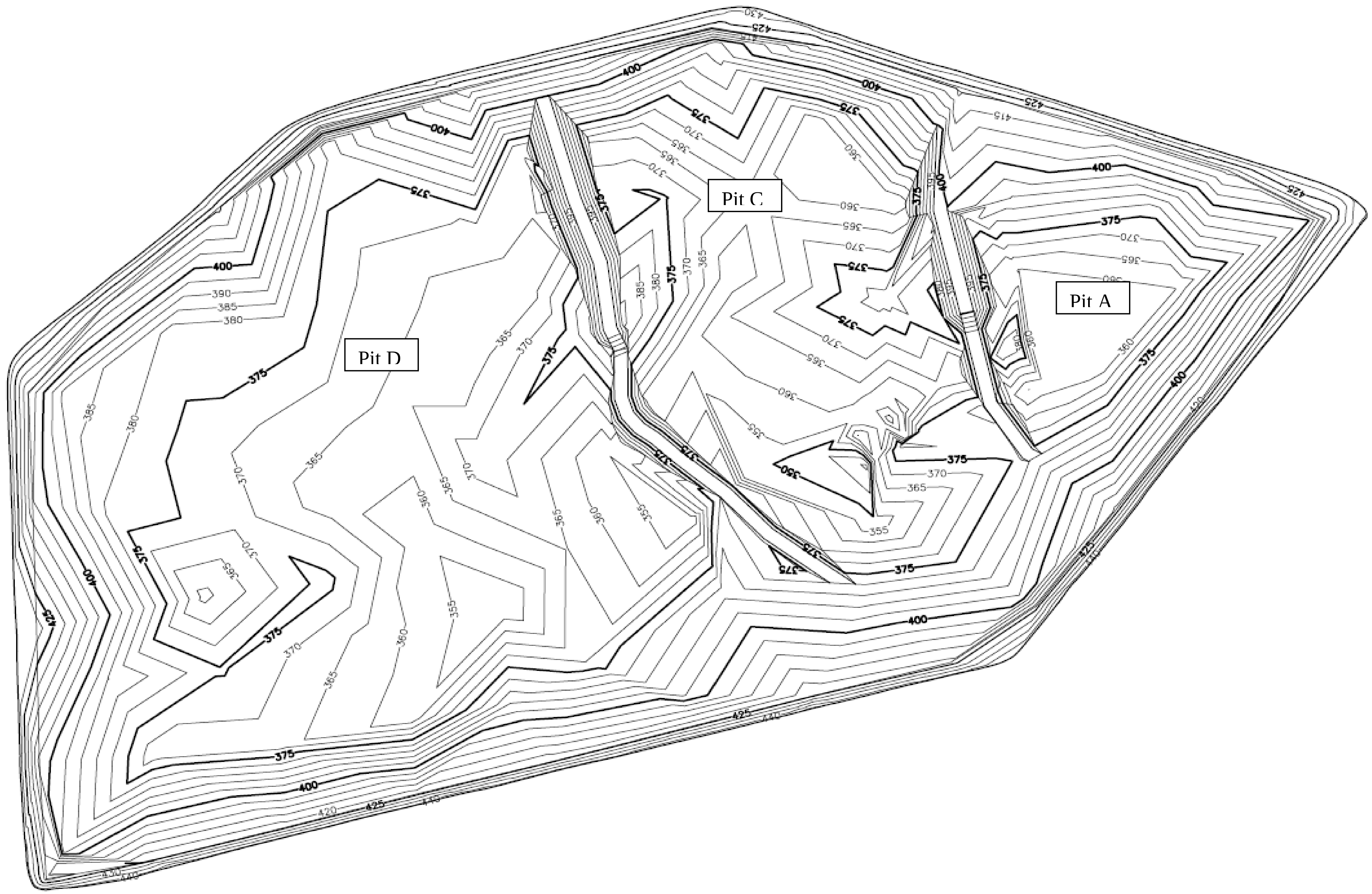


Figure 11. Bottom Elevation Contours of SOLW in WB-13

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

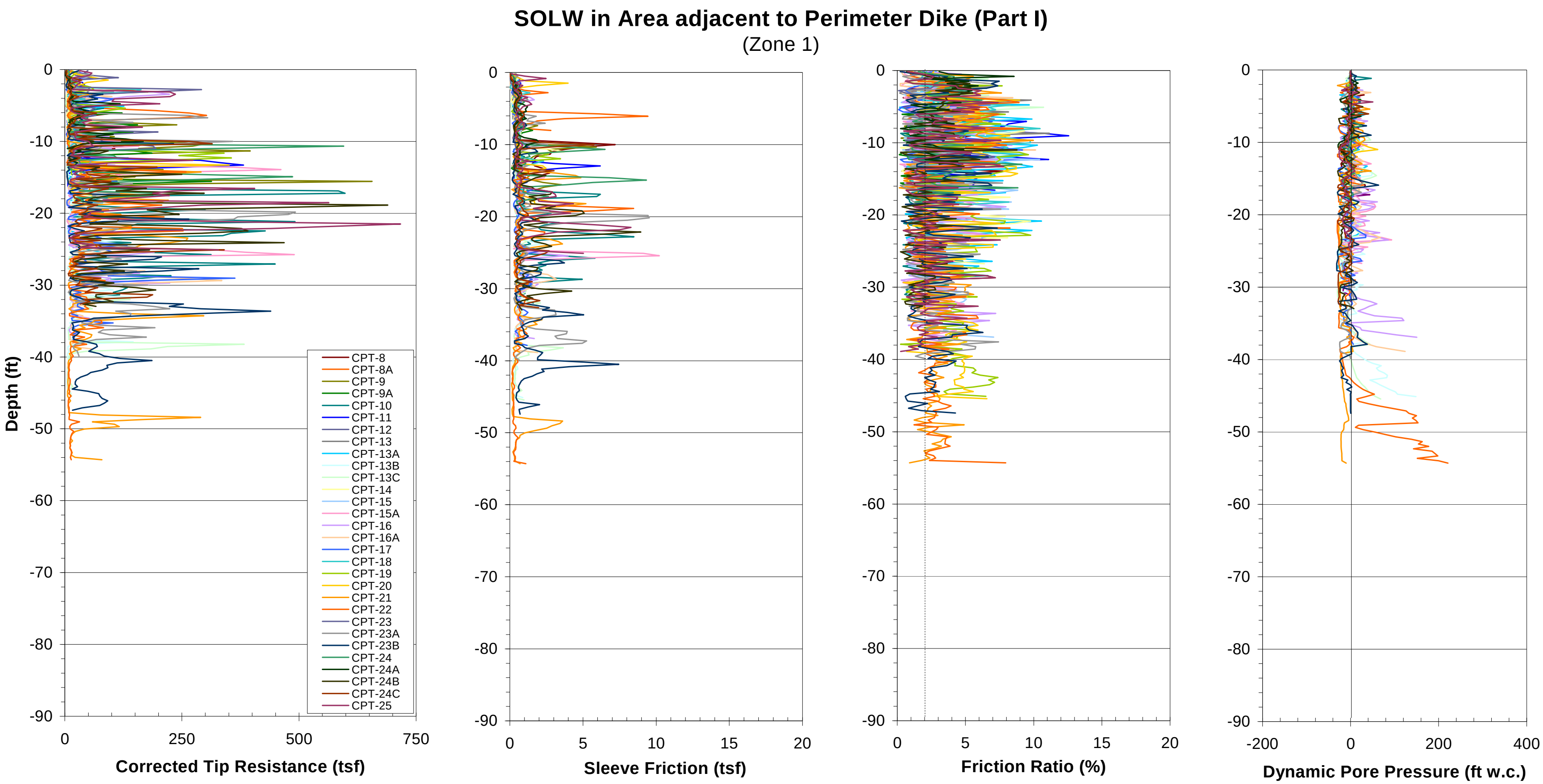


Figure 12. CPT Profiles of SOLW in Areas adjacent to the Perimeter Dikes of WB-13
[Based on CPT data provided in Parsons and Geosyntec (2008a), Parsons (2008c), and Parsons (2009)]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

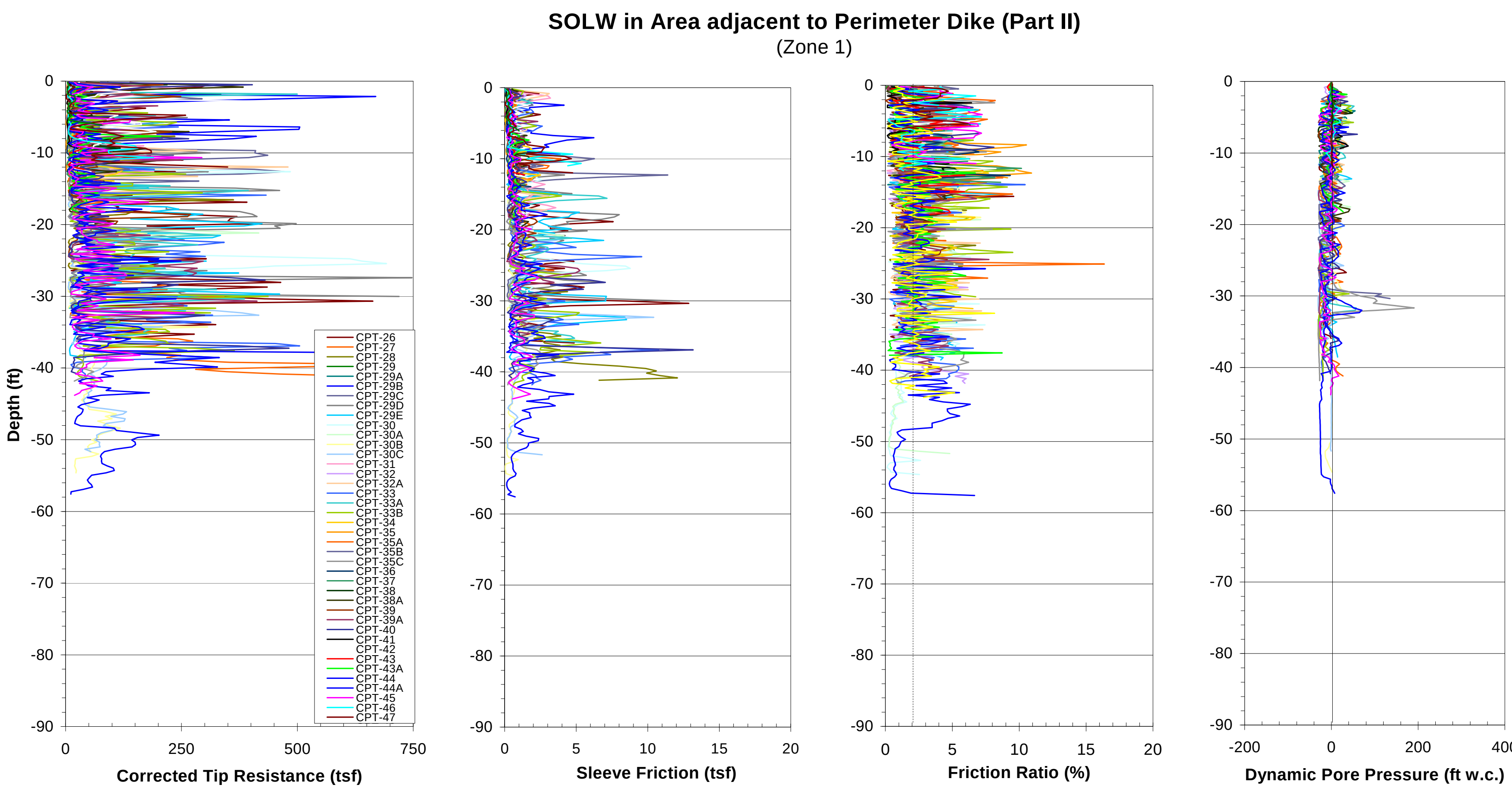


Figure 12. CPT Profiles of SOLW in Areas adjacent to the Perimeter Dikes of WB-13 (continued)
[Based on CPT data provided in Parsons and Geosyntec (2008a), Parsons (2008c), Parsons (2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

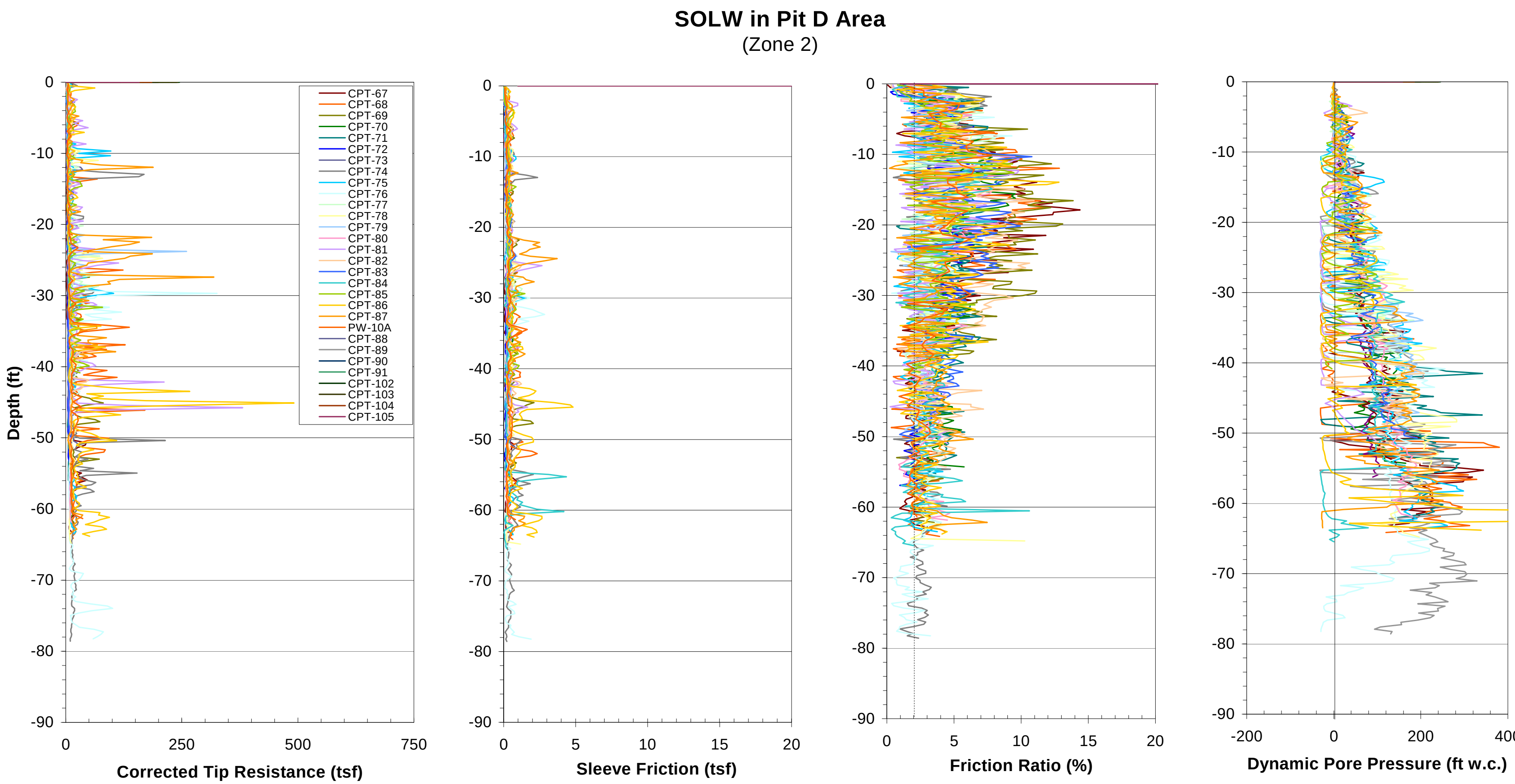


Figure 13. CPT Profiles of SOLW in Pit D Area of WB-13
[Based on CPT data provided in Parsons and Geosyntec (2008a), Parsons (2008c), and Parsons (2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

SOLW in Pit A and Pit C Areas
(Above 40 ft, Zone 2; Below 40 ft, Zone 3)

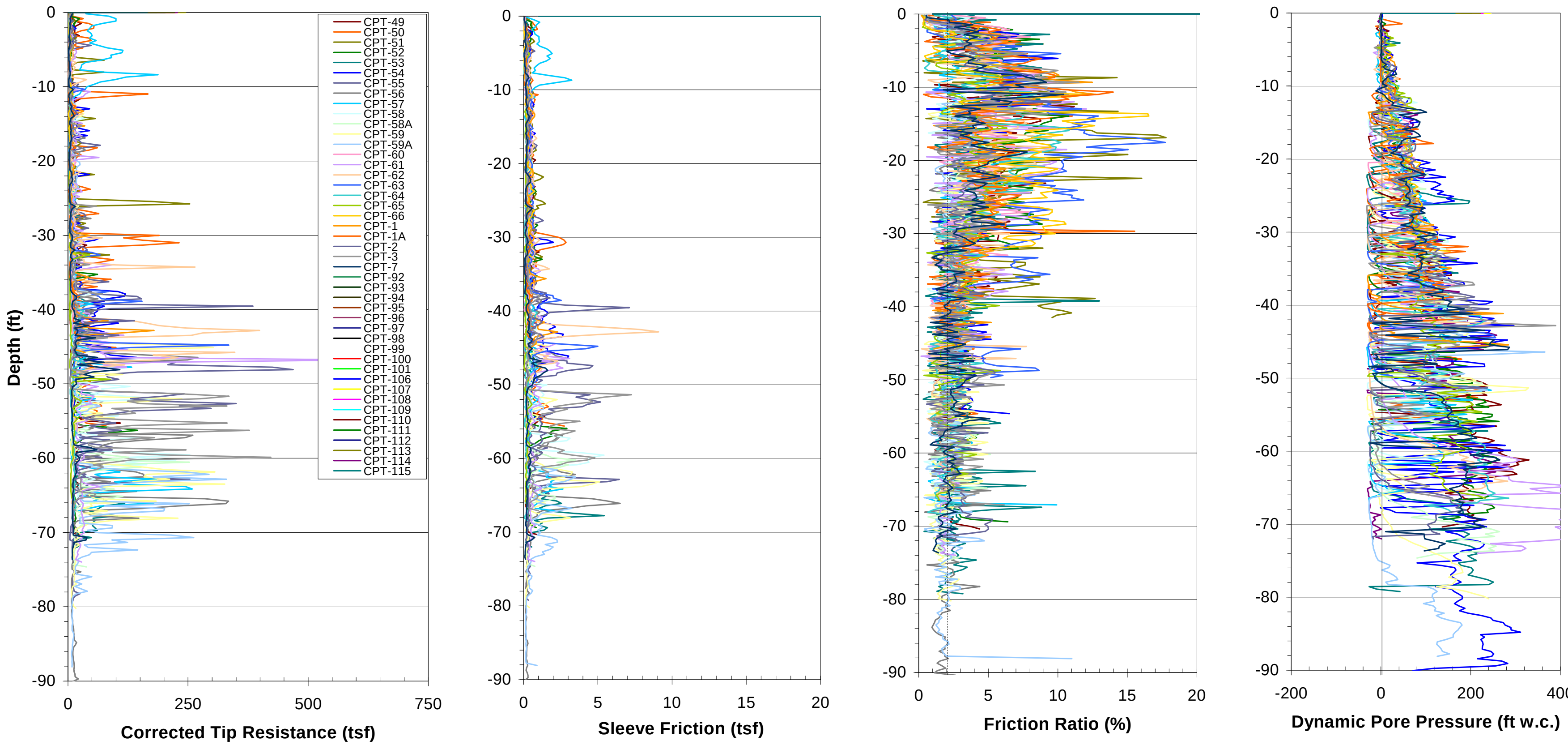


Figure 14. CPT Profiles of SOLW in Pit A and Pit C Areas of WB-13
[Based on CPT data provided in Parsons and Geosyntec (2008a), Parsons (2008c), and Parsons (2009)]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

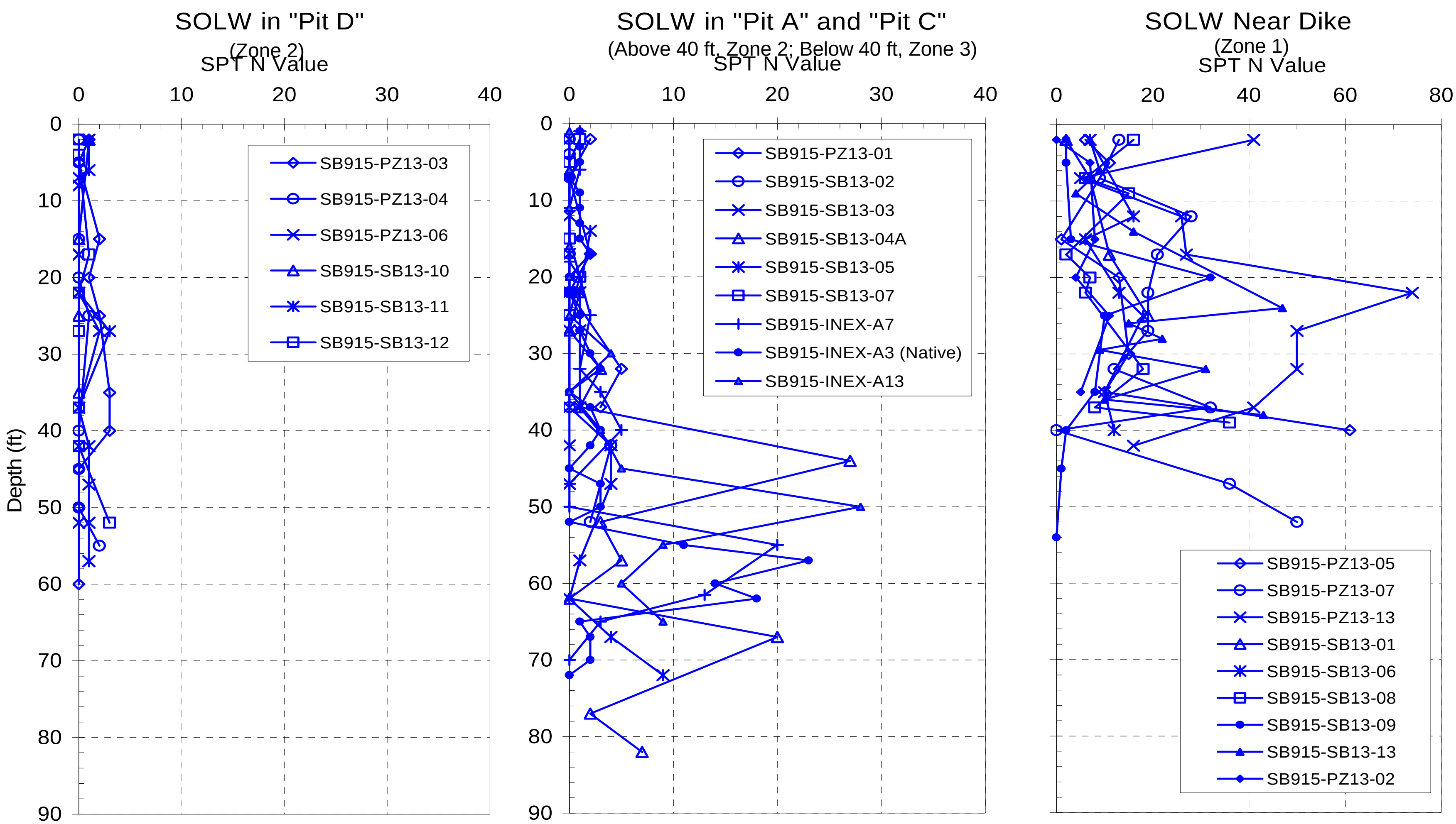
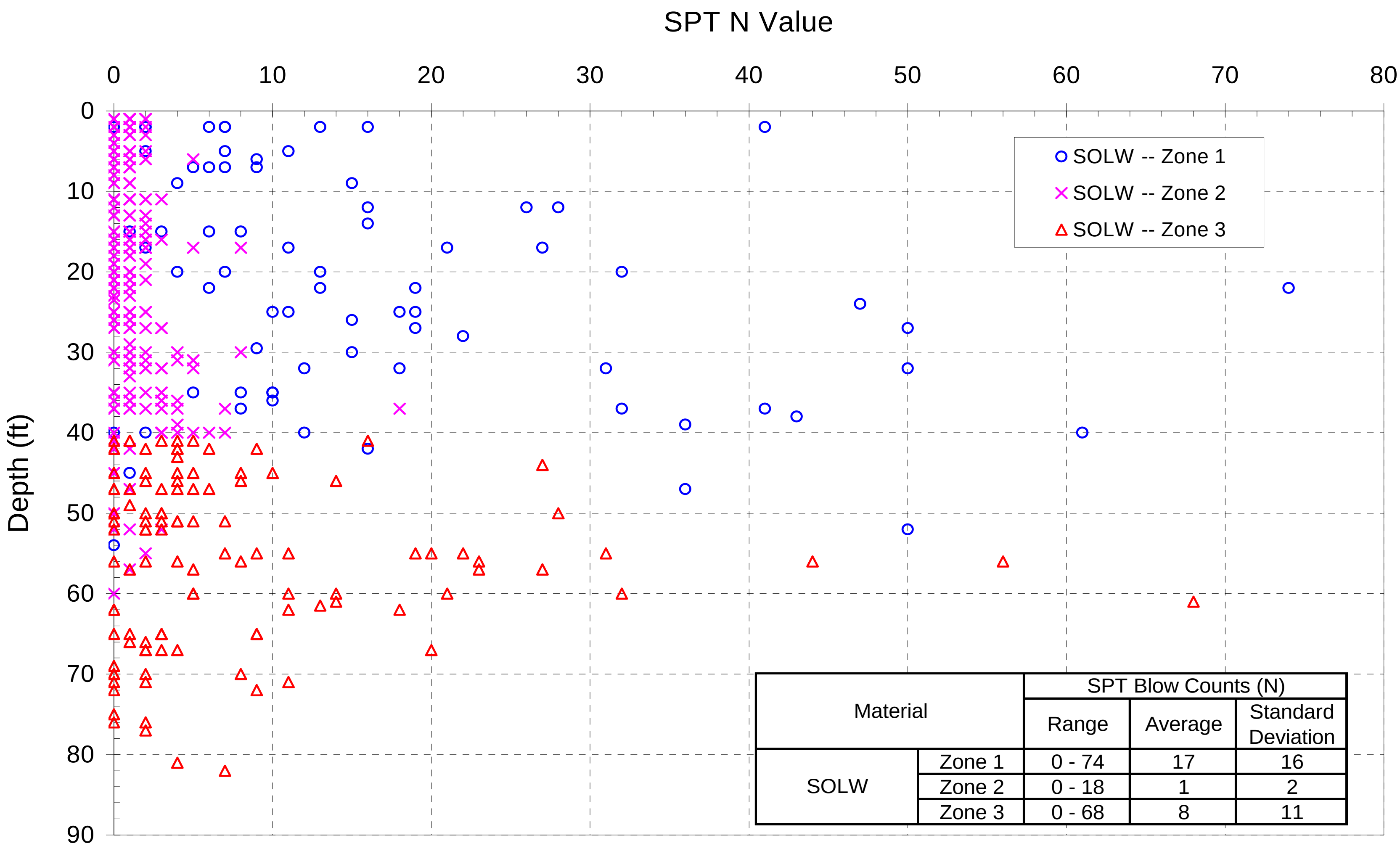


Figure 15. SPT N Value Profiles of SOLW at Selected Locations in WB-13

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**



Material		SPT Blow Counts (N) Range	Average	Standard Deviation
SOLW	Zone 1	0 - 74	17	16
	Zone 2	0 - 18	1	2
	Zone 3	0 - 68	8	11

Figure 16. SPT N Value Versus Depth of SOLW
[based on boring logs presented in Parsons and Geosyntec (2008a), Parsons (2008c), and Parsons (2009)]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

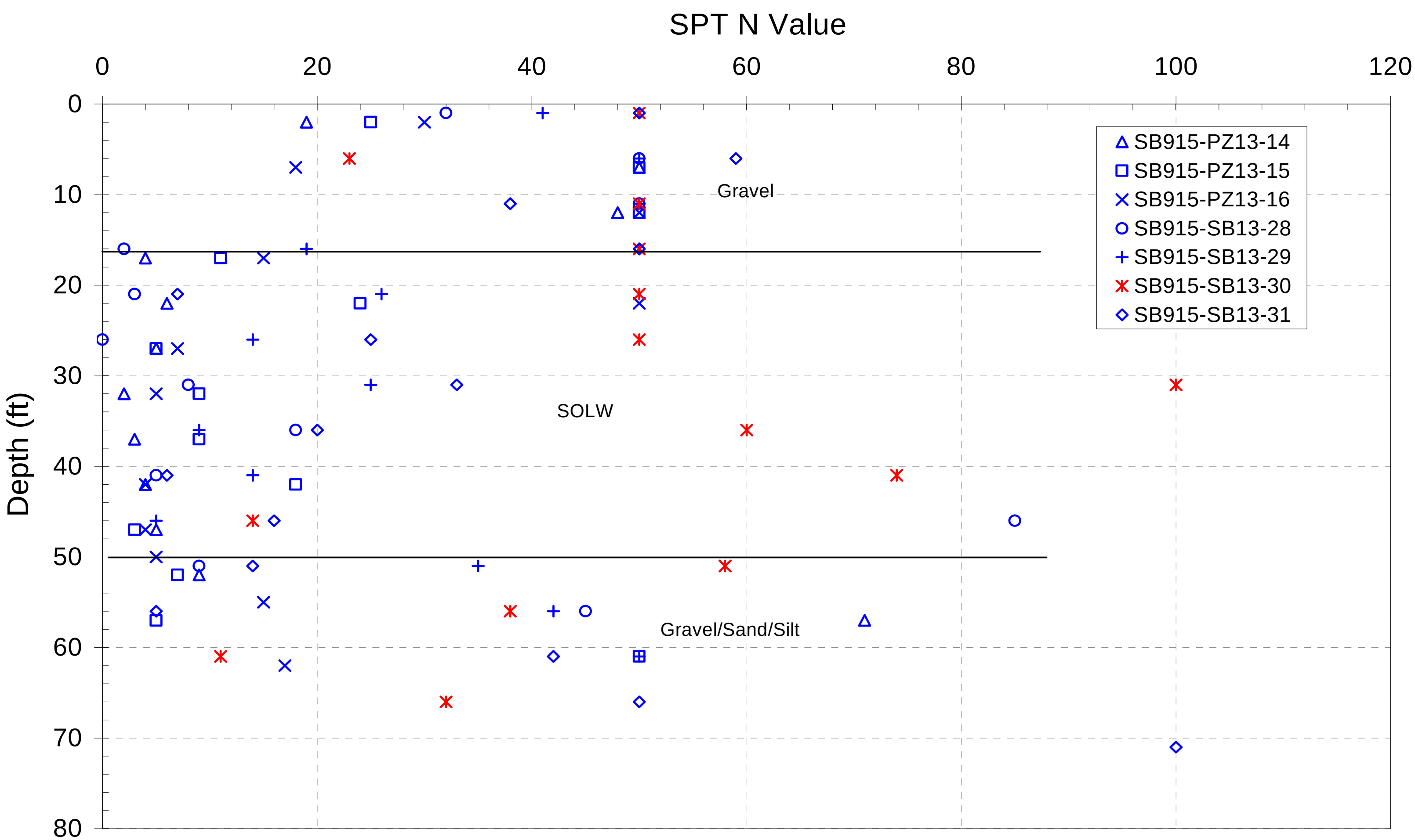
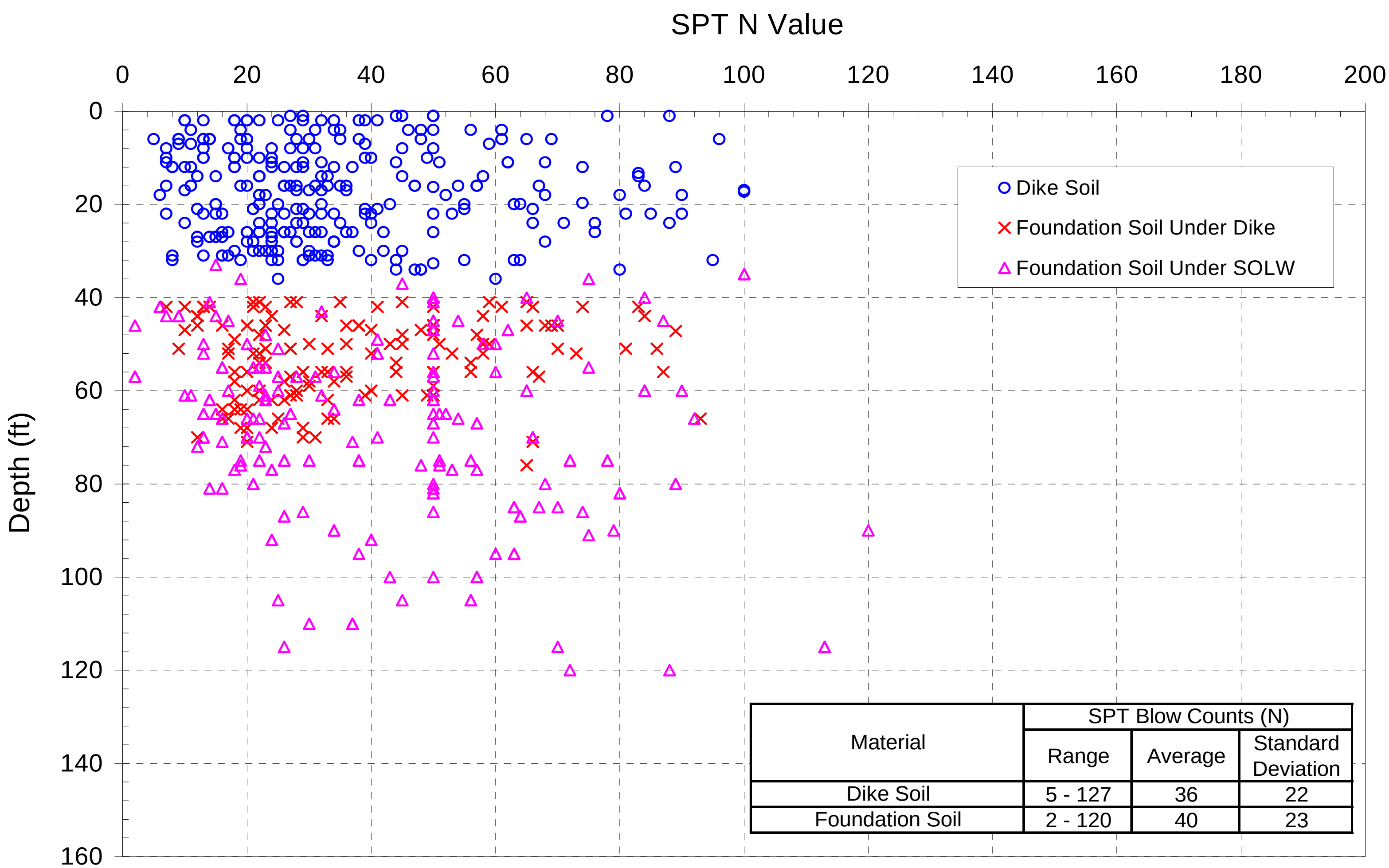


Figure 17. SPT N Values from Borings in Inter-cell Dike between WB-13 and Wastebeds 12 and 14 [based on boring logs presented in Parsons (2008c) and Parsons (2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04



Material	SPT Blow Counts (N)		
	Range	Average	Standard Deviation
Dike Soil	5 - 127	36	22
Foundation Soil	2 - 120	40	23

Figure 18. SPT N Values for Dike Soil and Foundation Soil
[based on boring logs presented in Parsons and Geosyntec (2008a), Parsons (2008c), Parsons (2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

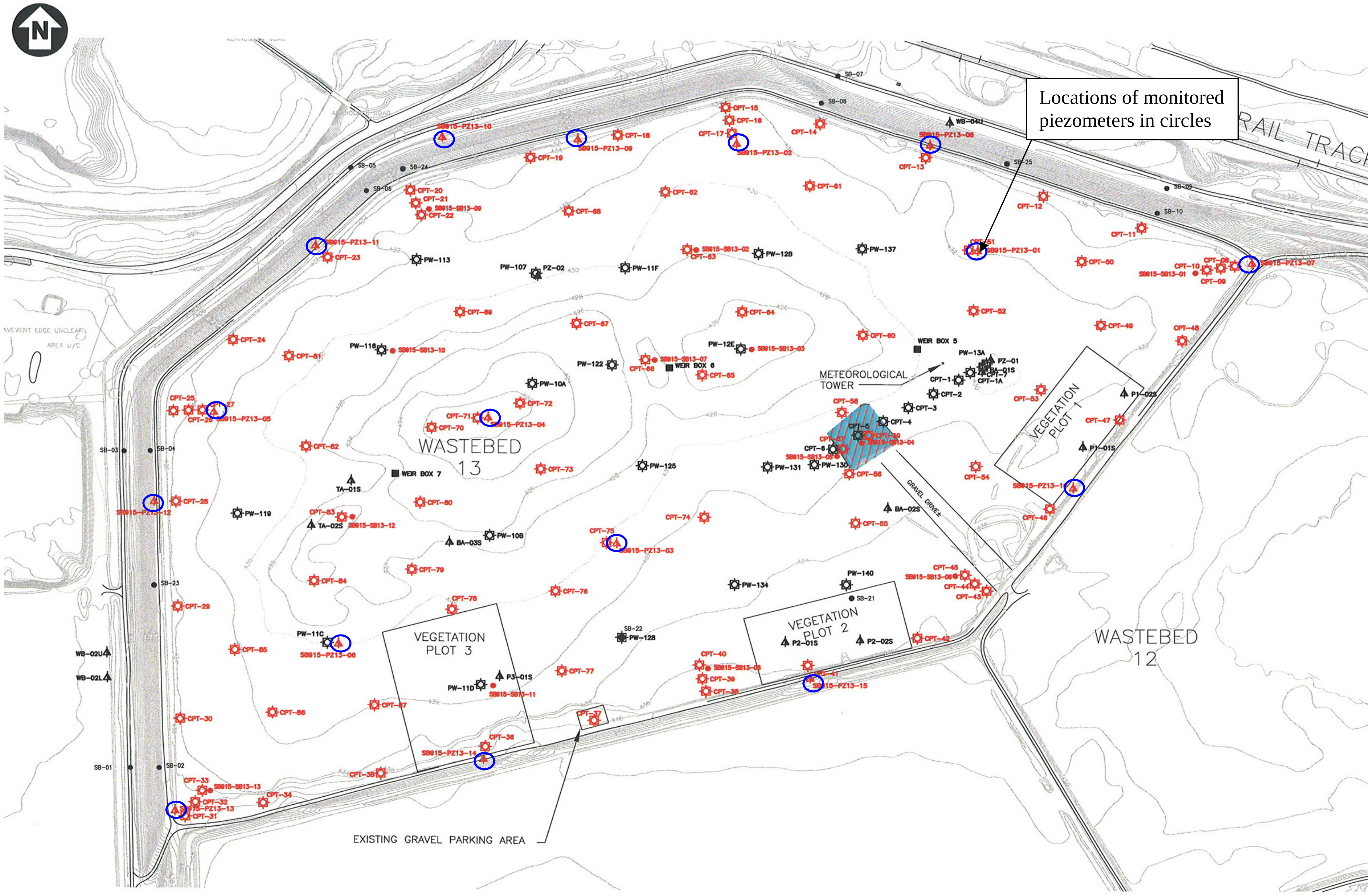


Figure 19. Locations of Piezometers Monitored Since November 2006

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

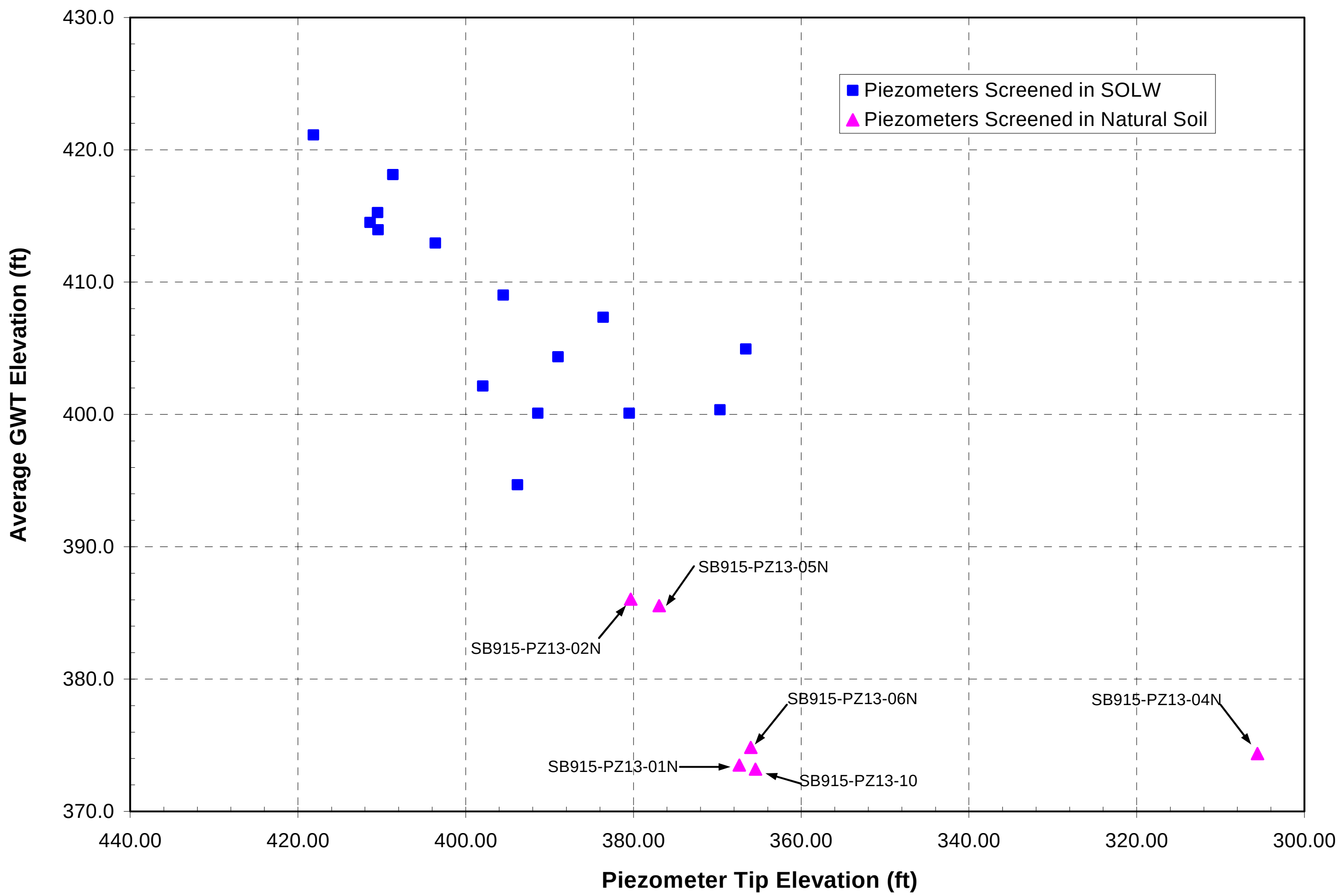


Figure 20. Average GWT Elevation vs. Piezometer Tip Elevation

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

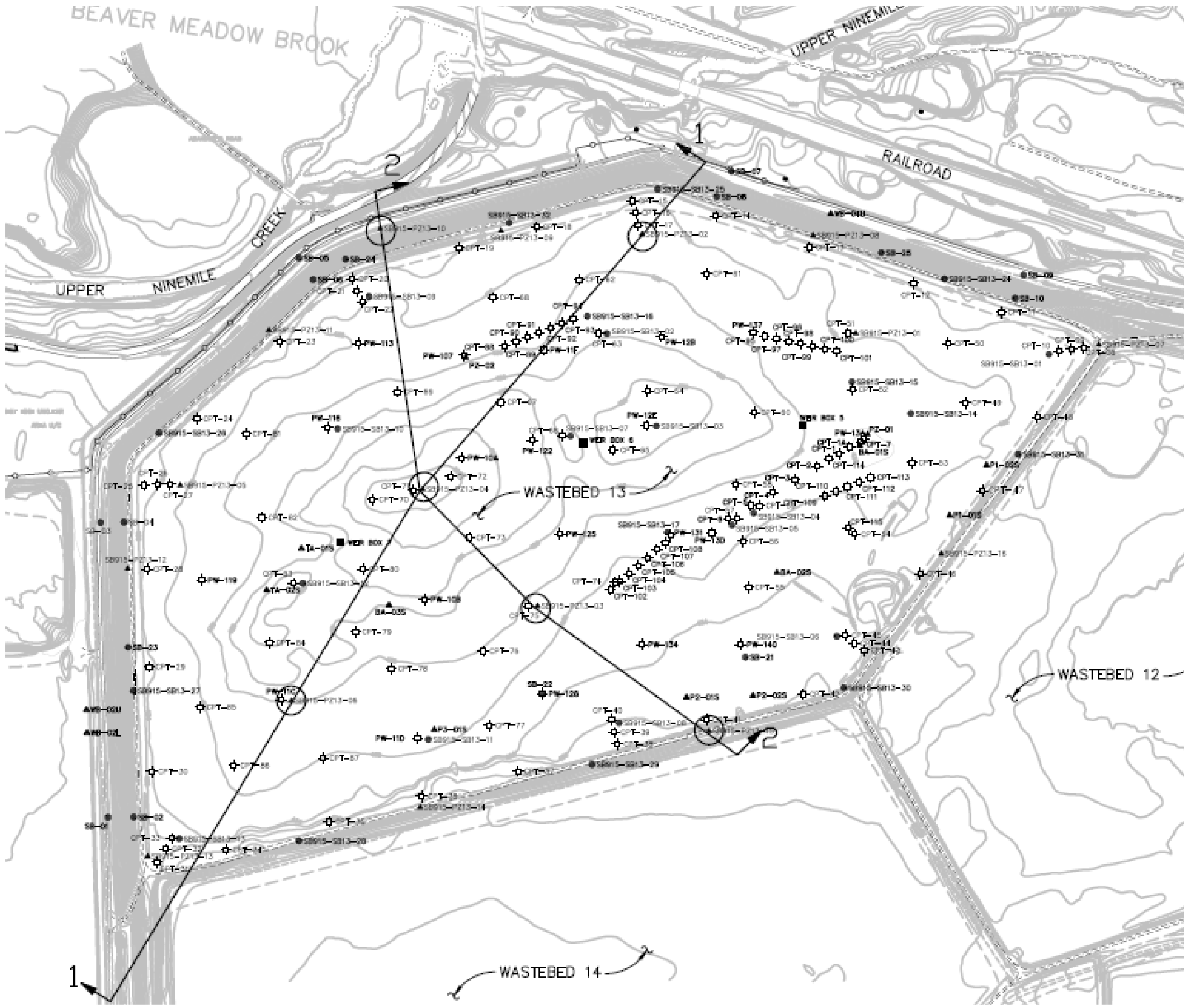


Figure 21. Locations of Cross Sections Showing Measured Groundwater Table Elevations

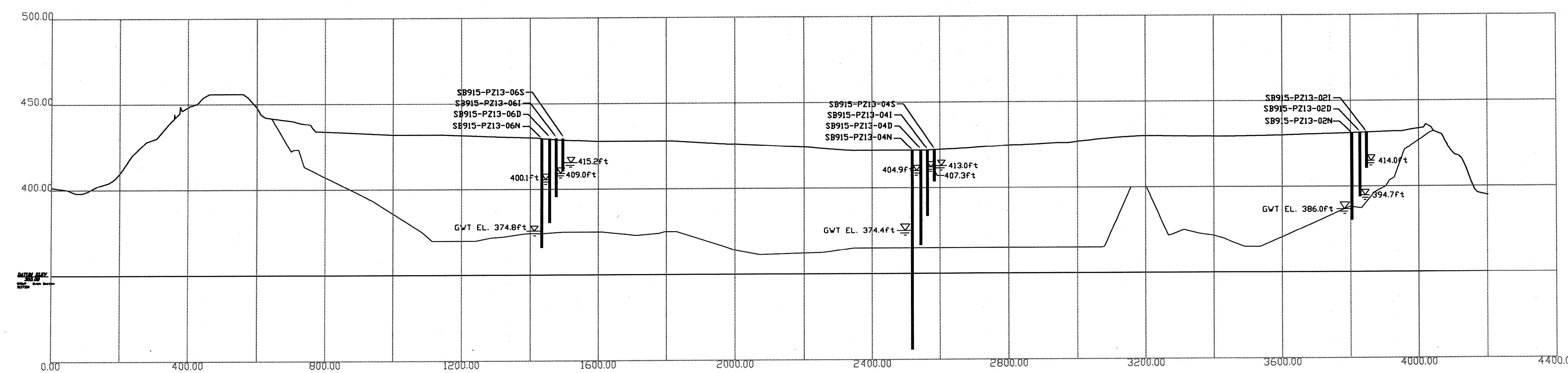


Figure 22. Measured Groundwater Table Elevations on Cross Section 1

Written by: Ming Zhu Date: 03/06/2008 Reviewed by: R. Kulasingam/Jay Beech Date: 03/06/2008

Client: Honeywell Project: Onondaga Lake SCA IDS Project/ Proposal No.: GD3944 Task No.: 04

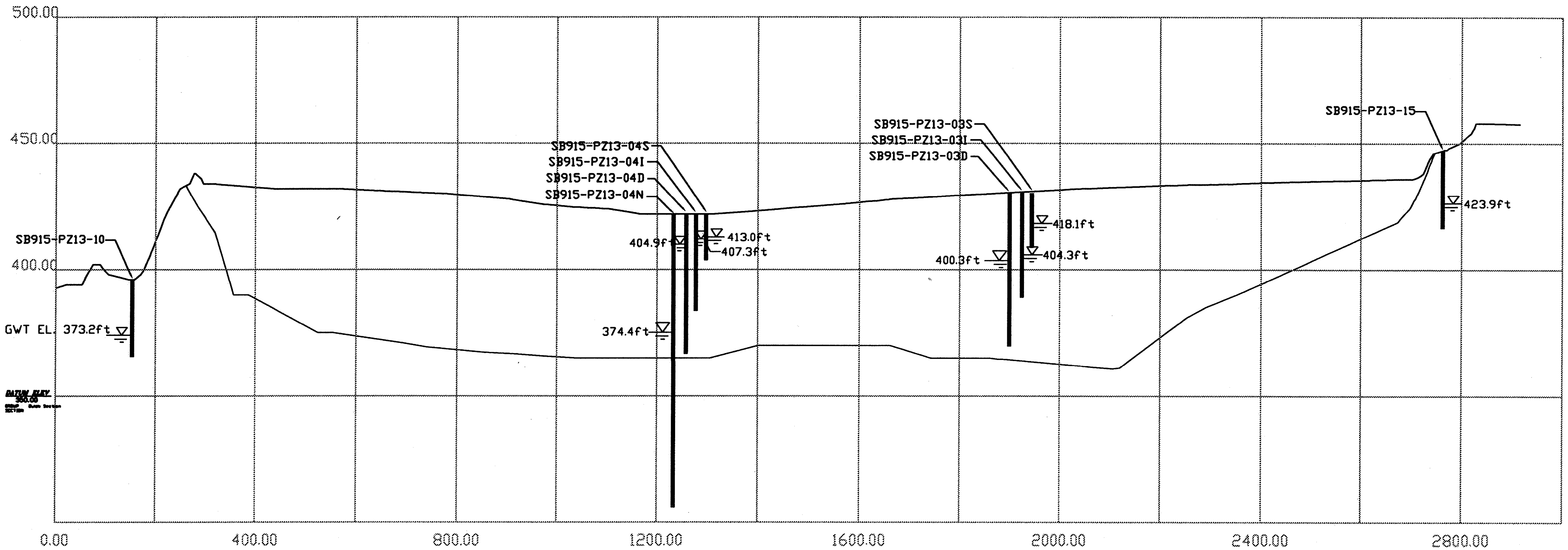
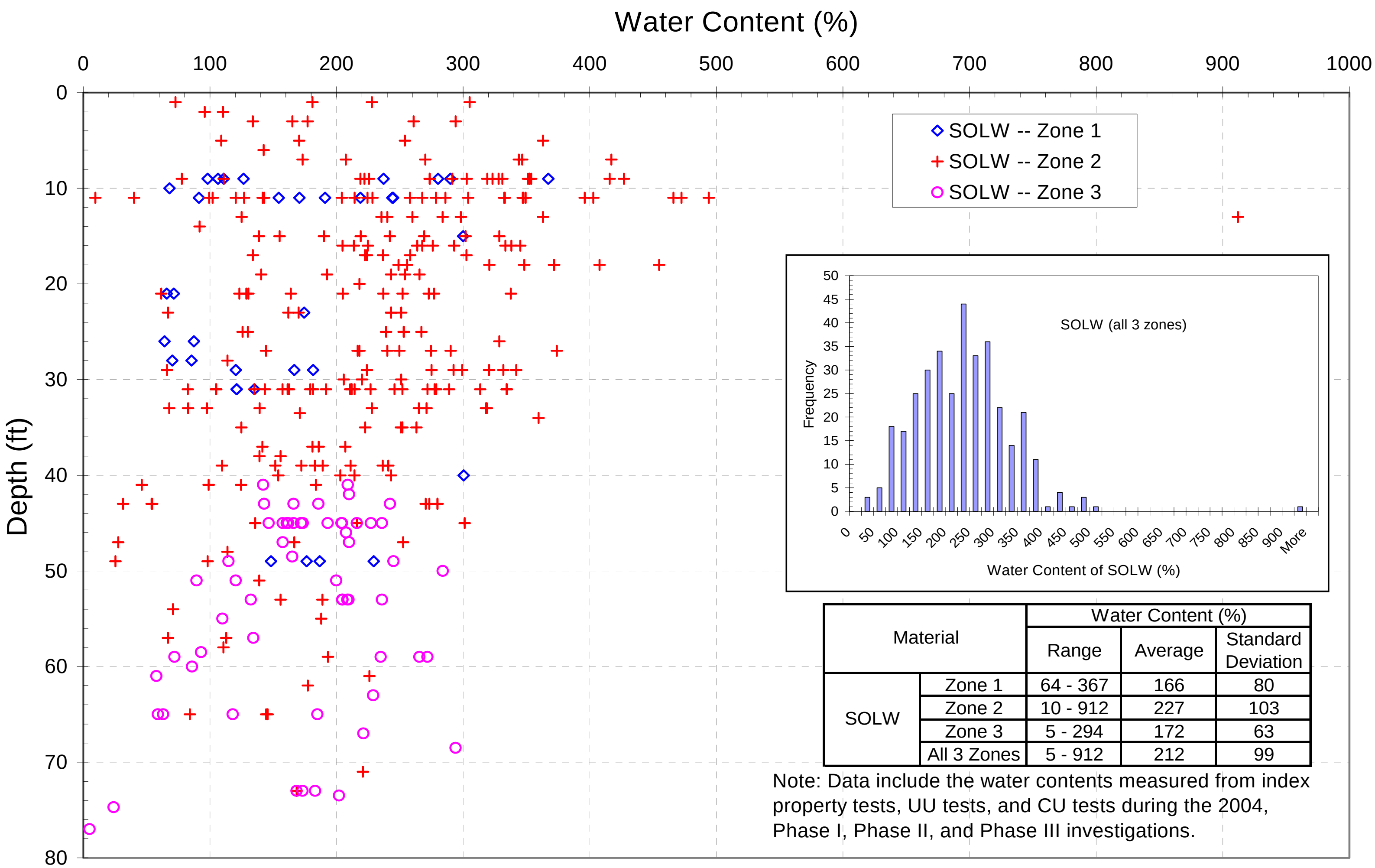


Figure 23. Measured Groundwater Table Elevations on Cross Section 2

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**



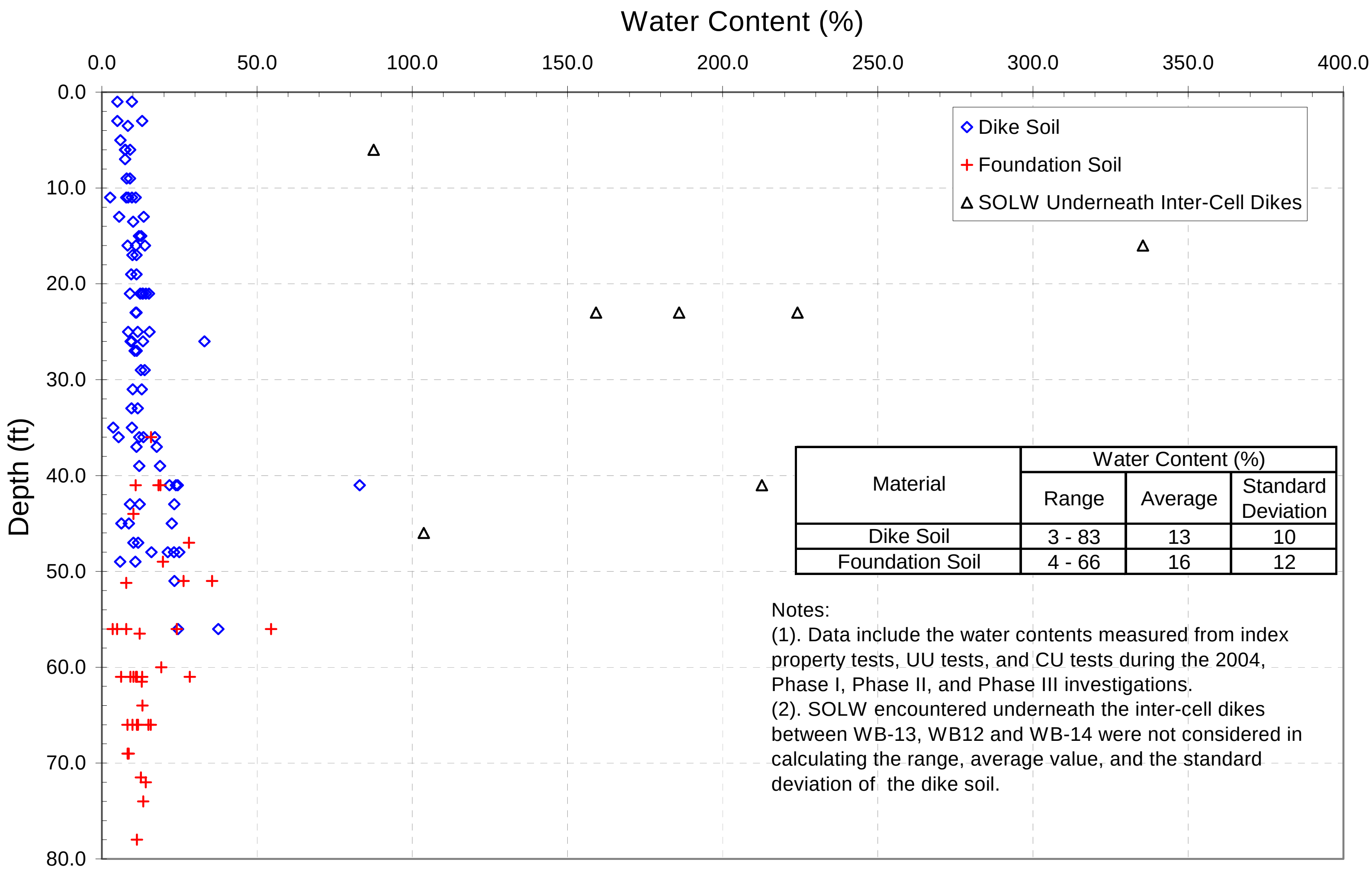
Material		Water Content (%) Range	Average	Standard Deviation
SOLW	Zone 1	64 - 367	166	80
	Zone 2	10 - 912	227	103
	Zone 3	5 - 294	172	63
	All 3 Zones	5 - 912	212	99

Note: Data include the water contents measured from index property tests, UU tests, and CU tests during the 2004, Phase I, Phase II, and Phase III investigations.

Figure 24. Water Content of SOLW
[Data from the summary tables provided in Attachment 3]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

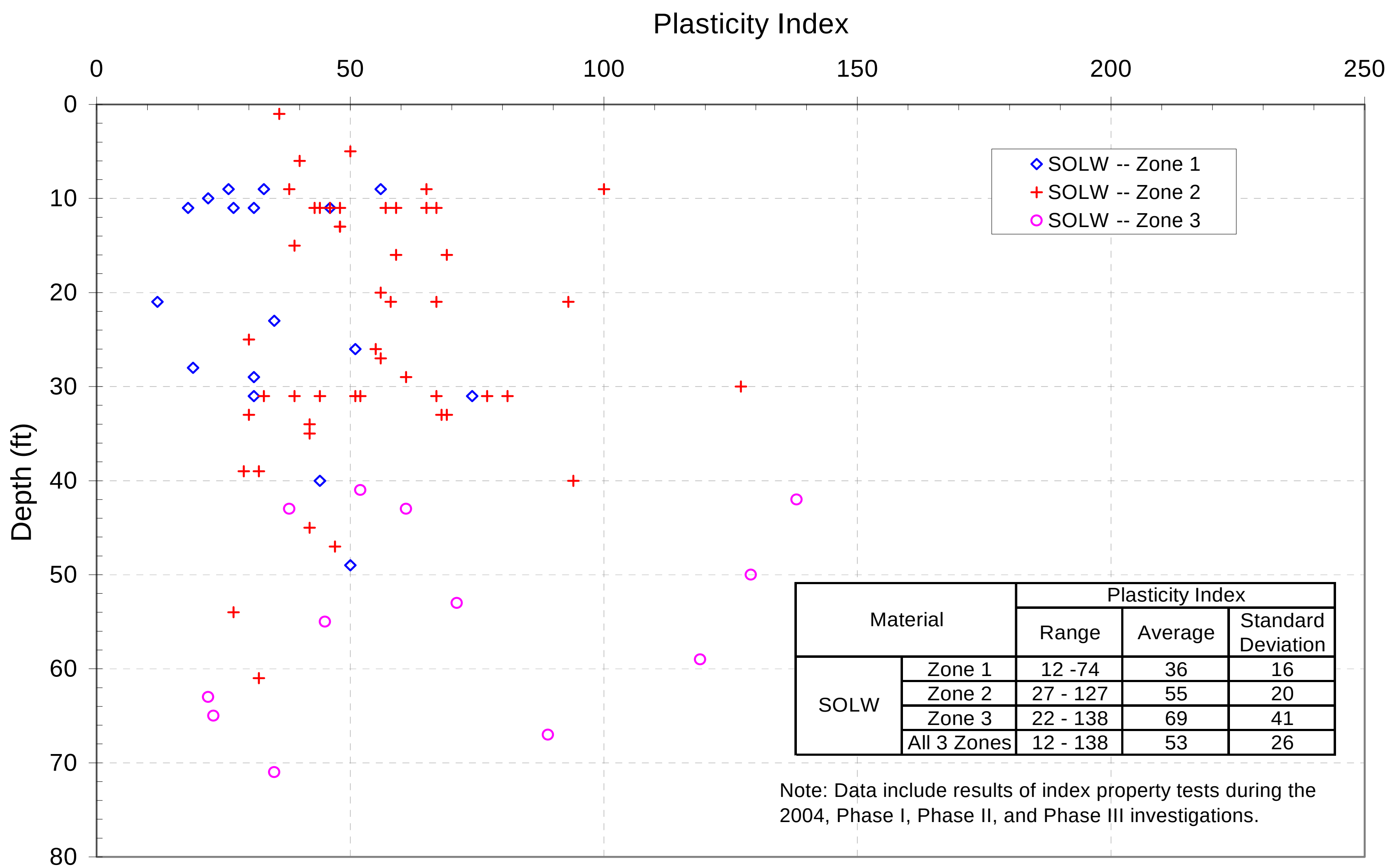


Material	Water Content (%)		
	Range	Average	Standard Deviation
Dike Soil	3 - 83	13	10
Foundation Soil	4 - 66	16	12

Notes:
(1). Data include the water contents measured from index property tests, UU tests, and CU tests during the 2004, Phase I, Phase II, and Phase III investigations.
(2). SOLW encountered underneath the inter-cell dikes between WB-13, WB12 and WB-14 were not considered in calculating the range, average value, and the standard deviation of the dike soil.

Figure 25. Water Content of Dike Soil and Foundation Soil
[Data from the summary tables provided in Attachment 3]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**



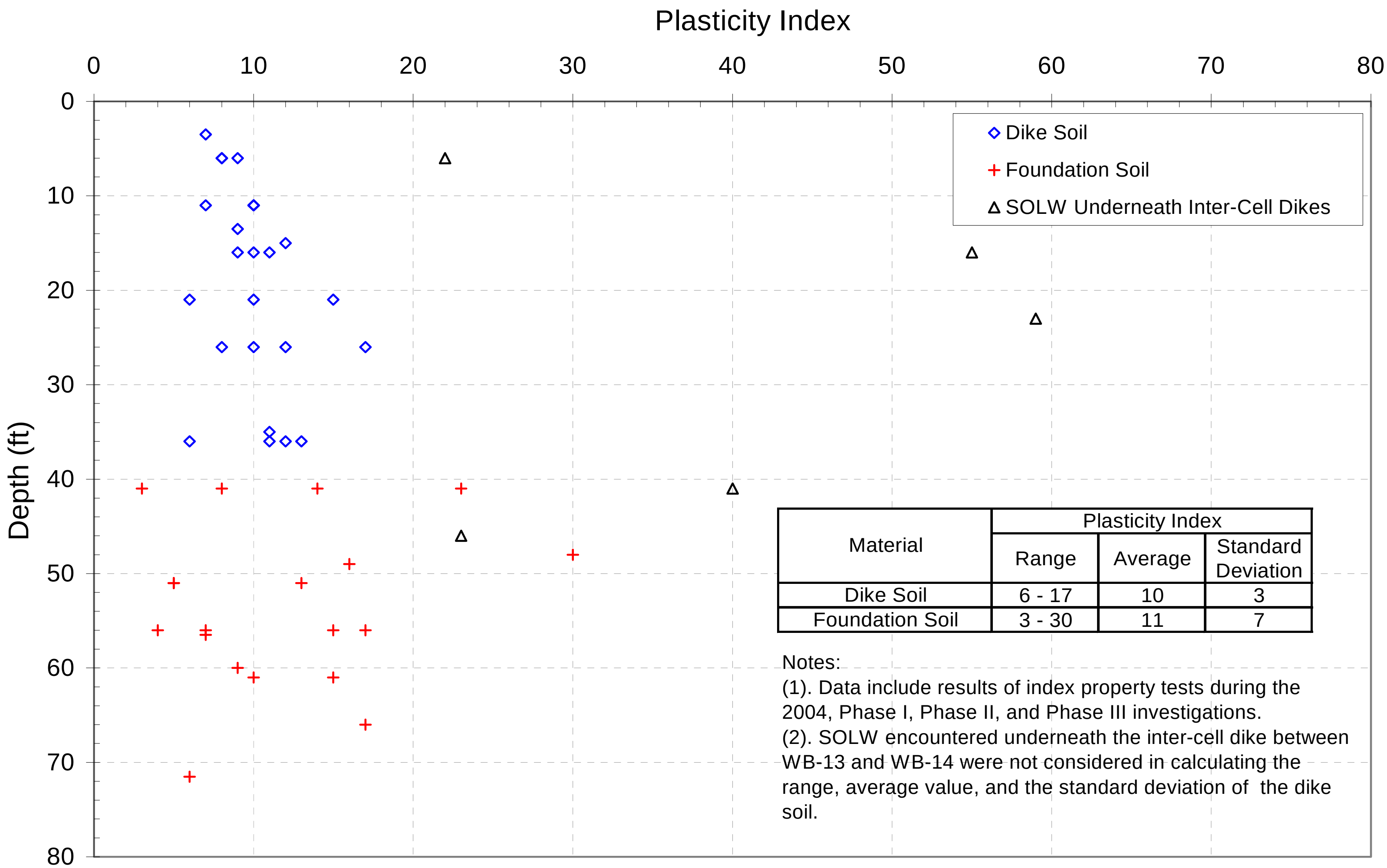
Material		Plasticity Index		
		Range	Average	Standard Deviation
SOLW	Zone 1	12 -74	36	16
	Zone 2	27 - 127	55	20
	Zone 3	22 - 138	69	41
	All 3 Zones	12 - 138	53	26

Note: Data include results of index property tests during the 2004, Phase I, Phase II, and Phase III investigations.

Figure 26. Plasticity Index of SOLW
[Data from the summary tables provided in Attachment 3]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

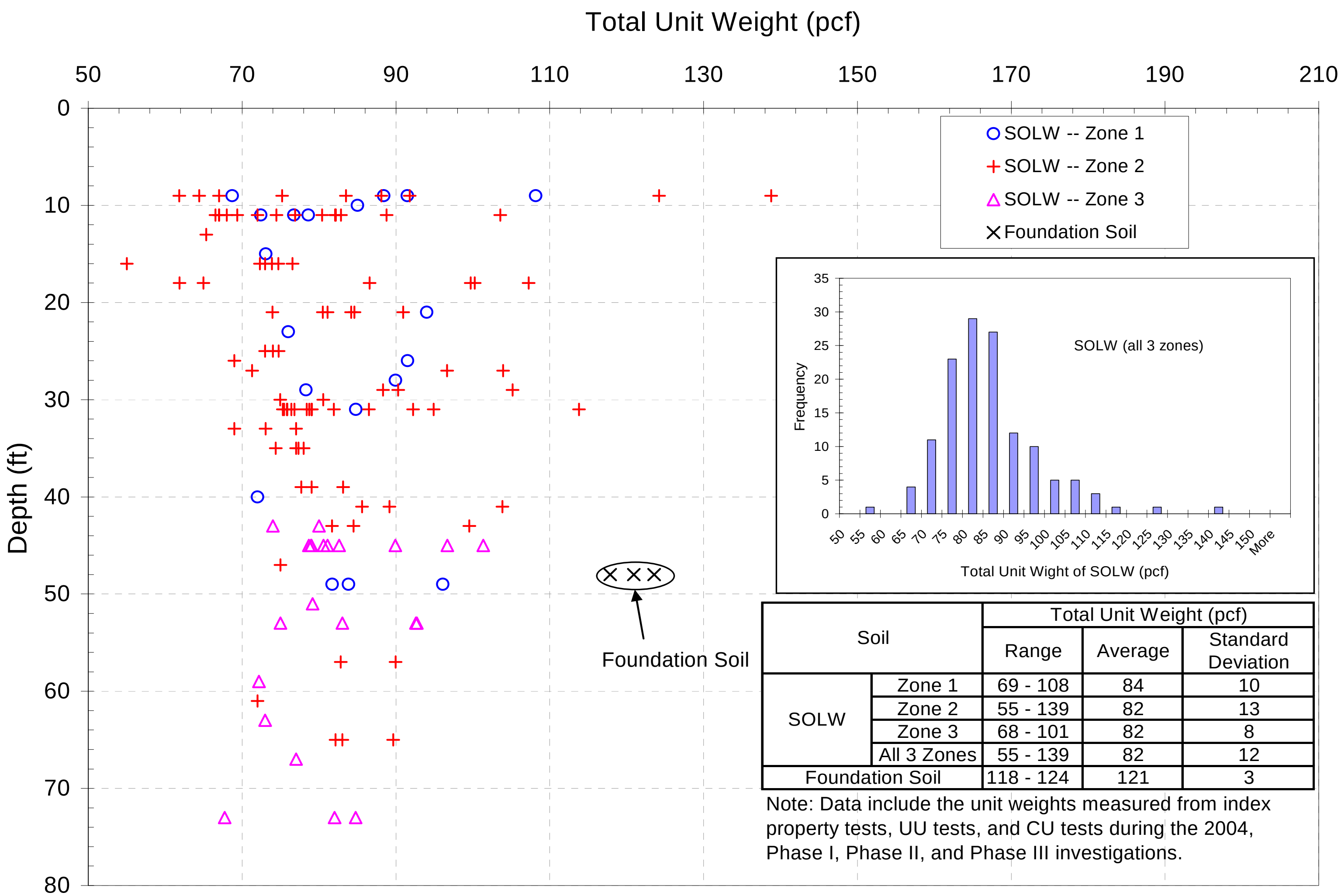


Material	Plasticity Index		
	Range	Average	Standard Deviation
Dike Soil	6 - 17	10	3
Foundation Soil	3 - 30	11	7

Notes:
(1). Data include results of index property tests during the 2004, Phase I, Phase II, and Phase III investigations.
(2). SOLW encountered underneath the inter-cell dike between WB-13 and WB-14 were not considered in calculating the range, average value, and the standard deviation of the dike soil.

Figure 27. Plasticity Index of Dike Soil and Foundation Soil
[Data from the summary tables provided in Attachment 3]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04



Soil		Total Unit Weight (pcf)		
		Range	Average	Standard Deviation
SOLW	Zone 1	69 - 108	84	10
	Zone 2	55 - 139	82	13
	Zone 3	68 - 101	82	8
	All 3 Zones	55 - 139	82	12
Foundation Soil		118 - 124	121	3

Note: Data include the unit weights measured from index property tests, UU tests, and CU tests during the 2004, Phase I, Phase II, and Phase III investigations.

Figure 28. Total Unit Weight of SOLW and Foundation Soil
[Data from the summary tables provided in Attachment 3]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

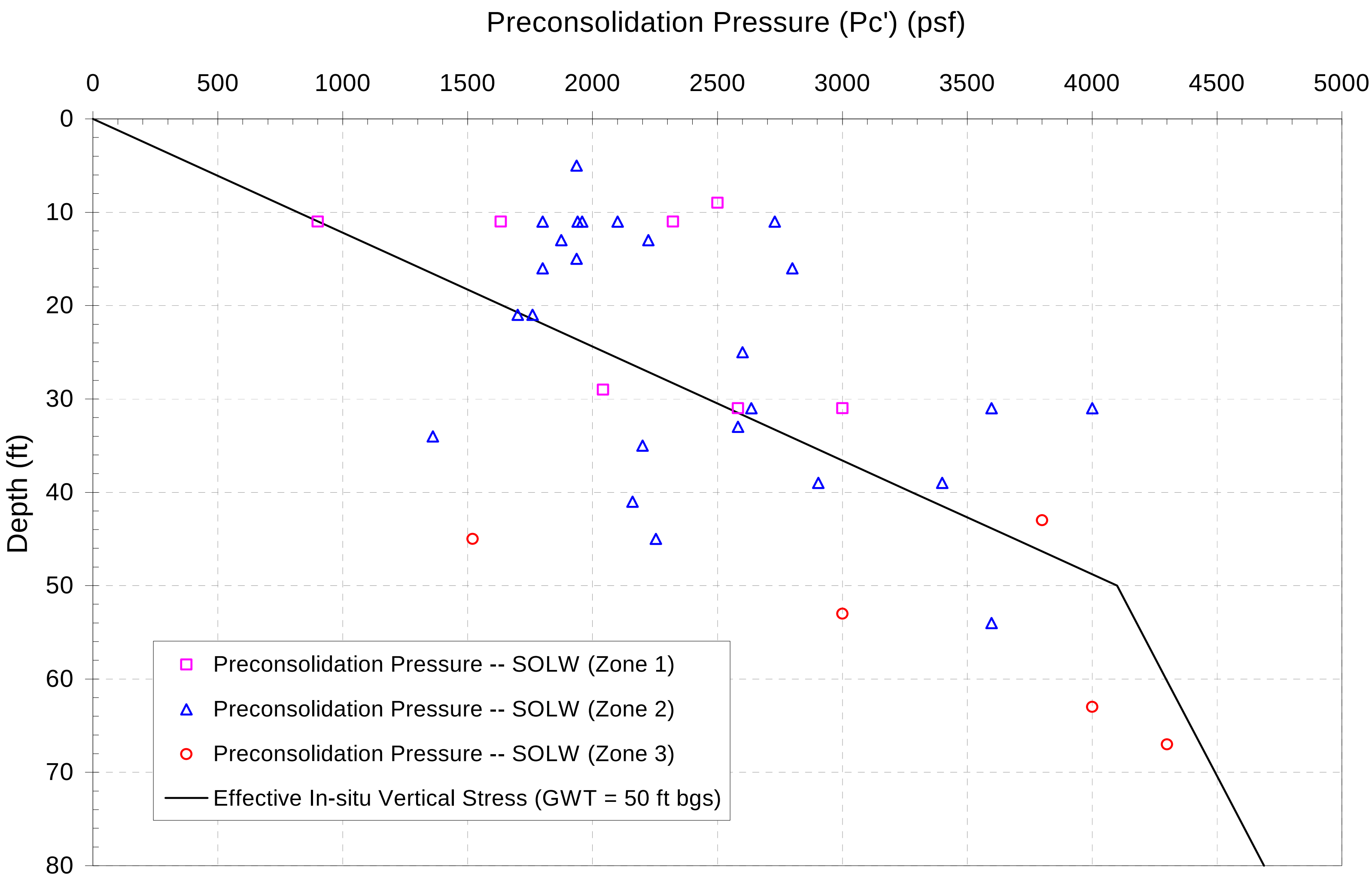


Figure 29. Preconsolidation Pressure of SOLW
[Data from the summary tables provided in Attachment 3]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

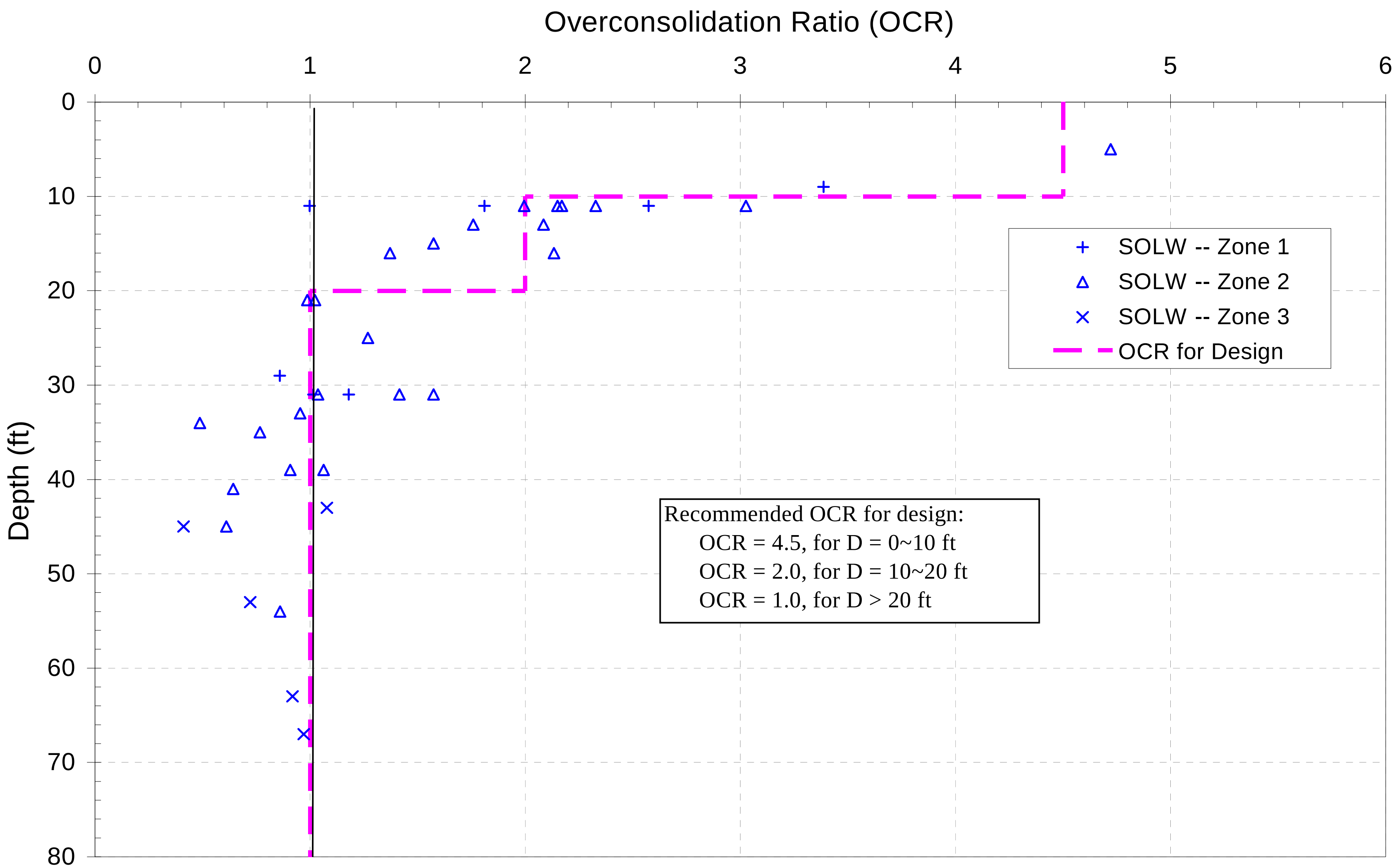
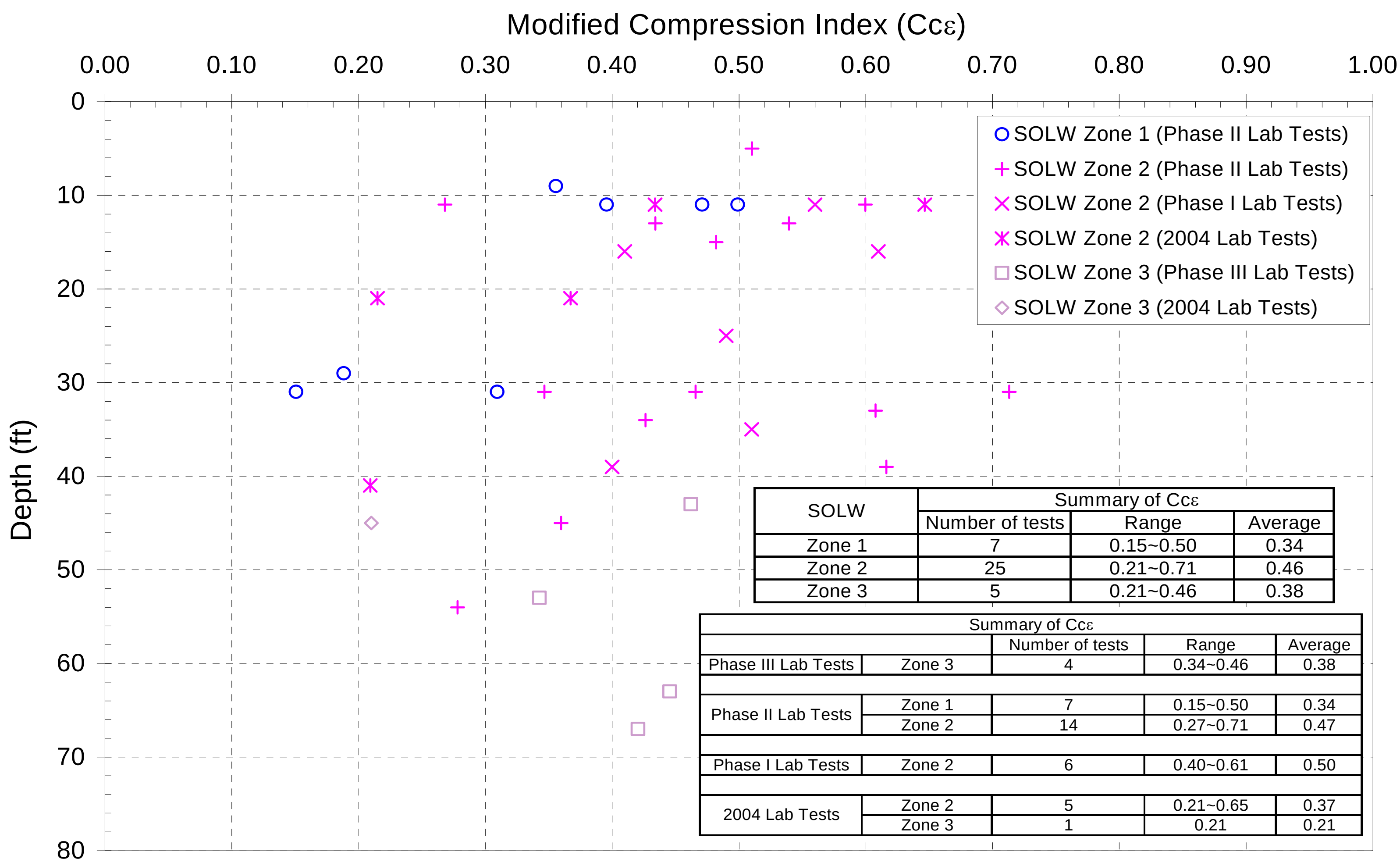


Figure 30. Overconsolidation Ratio of SOLW

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**



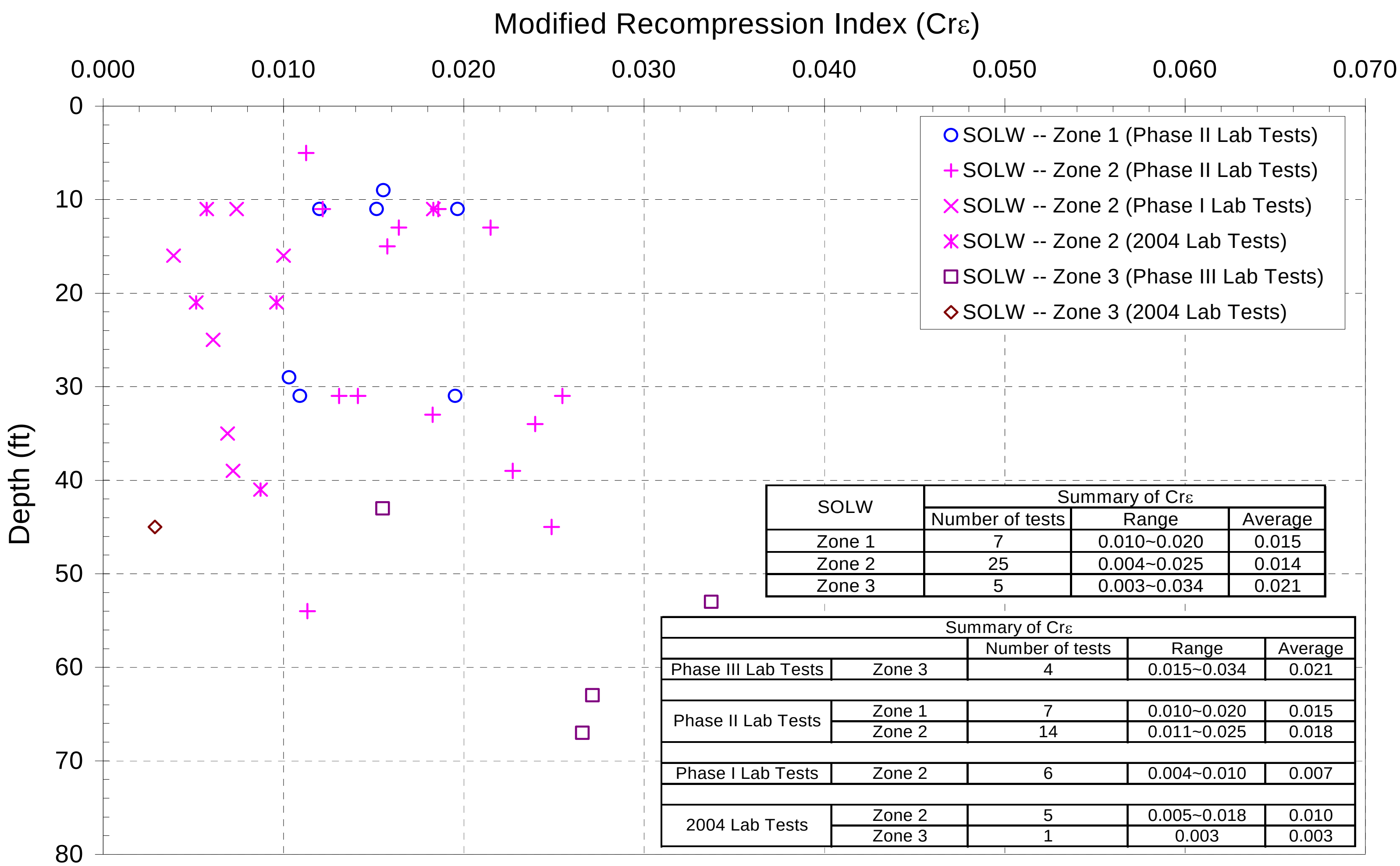
SOLW	Summary of Ccε		
	Number of tests	Range	Average
Zone 1	7	0.15~0.50	0.34
Zone 2	25	0.21~0.71	0.46
Zone 3	5	0.21~0.46	0.38

Summary of Ccε				
		Number of tests	Range	Average
Phase III Lab Tests	Zone 3	4	0.34~0.46	0.38
Phase II Lab Tests	Zone 1	7	0.15~0.50	0.34
	Zone 2	14	0.27~0.71	0.47
Phase I Lab Tests	Zone 2	6	0.40~0.61	0.50
2004 Lab Tests	Zone 2	5	0.21~0.65	0.37
	Zone 3	1	0.21	0.21

Figure 31. Modified Compression Index of SOLW
[Data from the summary tables provided in Attachment 3]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**



SOLW	Summary of Crε		
	Number of tests	Range	Average
Zone 1	7	0.010~0.020	0.015
Zone 2	25	0.004~0.025	0.014
Zone 3	5	0.003~0.034	0.021

Summary of Crε				
		Number of tests	Range	Average
Phase III Lab Tests	Zone 3	4	0.015~0.034	0.021
Phase II Lab Tests	Zone 1	7	0.010~0.020	0.015
	Zone 2	14	0.011~0.025	0.018
Phase I Lab Tests	Zone 2	6	0.004~0.010	0.007
2004 Lab Tests	Zone 2	5	0.005~0.018	0.010
	Zone 3	1	0.003	0.003

Figure 32. Modified Recompression Index of SOLW
[Data from the summary tables provided in Attachment 3]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

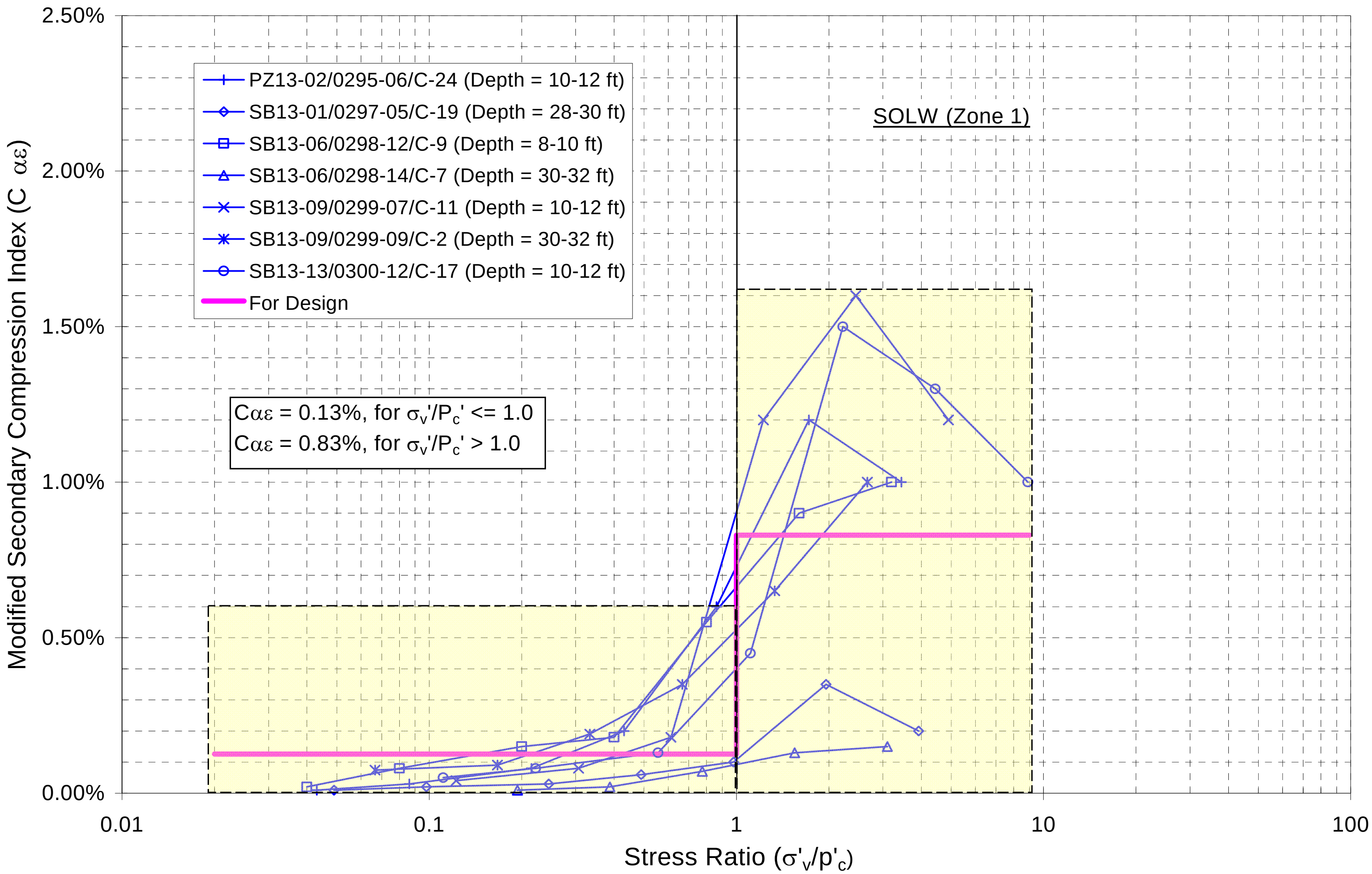


Figure 33. Modified Secondary Compression Index for SOLW in Zone 1
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a) and Parsons (2008c)]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

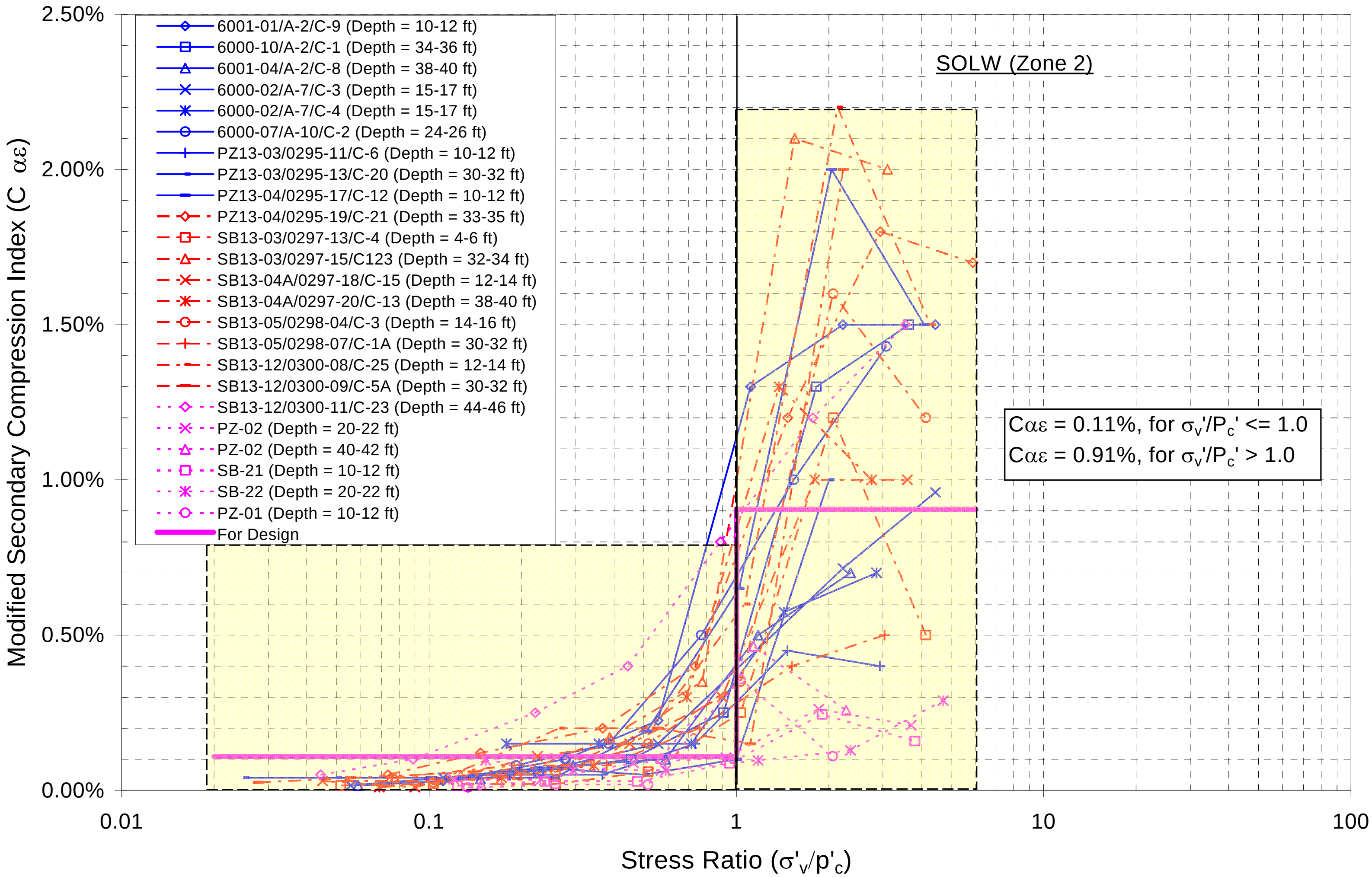


Figure 34. Modified Secondary Compression Index for SOLW in Zone 2
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a) and Parsons (2008c)]

Written by: Ming Zhu Date: 03/06/2008 Reviewed by: R. Kulasingam/Jay Beech Date: 03/06/2008

Client: Honeywell Project: Onondaga Lake SCA IDS Project/ Proposal No.: GD3944 Task No.: 04

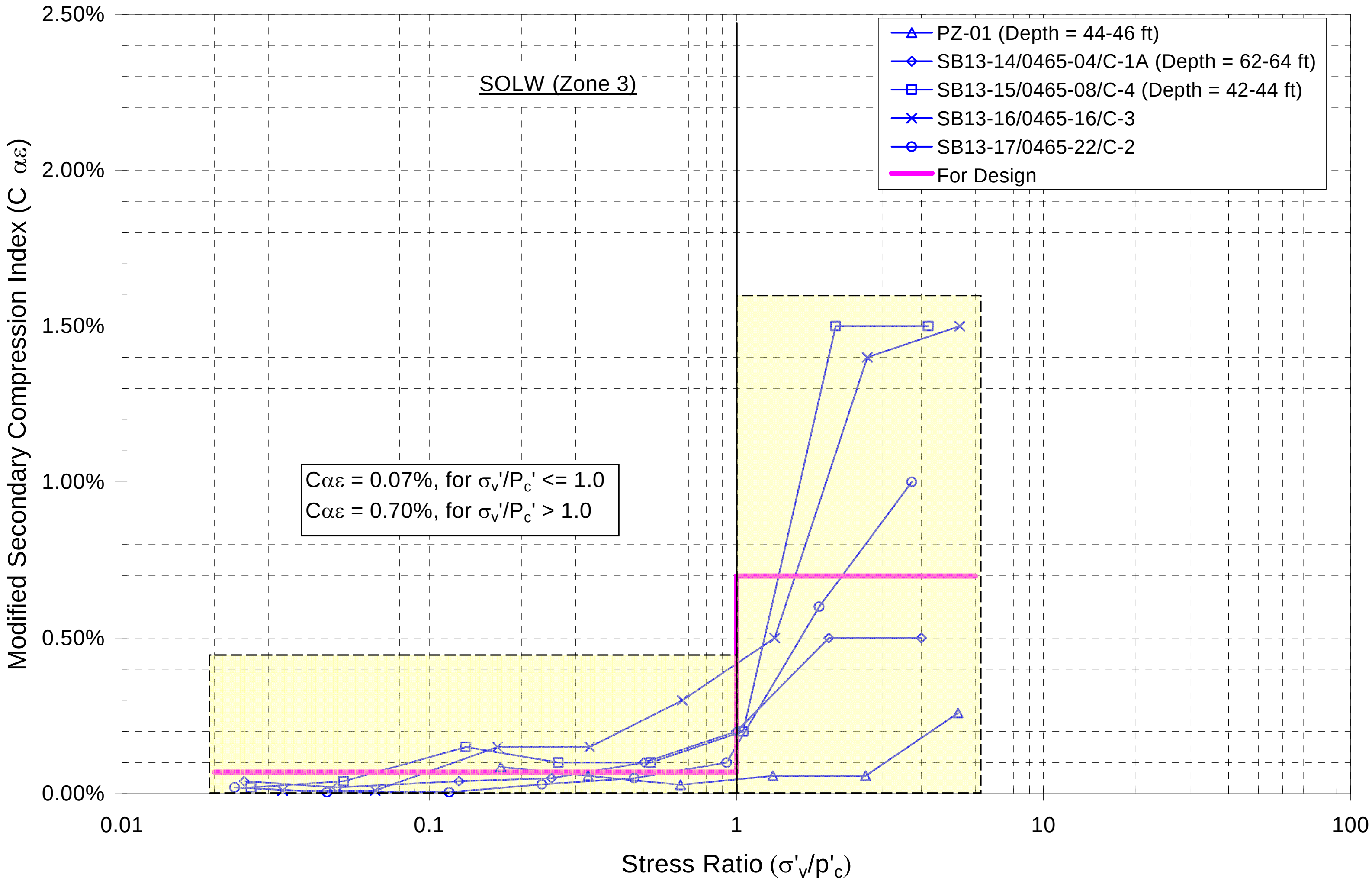


Figure 35. Modified Secondary Compression Index for SOLW in Zone 3
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a), Parsons (2008c;2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

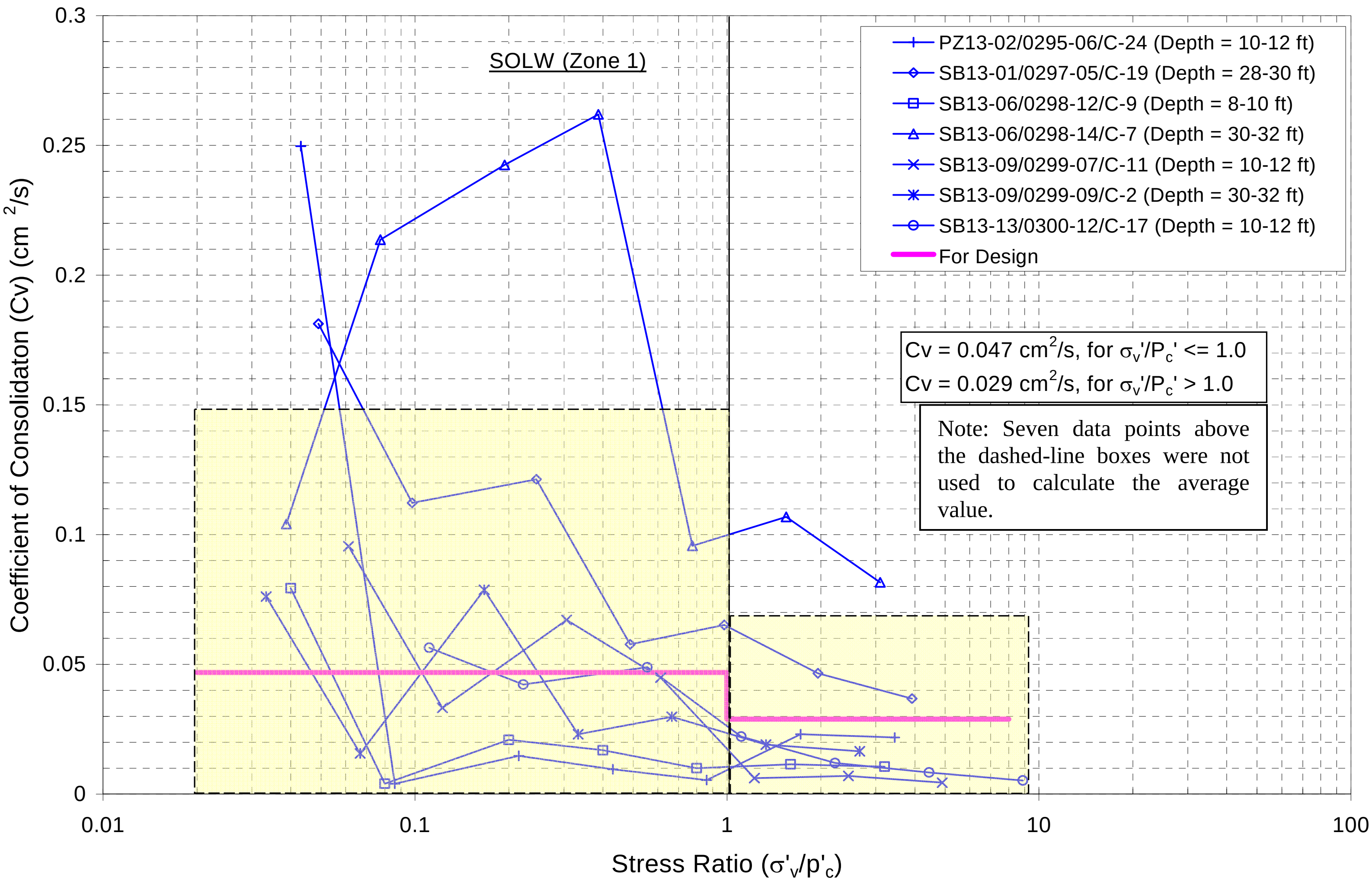


Figure 36. Coefficient of Consolidation for SOLW in Zone 1
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a) and Parsons (2008c)]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

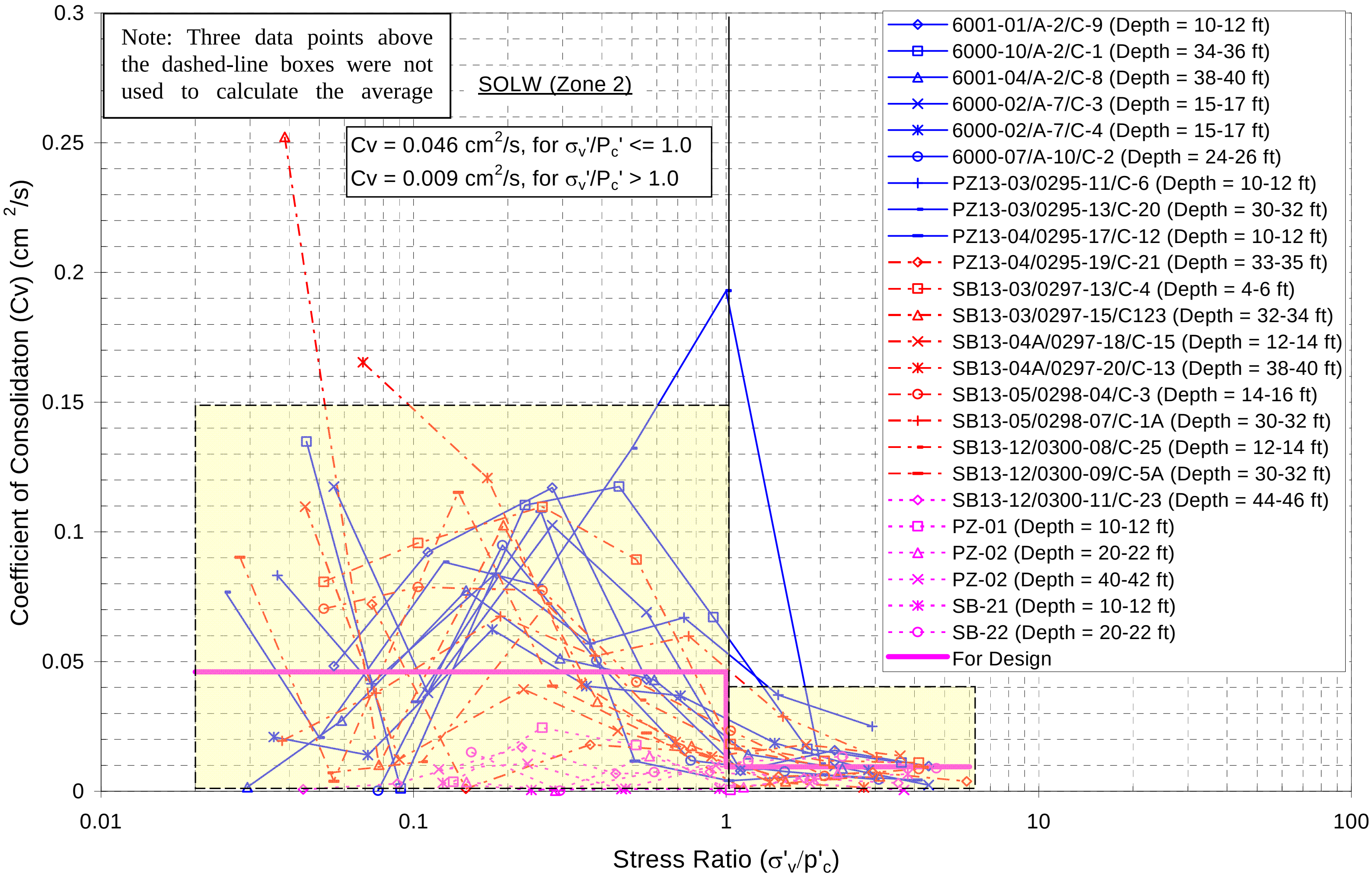


Figure 37. Coefficient of Consolidation for SOLW in Zone 2
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a) and Parsons (2008c)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

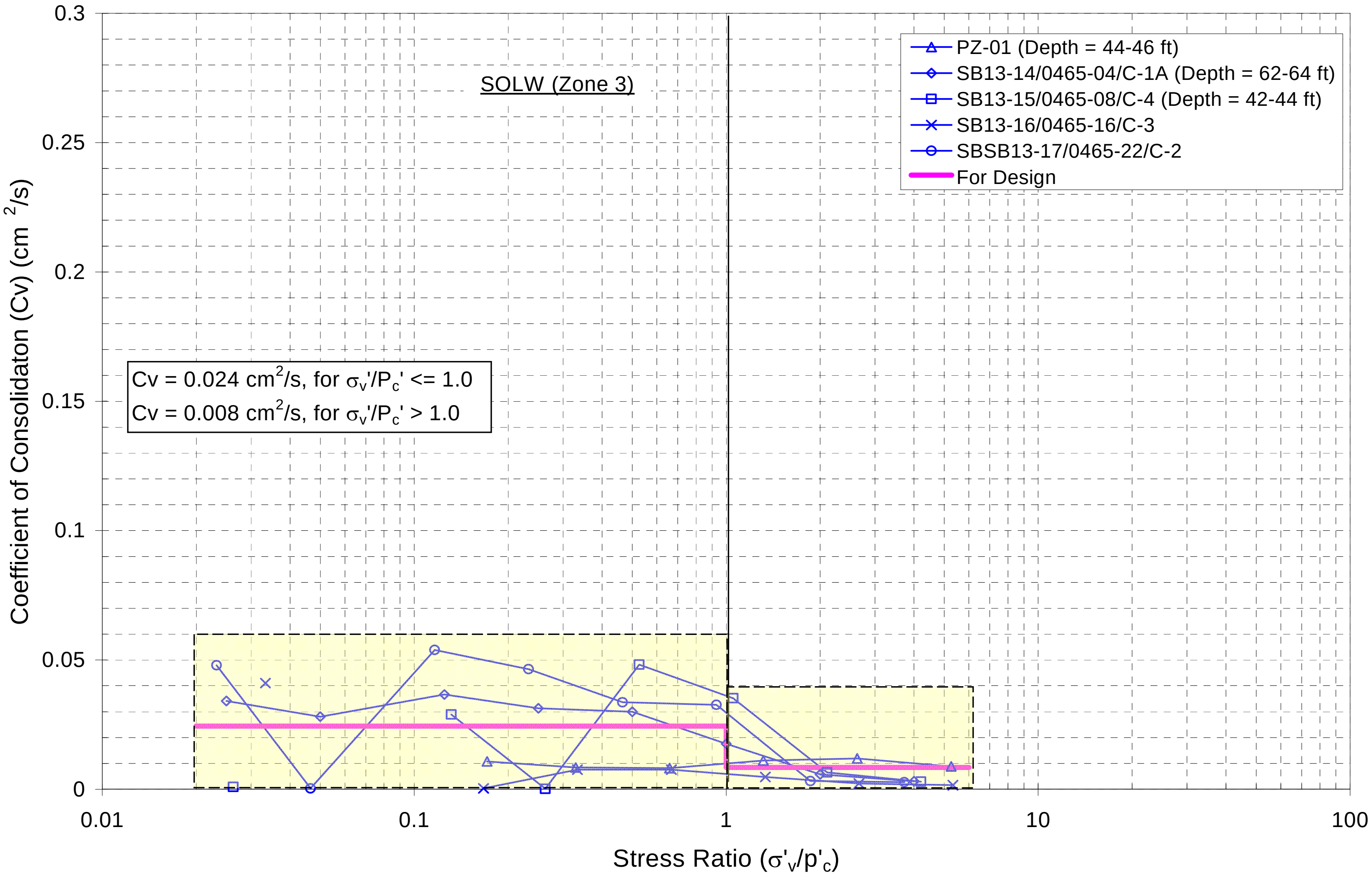


Figure 38. Coefficient of Consolidation for SOLW in Zone 3
[based on 1-D consolidation test reports provided in Parsons and Geosyntec (2008a) and Parsons (2008c;2009)]

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

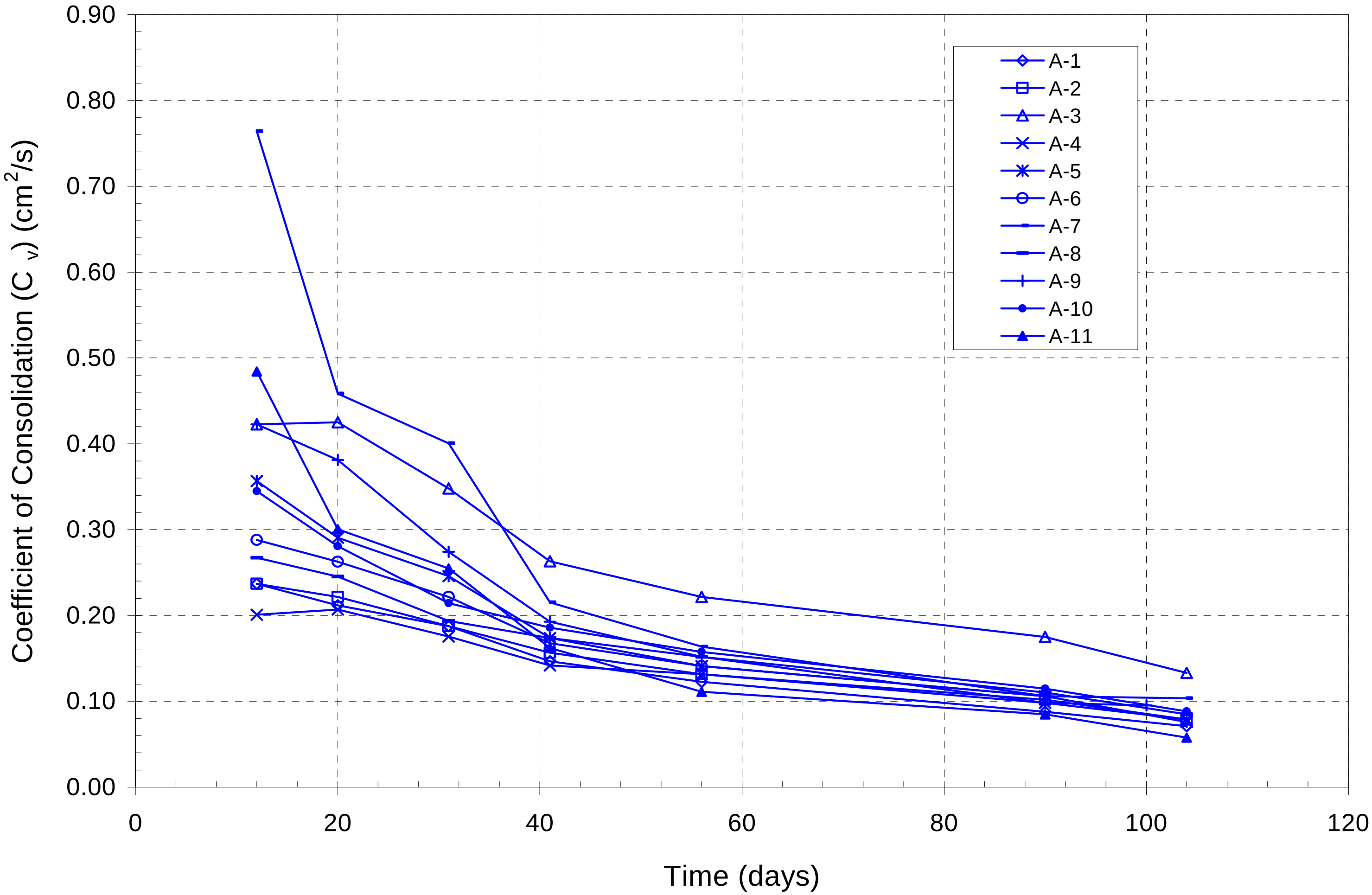


Figure 39. Coefficient of Consolidation from Phase I Pilot Study

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

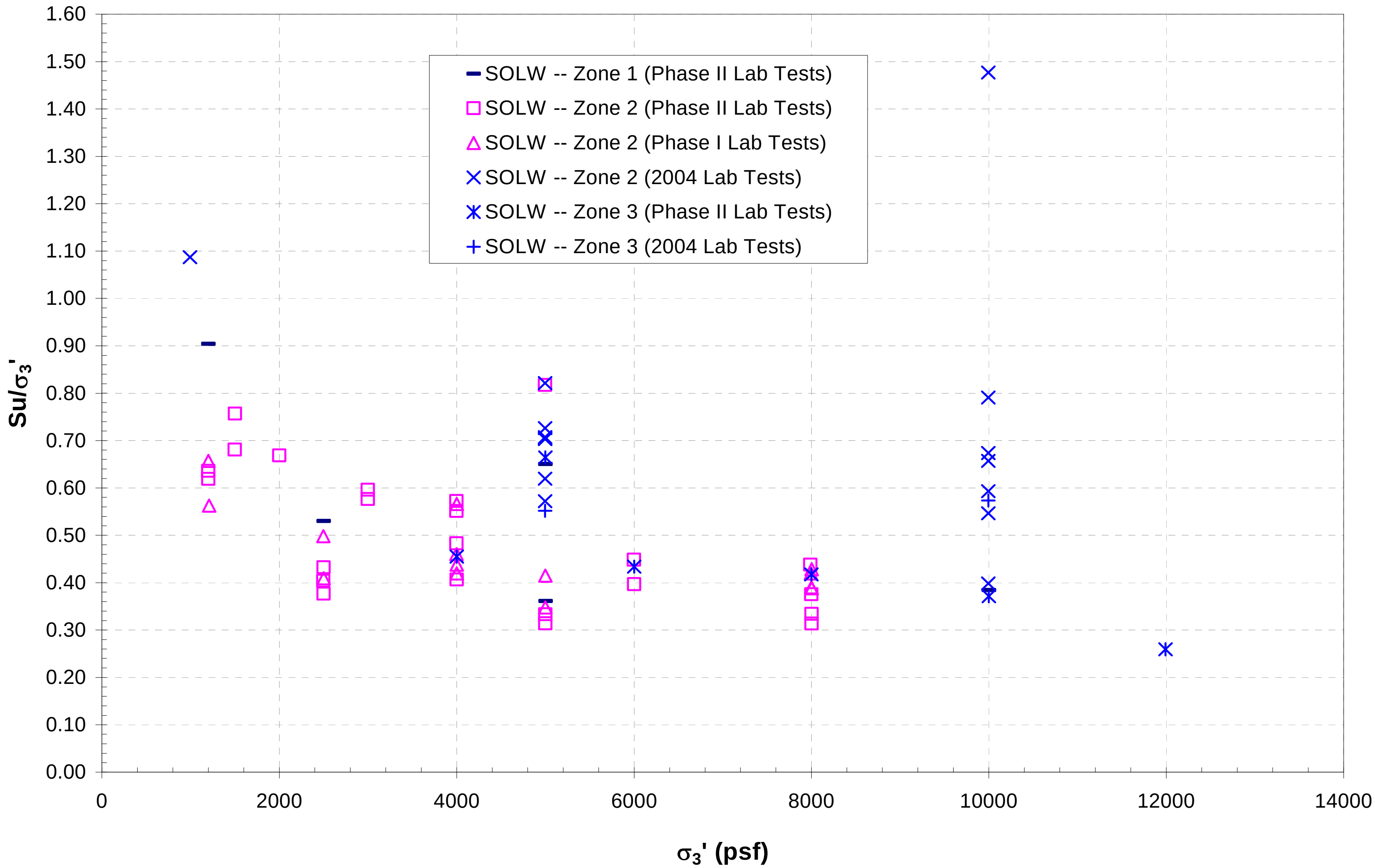
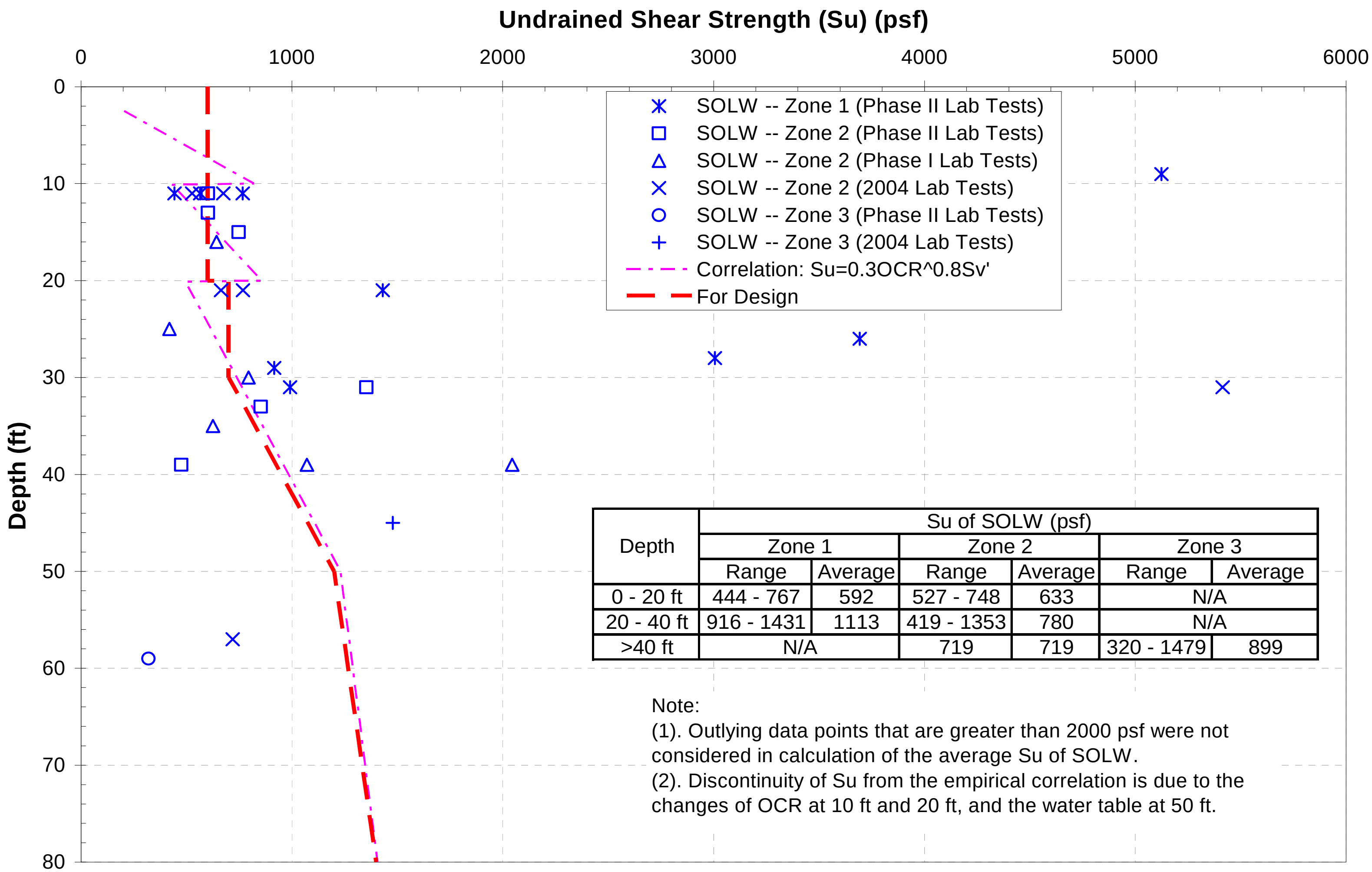


Figure 40. Undrained Strength Ratio of SOLW
[Data from the summary tables provided in Attachment 3]

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**



Depth	Su of SOLW (psf)					
	Zone 1		Zone 2		Zone 3	
	Range	Average	Range	Average	Range	Average
0 - 20 ft	444 - 767	592	527 - 748	633	N/A	
20 - 40 ft	916 - 1431	1113	419 - 1353	780	N/A	
>40 ft	N/A		719	719	320 - 1479	899

Note:
(1). Outlying data points that are greater than 2000 psf were not considered in calculation of the average Su of SOLW.
(2). Discontinuity of Su from the empirical correlation is due to the changes of OCR at 10 ft and 20 ft, and the water table at 50 ft.

Figure 41. Undrained Shear Strength of SOLW
[Data from the summary tables provided in Attachment 3]

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

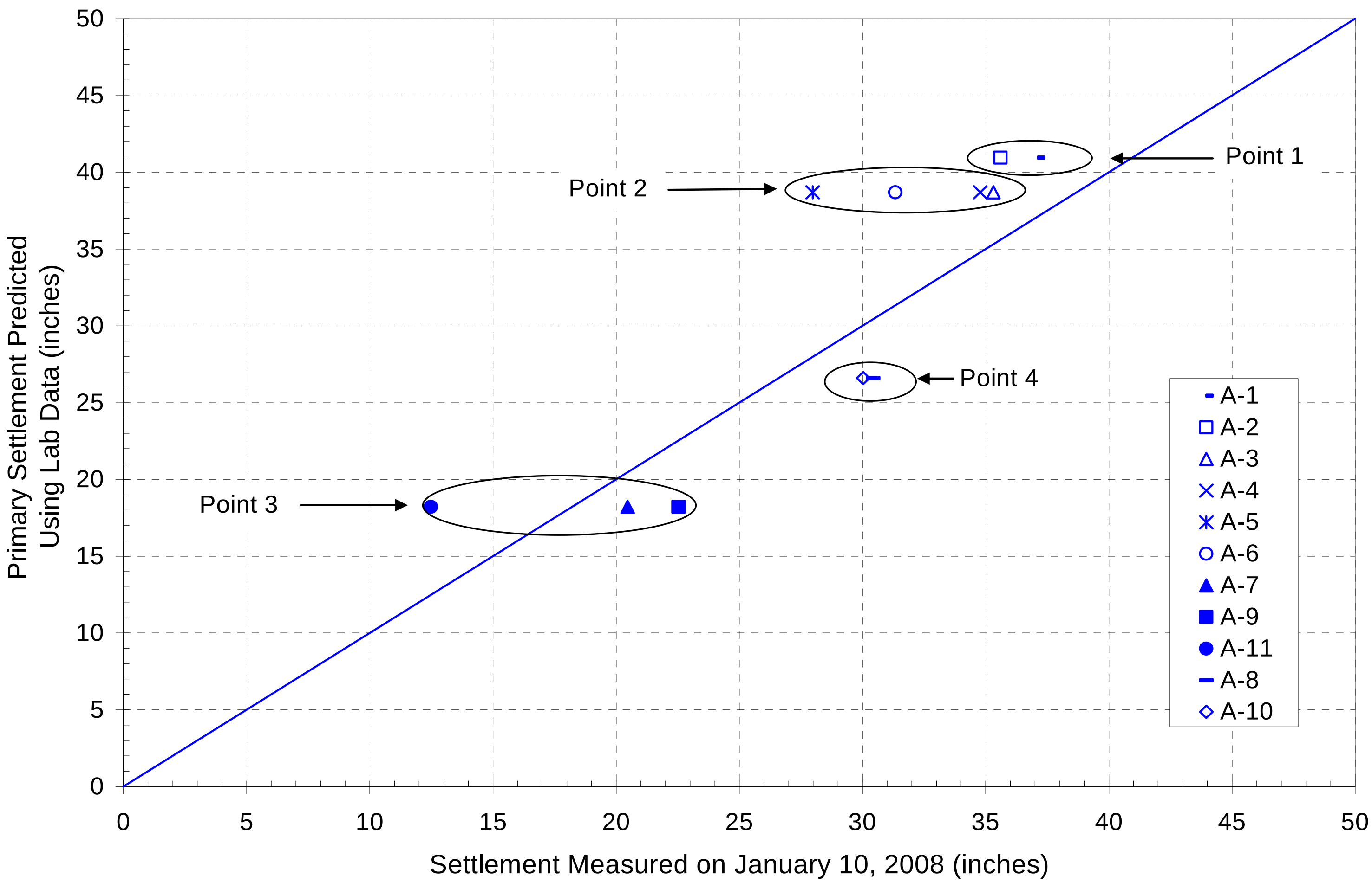


Figure 42. Comparison of Predicted Settlement with Settlement from Phase I Pilot Study

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

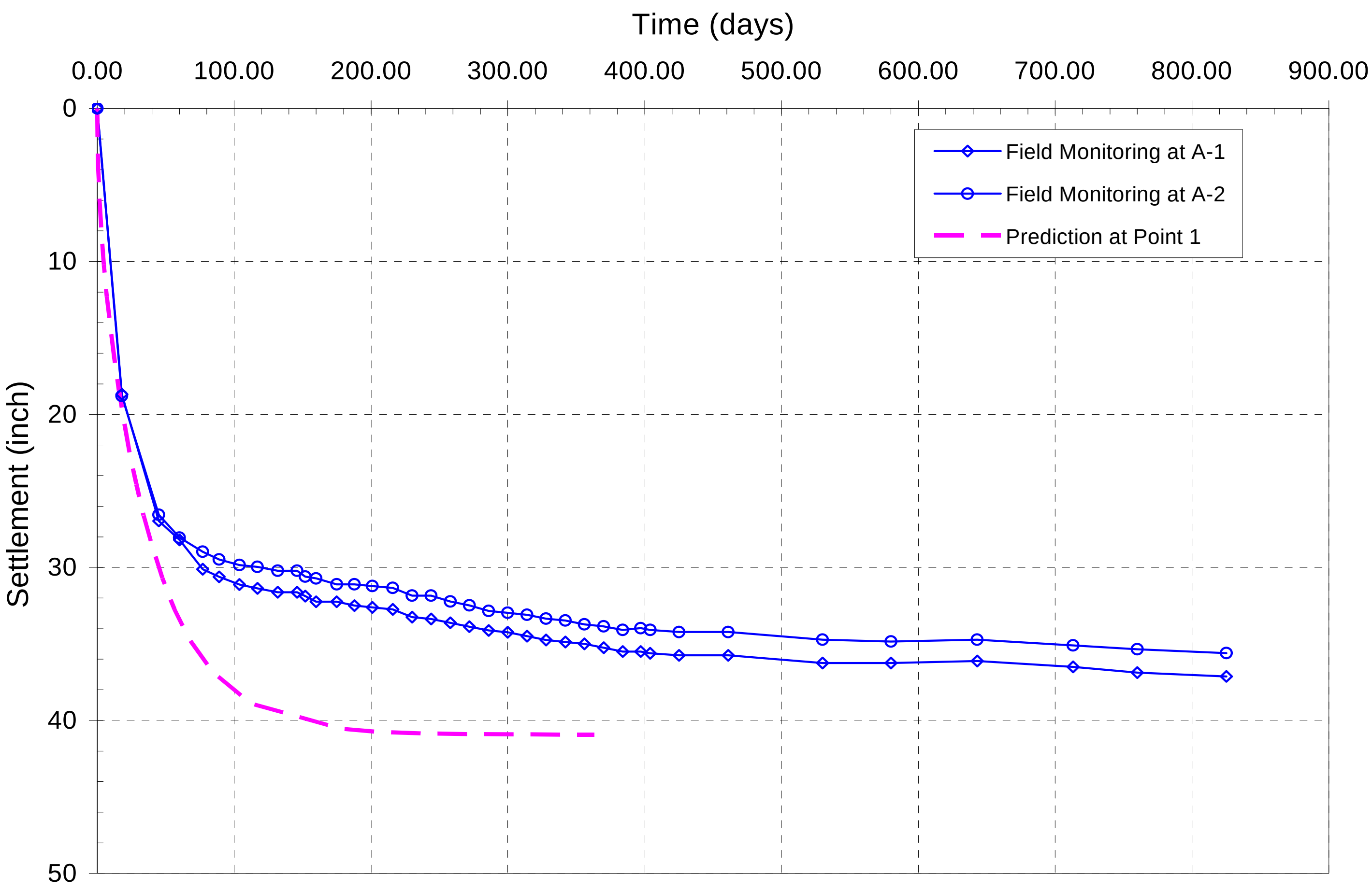


Figure 43. Prediction of Time Rate of Consolidation at Point 1

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

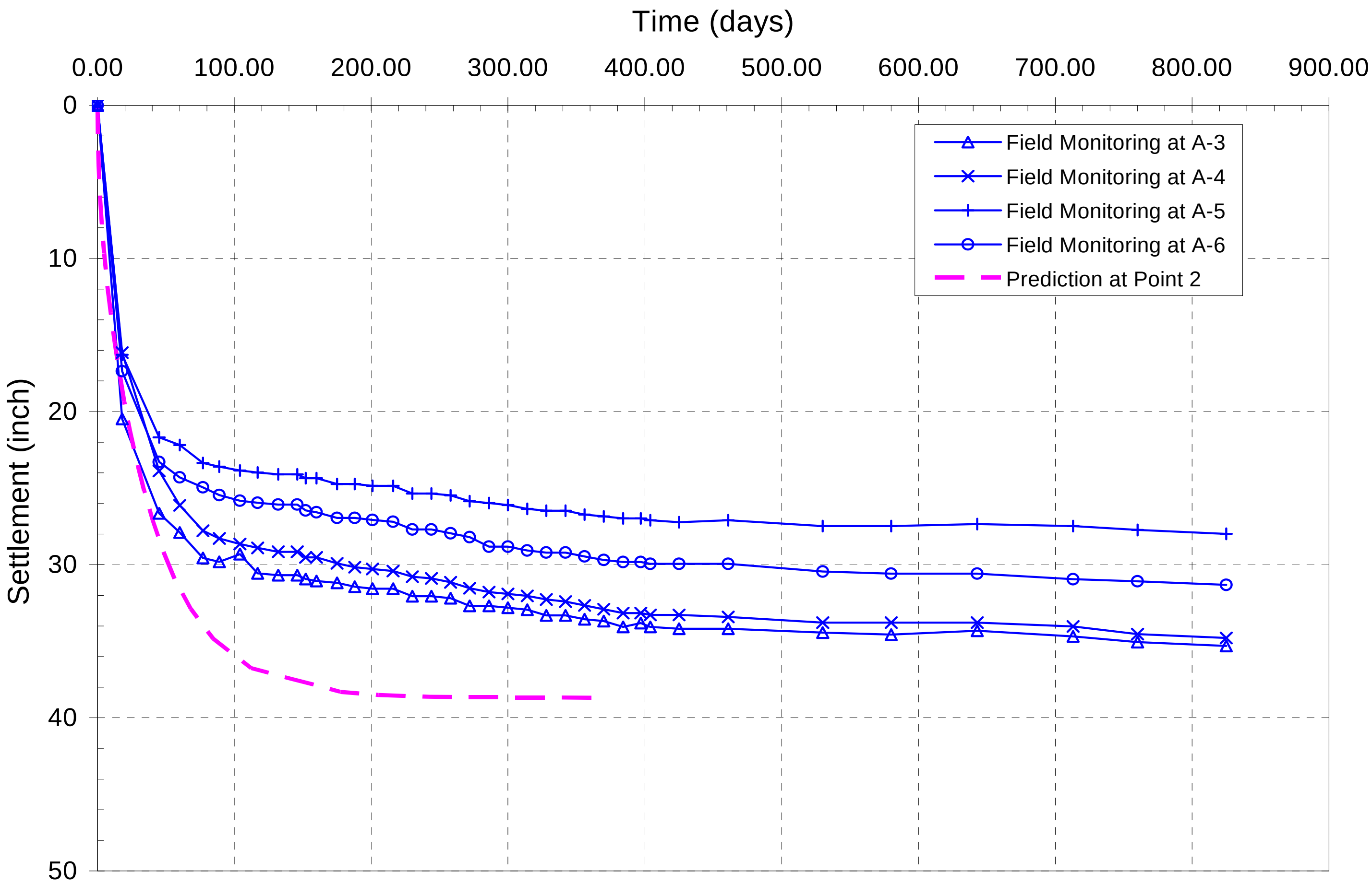


Figure 44. Prediction of Time Rate of Consolidation at Point 2

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

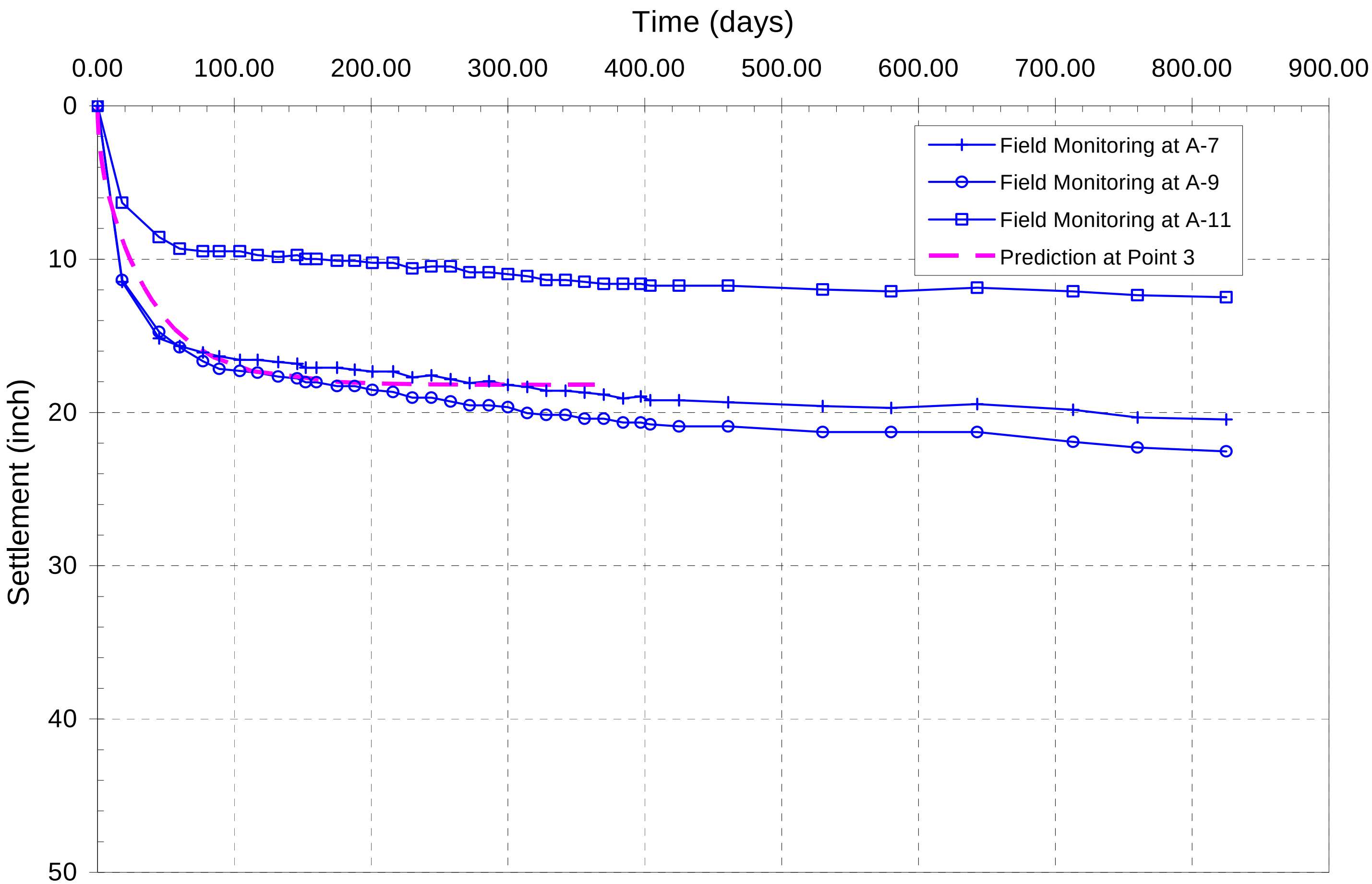


Figure 45. Prediction of Time Rate of Consolidation at Point 3

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

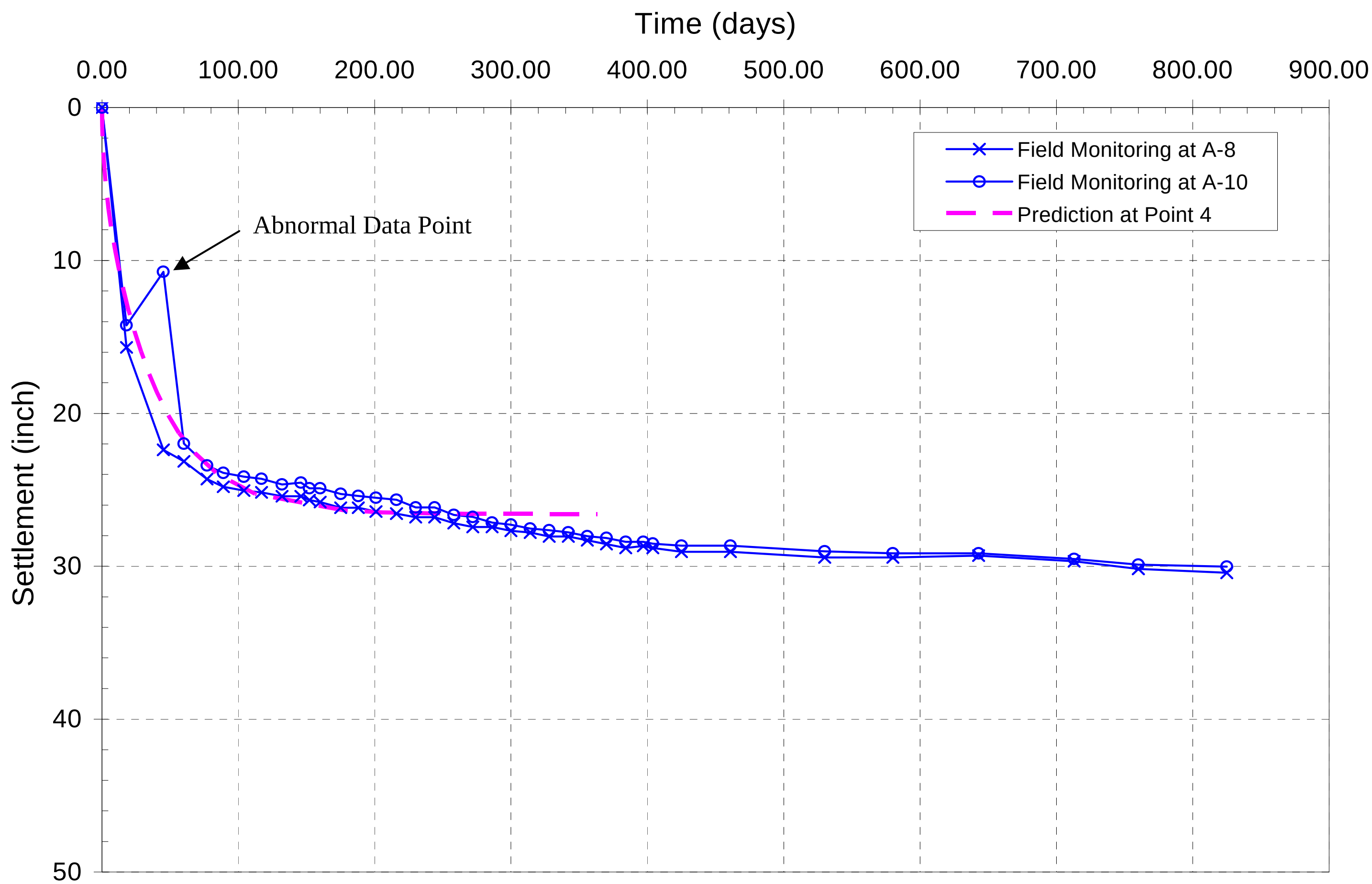


Figure 46. Prediction of Time Rate of Consolidation at Point 4

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

Attachment 1

Estimated Solvay Waste Thickness

(Provided to Geosyntec by Parsons; Phase III Thicknesses were added by Geosyntec)

Estimated Solvay Waste Thickness

	CPT #	Date	Northing	Easting	Ground Elevation (ft)	Waste Thickness (ft)	Bottom of Waste Elevation (ft)	Comments/ Co-Location	Waste Thickness from Boring Log (ft)
2006	CPT-8	10/2/06	1120851.4	908849.716	432.95	14.5	418.4		
(Phase II)	CPT-8A	10/2/06			433.00	8.0	425.0	25' from CPTU-8	
	CPT-9	10/2/06	1120843.73	908800.026	433.02	16.5	416.5		
	CPT-9A	10/2/06			432.61	16.0	416.6	75' from CPTU-8	
	CPT-10	10/2/06	1120836.01	908749.825	432.19	32.5	399.7	SB915-SB13-01	32.5
	CPT-11	10/2/06	1120995.21	908516.522	433.75	17.0	416.8		
	CPT-12	10/6/06	1121114.31	908161.085	433.30	17.0	416.3		
	CPT-13	10/5/06	1121258.75	907736.088	432.61	11.0	421.6		
	CPT-13A	10/5/06			432.61	27.0	405.6	25' from CPTU-13	
	CPT-13B	10/5/06			432.61	45.0	387.6	50' from CPTU-13	
	CPT-13C	10/5/06			432.61	45.5	387.1	75' from CPTU-13	
	CPT-14	10/5/06	1121385.37	907356.373	431.79	12.0	419.8		
	CPT-15	10/5/06	1121447.7	907017.49	431.36	9.0	422.4		
	CPT-15A	10/5/06			431.00	27.0	404.0	25' from CPTU-15	
	CPT-16	10/5/06	1121399.41	907029.364	430.65	37.0	393.7		
	CPT-16A	10/5/06			430.50	39.0	391.5	75' from CPTU-15	
	CPT-17	10/5/06	1121349.35	907040.73	430.34	39.0	391.3	SB915-PZ13-02	39.0
	CPT-18	10/5/06	1121342.15	906628.862	432.86	13.0	419.9		
	CPT-19	10/5/06	1121256.09	906313.579	433.39	15.0	418.4		
	CPT-20	9/26/06	1121130.39	905880.227	433.41	20.5	412.9		
	CPT-21	9/26/06	1121081.03	905900.258	431.62	54.0	377.6		
	CPT-22	9/26/06	1121036.16	905920.846	431.27	53.5	377.8	SB915-SB13-09	53.5
	CPT-23	9/25/06	1120874.72	905584.954	434.24	13.0	421.2		
	CPT-23A	9/25/06			434.24	40.0	394.2	50' from CPTU-23	
	CPT-23B	9/25/06			434.24	48.0	386.2	100' from CPTU-23	
	CPT-24	9/25/06	1120558.83	905250.089	433.67	19.0	414.7		
	CPT-24A	10/6/06			432.67	13.0	419.7	25' from CPTU-24	
	CPT-24B	10/6/06			432.67	33.0	399.7	50' from CPTU-24	
	CPT-24C	10/6/06			432.67	33.0	399.7	63' from CPTU-24	
	CPT-24D	10/6/06			432.67	35.5	397.2	75' from CPTU-24	
	CPT-25	9/25/06	1120290.23	905035.498	434.30	25.0	409.3		
	CPT-26	9/25/06	1120292.68	905090.283	433.71	36.0	397.7		
	CPT-27	9/25/06	1120293.82	905139.818	432.94	44.5	388.4	SB915-PZ13-05	44.5
	CPT-28	9/22/06	1119947.63	905047.266	432.87	27.5	405.4		
	CPT-29	9/22/06	1119544.22	905059.137	434.61	2.0	432.6		
	CPT-29A	9/22/06			434.61	2.0	432.6	3' south of CPT-29	
	CPT-29B	9/22/06			434.61	9.5	425.1	10' south of CPT-29	
	CPT-29C	9/27/06			434.61	14.5	420.1	25' from CPTU-29	
	CPT-29D	9/27/06			434.61	29.5	405.1	50' from CPTU-29	
	CPT-29E	9/27/06			434.61	38.5	396.1	75' from CPTU-29	
	CPT-30	9/21/06	1119124.74	905066.84	433.52	30.0	403.5		
	CPT-30A	10/6/06			433.52	31.5	402.0	25' from CPTU-30	
	CPT-30B	10/6/06			433.52	55.0	378.5	50' from CPTU-30	
	CPT-30C	10/6/06			433.52	52.0	381.5	75' from CPTU-30	
	CPT-31	9/20/06	1118754.53	905087.143	436.92	19.0	417.9		
	CPT-32	9/20/06	1118797.02	905113.582	436.57	12.0	424.6		
	CPT-32A	9/21/06			436.31	17.0	419.3	7' W of CPT-32	
	CPT-33	9/21/06	1118840.37	905138.455	436.05	42.0	394.1	SB915-SB13-13	42.0
	CPT-33A	9/21/06			436.00	36.0	400.0	25' NE of CPT-33	
	CPT-33B	9/21/06			436.00	42.0	394.0	25' NE of CPT-33A	
	CPT-34	9/21/06	1118805.83	905368.018	439.11	14.0	425.1		
	CPT-35	9/21/06	1118919.19	905786.83	436.59	13.0	423.6		
	CPT-35A	10/6/05			433.59	18.0	415.6	30' from CPTU-35	
	CPT-35B	10/6/06			432.59	30.5	402.1	50' from CPTU-35	
	CPT-35C	10/6/06			432.59	42.0	390.6	75' from CPTU-35	
	CPT-36	9/21/06	1119023.55	906162.176	437.19	14.0	423.2		
	CPT-37	9/21/06	1119125.07	906553.305	438.25	14.0	424.2		
	CPT-38	9/27/06	1119236.6	906957.379	435.77	12.0	423.8		
	CPT-38A	9/27/06			435.65	20.0	415.7	25' from CPTU-38	
	CPT-39	9/27/06	1119283.59	906944.057	435.56	25.0	410.6		
	CPT-39A	9/27/06			435.38	35.0	400.4	75' from CPTU-38	
	CPT-40	9/27/06	1119335.75	906932.568	435.20	41.0	394.2	SB915-SB13-08	41.0
	CPT-41	9/28/06	1119335.2	907318.782	434.08	9.5	424.6		
	CPT-42	9/28/06	1119439.45	907712.468	434.78	13.0	421.8		

Estimated Solvay Waste Thickness

	CPT #	Date	Northing	Easting	Ground Elevation (ft)	Waste Thickness (ft)	Bottom of Waste Elevation (ft)	Comments/ Co-Location	Waste Thickness from Boring Log (ft)
2006	CPT-43	9/28/06	1119618.17	907961.282	434.42	12.0	422.4		
(Phase II)	CPT-43A	9/28/06			434.26	18.0	416.3	25' from CPTU-43	
	CPT-44	9/28/06	1119645.6	907917.811	434.09	38.0	396.1		
	CPT-44A	9/28/06			434.29	58.0	376.3	75' from CPTU-43	
	CPT-45	9/28/06	1119678.88	907882.555	434.49	44.0	390.5	SB915-SB13-06	44.0
	CPT-46	9/28/06	1119927.93	908194.704	432.17	11.0	421.2		
	CPT-47	9/28/06	1120267.77	908440.081	432.72	12.0	420.7		
	CPT-48	9/28/06	1120567.64	908662.239	432.22	6.0	426.2		
	CPT-49	9/28/06	1120625.77	908370.381	430.59	70.5	360.1		
	CPT-50	10/2/06	1120867.76	908300.046	432.17	55.5	376.7		
	CPT-51	10/5/06	1120909.51	907892.659	430.89	41.3	389.6	SB915-PZ13-01	41.3
	CPT-52	10/2/06	1120679.99	907910.529	429.65	70.0	359.6		
	CPT-53	10/2/06	1120381.68	908154.152	429.58	73.0	356.6		
	CPT-54	9/28/06	1120090.32	907920.185	431.70	55.0	376.7		
	CPT-55	9/28/06	1119874.72	907490.116	431.75	80.0	351.8		
	CPT-56	10/3/06	1120061.17	907466.239	430.60	91.5	339.1		
	CPT-57	10/4/06	1120155.76	907443.59	436.51	66.5	370.0	SB915-SB13-05	72-80 ft - 11.5 ft fill
	CPT-58	10/3/06	1120293.52	907439.217	428.99	66.0	363.0	Adj to Test Plot	
	CPT-58A	10/4/06			437.30	63.5	373.8	Test Plot	75 ft - 11.5 ft fill
	CPT-59	10/3/06	1120207.66	907534.237	437.68	70.0	367.7	SB915-SB13-04A	81.5 ft - 11.5 ft fill
	CPT-59A	10/4/06			437.70	76.5	361.2	Test Plot	88 ft - 11.5 ft fill
	CPT-60	10/2/06	1120586.49	907513.751	426.53	44.0	382.5		
	CPT-61	10/5/06	1121151.29	907319.048	430.17	74.0	356.2		
	CPT-62	10/5/06	1121128.5	906802.386	429.08	66.0	363.1		
	CPT-63	10/4/06	1120909.28	906882.569	427.49	52.0	375.5	SB915-SB13-02	52-55 ft
	CPT-64	10/4/06	1120673.64	907080.047	423.76	68.0	355.8		
	CPT-65	10/4/06	1120434.57	906938.278	424.91	68.0	356.9		
	CPT-66	10/4/06	1120491.85	906732.648	427.19	33.0	394.2	SB915-SB13-07	33.0
	CPT-67	10/4/06	1120628.43	906483.39	424.38	63.0	361.4		
	CPT-68	10/4/06	1121054.46	906451.966	430.53	65.0	365.5		
	CPT-69	9/26/06	1120670.68	906062.658	428.72	62.0	366.7		
	CPT-70	9/26/06	1120231.19	905962.982	420.19	54.5	365.7		
	CPT-71	9/26/06	1120268.54	906128.133	419.10	55.0	364.1	SB915-PZ13-04	55.0
	CPT-72	9/26/06	1120325.74	906281.38	420.38	59.0	361.4		
	CPT-73	9/22/06	1120076.4	906357.001	424.33	51.0	373.3		
	CPT-74	9/22/06	1119895.48	906948.459	430.88	79.0	351.9		
	CPT-75	9/21/06	1119798.11	906596.558	429.17	64.0	365.2	SB915-PZ13-03	64.0
	CPT-76	9/27/06	1119614.59	906412.62	428.57	78.5	350.1		
	CPT-77	9/21/06	1119312.05	906436.059	431.27	41.5	389.8		
	CPT-78	9/27/06	1119542.97	906039.716	429.15	66.0	363.2	SB915-SB13-11	66.0
	CPT-79	9/27/06	1119692.99	905894.595	427.31	50.0	377.3		
	CPT-80	9/22/06	1119948.22	905923.474	423.68	62.0	361.7		
	CPT-81	9/25/06	1120499.95	905450.616	430.54	51.5	379.0		
	CPT-82	9/25/06	1120157.68	905513.689	428.10	55.0	373.1		
	CPT-83	9/22/06	1119890.76	905646.705	423.44	51.7	371.7	SB915-SB13-12	51.7
	CPT-84	9/22/06	1119648.2	905544.763	424.49	66.0	358.5		
	CPT-85	9/22/06	1119386.28	905263.403	431.30	41.0	390.3		
	CPT-86	9/21/06	1119148.47	905399.366	430.84	64.0	366.8		
	CPT-87	9/27/06	1119178.88	905761.735	430.94	64.0	366.9		
2005	CPT-1	8/16/2005	1120418.34	907858.035	430.00	46.0	384.00		
(Phase I)	CPT-1A	8/17/2005	1120446.65	907899.34	430.00	45.0	385.00		
	CPT-2	8/16/2005	1120365.66	907767.915	431.00	72.0	359.00		
	CPT-3	8/16/2005	1120312.98	907677.794	431.00	67.0	364.00		
	CPT-4	8/16/2005	1120230.7	907578.273	429.84	76.0	353.84	SB915-INEX-A10	76.0
	CPT-5	8/16/2005	1120188.61	907516.629	430.30	74.0	356.30	SB915-INEX-A1/ SB915-INEX-A2	74.0
	CPT-6	8/16/2005	1120154.93	907407.433	431.00	71.0	360.00		
	CPT-7	8/16/2005	1120469.67	907946.178	430.00	74.0	356.00		
	CPT-A3	8/18/2005	1120201.8	907463.409	429.86	73.0	356.86	SB915-PZ-A3(N)	73.0
	CPT-A4	8/17/2005	1120250.57	907528.687	429.38	70.0	359.38		
	CPT-A5	8/18/2005	1120114.45	907510.563	430.83	71.0	359.83		
	CPT-A6	8/18/2005	1120151.36	907581.627	430.39	75.0	355.39		
	CPT-A7	8/17/2005	1120203.62	907416.452	429.70	74.0	355.70	SB915-INEX-A7	74.0
	CPT-A8	8/17/2005	1120250.86	907472.522	429.33	74.0	355.33	SB915-INEX-A8	74.0
	CPT-A9	8/17/2005	1120291.59	907538.511	429.42	74.0	355.42		
	CPT-A11	8/17/2005	1120079.01	907495.747	430.58	67.0	363.58		
	CPT-A12	8/18/2005	1120169.96	907621.91	430.64	54.0	376.64		
	CPT-A20	8/17/2005	1120125.05	907567.29	430.72	50.0	380.72		

Estimated Solvay Waste Thickness

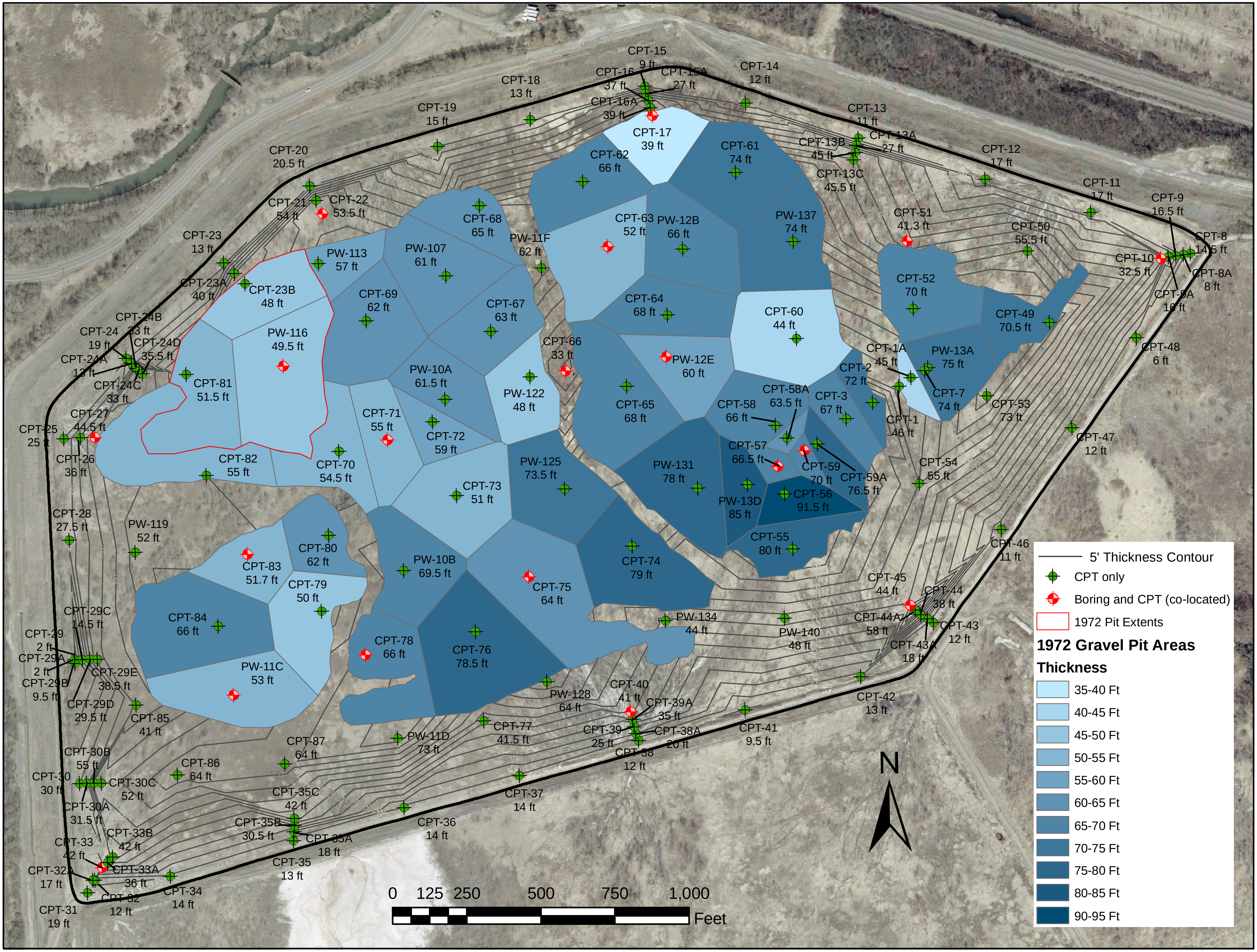
	CPT #	Date	Northing	Easting	Ground Elevation (ft)	Waste Thickness (ft)	Bottom of Waste Elevation (ft)	Comments/ Co-Location	Waste Thickness from Boring Log (ft)
2004	PW-10A	6/14/2004	1120400.86	906324.335	424.00	61.5	362.50		
	PW-10B	6/9/2004	1119824.87	906174.33	426.00	69.5	356.50		
	PW-11C	6/14/2004	1119415.29	905592.804	428.67	53.0	375.67	SB915-PZ13-06	52-55 ft
	PW-11D	6/9/2004	1119259.28	906145.024	429.93	73.0	356.93		
	PW-11F	6/10/2004	1120840.5	906657.315	430.00	62.0	368.00		
	PW-12B	6/12/2004	1120895.31	907136.098	428.00	66.0	362.00		
	PW-12E	6/12/2004	1120534.04	907074.41	425.10	60.0	365.10	SB915-SB13-03	60.0
	PW-13A	6/11/2004	1120479.21	907956.934	430.00	75.0	355.00		
	PW-13D	6/11/2004	1120096.36	907340.153	431.00	85.0	346.00		
	PW-107	6/10/2004	1120818.71	906334.772	430.00	61.0	369.00		
	PW-113	6/12/2004	1120867.46	905904.229	432.00	57.0	375.00		
	PW-116	6/11/2004	1120524.16	905780.231	428.49	49.5	378.99	SB915-SB13-10	49.5
	PW-119	6/12/2004	1119903.38	905269.392	431.00	52.0	379.00		
	PW-122	6/10/2004	1120472.5	906611.667	425.00	48.0	377.00		
	PW-125	6/14/2004	1120091.55	906723.48	428.50	73.5	355.00		
	PW-128	6/10/2004	1119440.88	906652.206	434.00	64.0	370.00		
	PW-131	6/12/2004	1120086.97	907172.513	431.00	78.0	353.00		
	PW-134	6/10/2004	1119641.38	907056.2	434.00	44.0	390.00		
	PW-137	6/14/2004	1120913.5	907509.711	430.50	74.0	356.50		
	PW-140	6/10/2004	1119641.38	907457.522	434.50	48.0	386.50		
2007 (Phase III)	CPT-88	10/3/2007	1120856.03	906499.036	430.00	65.0	365.00		
	CPT-89	10/3/2007	1120874.65	906545.438	430.00	66.0	364.00		
	CPT-90	10/2/2007	1120893.27	906591.841	430.00	40.0	390.00		
	CPT-91	10/2/2007	1120911.89	906638.243	430.00	30.0	400.00	SB915-SB13-18	31.3
	CPT-92	10/2/2007	1120930.52	906684.646	430.00	55.0	375.00		
	CPT-93	10/2/2007	1120949.14	906731.048	430.00	55.0	375.00		
	CPT-94	10/2/2007	1120967.76	906777.451	430.00	55.0	375.00		
	CPT-95	10/3/2007	1120897.16	907554.271	431.00	74.0	357.00		
	CPT-96	10/3/2007	1120886.8	907603.185	431.00	70.0	361.00		
	CPT-97	10/3/2007	1120876.44	907652.099	431.00	40.0	391.00		
	CPT-98	10/3/2007	1120866.07	907701.013	431.00	32.0	399.00	SB915-SB13-19	32-35 ft
	CPT-99	10/3/2007	1120855.71	907749.927	431.00	50.0	381.00		
	CPT-100	10/4/2007	1120845.34	907798.841	431.00	46.0	385.00		
	CPT-101	10/4/2007	1120834.98	907847.755	431.00	52.0	379.00		
	CPT-102	10/1/2007	1119864.81	906928.629	432.00	80.0	352.00		
	CPT-103	10/1/2007	1119897.4	906966.541	432.00	80.0	352.00		
	CPT-104	10/1/2007	1119930	907004.453	432.00	62.0	370.00		
	CPT-105	10/1/2007	1119962.6	907042.365	432.00	52.0	380.00	SB915-SB13-20	56.0
	CPT-106	10/2/2007	1119995.2	907080.277	432.00	57.0	375.00		
	CPT-107	10/2/2007	1120027.8	907118.189	432.00	80.0	352.00		
	CPT-108	10/2/2007	1120056.42	907152.524	432.00	80.0	352.00		
	CPT-109	10/5/2007	1120246.34	907798.819	432.00	51.0	381.00	SB915-SB13-21	76.8
	CPT-110	10/5/2007	1120264.96	907845.222	432.00	51.0	381.00		
	CPT-111	10/4/2007	1120283.58	907891.624	432.00	61.0	371.00	SB915-SB13-22	61.6
	CPT-112	10/4/2007	1120302.21	907938.027	432.00	76.0	356.00		
	CPT-113	10/4/2007	1120320.83	907984.43	432.00	74.0	358.00		
	CPT-114	10/5/2007	1120397.77	907816.256	431.00	56.0	375.00	SB915-SB13-23	56.8
	CPT-115	10/5/2007	1120116.78	907894.46	433.00	54.0	379.00		

Notes:

1. CPTu Locations shown in red were added during the field program, and the coordinates were estimated based on other nearby locations. Only estimated survey data are available at these locations.
2. All 2004 CPTu (i.e., PW series) location ground elevations, except for PW-11C, PW-11D, PW-12E, and PW-116, were estimated from an existing contour map.
3. The 2005 CPTu location ground elevations for CPT-1 through CPT-7 and CPT-1A were estimated from an existing contour map. The other 2005 CPTu location ground elevations were estimated based on nearby instrument installations that were surveyed by Ianuzi & Romans (a licensed surveyor).
4. 2006 CPTu locations (CPT-8 to 87) were surveyed by Ianuzi & Romans (licensed surveyor) except those with an A, B, C, D, or E suffix (i.e., additional locations assigned during CPTu testing and shown in red on this spreadsheet [see Note 1]).
5. Ground elevations at 2007 CPTu locations were estimated from an existing coutour map.

Criteria for Estimating Solvay Waste Thickness:

1. For all cases where a CPTu test was co-located with a boring, the waste thickness from the boring was assumed.
2. If Criteria 1 did not apply, the bottom of waste was assumed to coincide with refusal when (i) the tip resistance was relatively small prior to refusal; or (ii) the profile had numerous spikes (therefore, by default, refusal was assumed to coincide with the bottom of the waste). It should be recognized that hard Solvay waste layers can also cause refusal.
3. If the above criteria did not apply and there was a significant increase in tip resistance that coincided with a sudden dissipation in dynamic pore water pressure, the bottom of the Solvay waste was assumed to coincide with this depth.
4. The SBTs (Soil Behavior Types) were used as supporting information.



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Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

Attachment 2

Piezometer Data Collected Between November 2006 and December 2007

(Provided to Geosyntec by Parsons)

OL Phase II PDI
Wastebed 13 Piezometers

Piezometer Location	Serial Number	Date Installed	Depth to Piezometer Tip from Ground Surface (ft)	Initial Ground Surface Elevation (ft)	Piezometer Tip Elevation (ft)	Type
Wastebed Piezometers						
SB915-PZ13-01S	06-20309	11/10/2006	19.5	430.89	411.39	Typ VW
SB915-PZ13-01D	06-19784	11/10/2006	39.5	430.89	391.39	Typ VW
SB915-PZ13-01N	06-19773	11/9/2006	63.5	430.89	367.39	Typ VW
SB915-PZ13-02I	06-20310	11/8/2006	19.9	430.34	410.44	Typ VW
SB915-PZ13-02D	06-20305	11/8/2006	36.5	430.34	393.84	Typ VW
SB915-PZ13-02N	06-19778	11/7/2006	50	430.34	380.34	Typ VW
SB915-PZ13-03S	06-20308	11/14/2006	20.5	429.17	408.67	Typ VW
SB915-PZ13-03I	06-19786	11/13/2006	40.2	429.17	388.97	Typ VW
SB915-PZ13-03D	06-19775	11/13/2006	59.5	429.17	369.67	Typ VW
SB915-PZ13-04S	06-19781	11/20/2006	15.5	419.10	403.60	Typ VW
SB915-PZ13-04I	06-19774	11/20/2006	35.5	419.10	383.60	Typ VW
SB915-PZ13-04D	06-19776	11/17/2006	52.5	419.10	366.60	Typ VW
SB915-PZ13-04N	NA	11/16/2006	113	418.6	305.6	SP
SB915-PZ13-05S	06-20311	11/6/2006	14.8	432.94	418.14	Typ VW
SB915-PZ13-05I	06-19785	11/3/2006	35	432.94	397.94	Typ VW
SB915-PZ13-05N	06-19772	11/3/2006	56	432.94	376.94	Typ VW
SB915-PZ13-06S	06-20307	11/7/2006	19.5	428.67	410.5	Typ VW
SB915-PZ13-06I	06-20306	11/6/2006	34.5	428.67	395.5	Typ VW
SB915-PZ13-06D	06-19771	11/6/2006	49.5	428.67	380.5	Typ VW
SB915-PZ13-06N	06-19769	11/3/2006	64	428.67	366	Typ VW
Dike Piezometers						
SB915-PZ13-07	06-19782	11/14/2006	54	438.23	384.23	Typ VW
SB915-PZ13-08	NA	11/27/2006	40	431.35	391.35	SP
SB915-PZ13-09	06-19783	11/16/2006	36.5	432.48	395.98	Typ VW
SB915-PZ13-10	NA	11/29/2006	32	397.45	365.45	SP
SB915-PZ13-11	06-19787	11/17/2006	41	432.44	391.44	Typ VW
SB915-PZ13-12	NA	11/28/2006	25	431.51	406.51	SP
SB915-PZ13-13	06-19779	11/21/2006	30	434.26	404.26	Typ VW
SB915-PZ13-14	06-19780	11/27/2006	30	443.67	413.67	Typ VW
SB915-PZ13-15	06-19770	11/29/2006	30	446.56	416.56	Typ VW
SB915-PZ13-16	NA	11/22/2006	30	441.08	411.08	SP

Notes:
Typ VW = Typical Vibrating Wire Piezometer (GeoKon model 4500S)
SP = Standpipe
NA = Not Applicable

OL Phase II PDI - First to Fourth Quarter Monitoring Data
Wastebed 13 Piezometers

Wastebed Piezometers

Date	Piezometric Elevation (ft)								
	SB915-PZ13-01S	SB915-PZ13-01D	SB915-PZ13-01N	SB915-PZ13-02I	SB915-PZ13-02D	SB915-PZ13-02N	SB915-PZ13-03S	SB915-PZ13-03I	SB915-PZ13-03D
11/30/06	412.4		374.0	413.0	394.7	NA	416.9	398.3	393.5
12/07/06	414.9		374.5	415.3	394.9	381.6	419.0	400.0	397.8
12/14/06	413.1		374.2	413.9	394.9	382.3	417.8	399.9	399.5
12/21/06	412.5		374.2	413.2	394.5	383.7	416.8	400.3	399.4
12/28/06	415.0		374.5	414.3	394.2	384.5	418.6	401.1	401.6
01/11/07	416.9		374.9	417.3	395.2	386.5	420.5	406.3	405.7
02/08/07	411.7		373.7	412.6	393.8	385.7	416.5	411.5	404.8
03/07/07	NA	NA	NA	NA	NA	NA	418.7	410.3	403.8
03/09/07	411.9		374.0	411.7	394.3	385.5	NA	NA	NA
04/12/07	421.0	400.1	375.1	422.1	395.3	391.7	422.9	416.4	414.8
05/10/07	419.2	400.1	374.7	419.9	395.1	392.2	421.4	415.4	414.4
06/21/07			372.6	410.7		387.6	411.9	405.1	404.1
07/12/07			372.0			387.1	410.6	401.7	397.7
08/15/07			371.5			384.2		395.8	388.9
09/21/07			371.5	410.7				392.6	385.6
10/26/07			371.8	410.8			419.2	401.2	388.2
11/28/07	411.5		372.5	410.9			420.4	407.1	398.3
12/28/07	414.0		373.8	413.1			420.7	411.1	407.8

Notes:
1. NA indicates no measurement was taken.
2. A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

OL Phase II PDI - First to Fourth Quarter Monitoring Data
Wastebed 13 Piezometers

Wastebed Piezometers

Date	Piezometric Elevation (ft)										
	SB915-PZ13-04S	SB915-PZ13-04I	SB915-PZ13-04D	SB915-PZ13-04N	SB915-PZ13-05S	SB915-PZ13-05I	SB915-PZ13-05N	SB915-PZ13-06S	SB915-PZ13-06I	SB915-PZ13-06D	SB915-PZ13-06N
11/30/06	412.0	411.3	407.5	NA		400.1	NA	413.2	406.8	403.9	375.4
12/07/06	415.7	414.7	412.3	375.5		402.0	386.1	415.6	409.8	406.6	376.0
12/14/06	413.7	412.7	410.6	375.3		402.4	387.0	414.2	408.2	405.2	375.7
12/21/06	412.1	411.2	409.2	374.9		401.9	386.9	413.6	406.9	404.3	375.7
12/28/06	414.9	413.6	411.4	375.1		402.4	387.7	415.7	409.4	406.8	375.9
01/11/07	418.0	416.9	415.2	375.4		404.1	391.6	417.8	411.7	409.3	376.4
02/08/07	411.5	410.8	409.0	375.0		401.3	390.9	412.4	405.5	403.8	375.2
03/07/07	408.2	407.5	405.8	374.5	NA	NA	NA	412.7	404.7	403.8	374.9
03/09/07	NA	NA	NA	NA		399.0	378.6	NA	NA	NA	NA
04/12/07	NA	NA	NA	NA	422.0	405.8	390.1	421.5	415.4	413.9	377.1
05/10/07	418.7	417.8	415.0	375.8	420.2	405.0	390.2	419.8	413.8	412.2	376.6
06/21/07	404.6	404.2	402.3	374.0			380.7			393.2	373.9
07/12/07		400.4	398.5	373.4			378.2			390.1	373.1
08/15/07		396.6	394.5	372.9						385.9	372.5
09/21/07		393.9	391.9	372.7						384.2	372.5
10/26/07		392.4	390.6	372.9						387.7	372.8
11/28/07		400.9	396.8	373.3				412.5		385.0	373.4
12/28/07	413.1	412.4	408.5	374.9		399.5	378.6	413.9	407.1	405.6	375.3

Notes:
1. NA indicates no measurement was taken.
2. A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

OL Phase II PDI - First to Fourth Quarter Monitoring Data
Wastebed 13 Piezometers

Dike Piezometers

Date	Piezometric Elevation (ft)									
	SB915-PZ13-07	SB915-PZ13-08	SB915-PZ13-09	SB915-PZ13-10	SB915-PZ13-11	SB915-PZ13-12	SB915-PZ13-13	SB915-PZ13-14	SB915-PZ13-15	SB915-PZ13-16
11/30/06	385.1	NA	396.3	NA		NA	408.9	426.0	NA	NA
12/7/06	384.9	391.5	396.4	374.5	391.5	406.8	409.6	427.8	427.8	425.0
12/14/06	385.0	391.5	396.3	374.3		407.1	409.4	427.5	427.0	425.2
12/21/06	385.3	391.5	396.7	374.0	391.8	406.9	409.2	426.4	426.0	425.2
12/28/06	385.2	391.5	396.8	374.1	391.8	416.6	409.6	427.8	426.4	425.2
1/11/07	385.4	391.5	396.8	374.4	391.8	412.2	410.5	429.9	429.0	425.6
2/8/07	385.0		396.2	373.5		410.6	408.3	425.9	424.9	424.8
3/7/07	385.3	NA	NA	373.0	NA	NA	407.3	421.6	422.4	424.3
3/9/07	NA		396.9	NA	391.9	409.4	NA	NA	NA	NA
4/12/07	385.5			375.1		408.7	410.6	430.8	430.4	427.5
5/10/07	385.6		396.2	374.6		408.1	410.1	429.8	428.8	426.7
6/21/07	385.2		396.1	372.5		407.5	406.7	419.8	421.6	424.7
7/12/07	385.0		396.1	371.9		407.2	406.0	417.8	420.4	424.2
8/15/07	384.9		396.1	371.4		406.8	405.5	416.5	419.0	423.1
9/21/07	385.0		396.2	371.1		406.8	405.5	415.9	418.0	420.6
10/26/07	384.9		396.2	371.4	391.5	406.7	405.4	415.7	417.2	417.1
11/28/07	384.9		396.3	371.8	391.6		405.5	417.9	417.8	420.5
12/28/07	385.1		396.1	373.5			408.7	429.1	426.1	424.0

Notes:
1. NA indicates no measurement was taken.
2. A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.
3. On 12/28/06, it was observed that surface runoff had entered the standpipe of SB915-PZ13-12.
4. Since 1/15/07, the thermistor on SB915-PZ13-13 has not been functioning; therefore, a temperature reading of 11.3 degrees Celsius is assumed for all calculations after that date.

Individual Piezometer Data Sheets

SB915-PZ13-01S Serial # 06-20309

Typical Vibrating Wire Piezometer

Date Installed:	11/10/2006	
Bentonite Seal =	Approximately 0 to 18	ft
Sandpack =	Approximately 18 to 20	ft
Depth to Piezometer Tip from Ground Surface =	19.5	ft
Ro =	9171	
To =	12	degrees Celsius
Linear Gage Factor (psi) =	0.01613	psi/digit
Thermal Factor =	0.00987	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	430.89	ft
Piezometer Tip Elevation =	411.39	ft

Note:

A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9142.5	10	0.4	1.0	18.5	412.4
12/7/06 13:02	9076.2	10.2	1.5	3.5	16.0	414.9
12/14/06 11:05	9124.6	10.2	0.7	1.7	17.8	413.1
12/21/06 11:48	9140	10.1	0.5	1.1	18.4	412.5
12/28/06 11:40	9072.1	10.1	1.6	3.6	15.9	415.0
1/11/07 12:49	9022.6	10.1	2.4	5.5	14.0	416.9
2/8/07 11:34	9162.8	10.2	0.1	0.3	19.2	411.7
3/9/07 9:26	9156.5	10.3	0.2	0.5	19.0	411.9
4/12/07 10:15	8911	10.3	4.2	9.6	9.9	421.0
5/10/07 14:28	8959.2	10.4	3.4	7.8	11.7	419.2
6/21/07 11:31	9179.2	10.1	-0.2	-0.3	>=19.5 ft	
7/12/07 11:07	9179.4	10.1	-0.2	-0.4	>=19.5 ft	
8/15/07 11:30	9180.6	10.2	-0.2	-0.4	>=19.5 ft	
9/21/07 11:17	9173.3	10.2	-0.1	-0.1	>=19.5 ft	
10/26/07 11:45	9170.4	9.8	0.0	0.0	>=19.5 ft	
11/28/07 10:04	9167.6	9.8	0.0	0.1	19.4	411.5
12/28/07 11:46	9100.3	9.9	1.1	2.6	16.9	414.0

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-01D Serial # 06-19784

Typical Vibrating Wire Piezometer
Date Installed: 11/10/2006
Bentonite Seal = 0 to 38 ft
Sandpack = 38 to 40 ft
Depth to Piezometer Tip from Ground Surface = 39.5 ft
Ro = 9073.7
To = 11.1 degrees Celsius
Linear Gage Factor (psi) = 0.01663 psi/digit
Thermal Factor = 0.01629 psi/℃
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 430.89 ft
Piezometer Tip Elevation = 391.39 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (℃)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9135.0	10.1	-1.0	-2.4	>=39.5 ft	
12/7/06 13:02	9125.7	10.2	-0.9	-2.0	>=39.5 ft	
12/14/06 11:06	9099.3	10.2	-0.4	-1.0	>=39.5 ft	
12/21/06 11:48	9106.2	10.2	-0.6	-1.3	>=39.5 ft	
12/28/06 11:41	9123.2	10.2	-0.8	-1.9	>=39.5 ft	
1/11/07 12:50	9085.6	10.2	-0.2	-0.5	>=39.5 ft	
2/8/07 11:35	9088.6	10.2	-0.3	-0.6	>=39.5 ft	
3/9/07 9:29	9118.7	10.2	-0.8	-1.8	>=39.5 ft	
4/12/07 10:15	8845.1	10.2	3.8	8.7	30.8	400.1
5/10/07 14:29	8847.1	10.1	3.8	8.7	30.8	400.1
6/21/07 11:32	9086	10.1	-0.2	-0.5	>=39.5 ft	
7/12/07 11:10	9103.1	10.1	-0.5	-1.2	>=39.5 ft	
8/15/07 11:31	9123.2	10.1	-0.8	-1.9	>=39.5 ft	
9/21/07 11:18	9103.8	10.1	-0.5	-1.2	>=39.5 ft	
10/26/07 11:45	9128	10.1	-0.9	-2.1	>=39.5 ft	
11/28/07 10:04	9124.5	10.1	-0.9	-2.0	>=39.5 ft	
12/28/07 11:46	9090.4	10.1	-0.3	-0.7	>=39.5 ft	

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-01N Serial # 06-19773

Typical Vibrating Wire Piezometer
Date Installed: 11/9/2006

Bentonite Seal =	0 to 62 ft
Sandpack =	62 to 64 ft
Depth to Piezometer Tip from Ground Surface =	63.5 ft
Ro =	8871.2
To =	11.3 degrees Celsius
Linear Gage Factor (psi) =	0.01697 psi/digit
Thermal Factor =	0.02385 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	430.89 ft
Piezometer Tip Elevation =	367.39 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8699.7	9.8	2.9	6.6	56.9	374.0
12/7/06 13:04	8687.7	9.9	3.1	7.1	56.4	374.5
12/14/06 11:07	8695.2	9.9	3.0	6.8	56.7	374.2
12/21/06 11:49	8694.4	9.9	3.0	6.8	56.7	374.2
12/28/06 11:43	8687.6	9.9	3.1	7.1	56.4	374.5
1/11/07 12:51	8678.1	9.9	3.2	7.5	56.0	374.9
2/8/07 11:36	8707.5	9.9	2.7	6.3	57.2	373.7
3/9/07 9:30	8701.6	9.9	2.8	6.6	56.9	374.0
4/12/07 10:16	8672.6	9.9	3.3	7.7	55.8	375.1
5/10/07 14:30	8682	9.9	3.2	7.3	56.2	374.7
6/21/07 11:32	8735.5	10	2.3	5.2	58.3	372.6
7/12/07 11:11	8751.9	10	2.0	4.6	58.9	372.0
8/15/07 11:32	8764.2	10.2	1.8	4.1	59.4	371.5
9/21/07 11:19	8764.3	10	1.8	4.1	59.4	371.5
10/26/07 11:45	8755.9	9.9	1.9	4.4	59.1	371.8
11/28/07 10:04	8740.1	9.9	2.2	5.1	58.4	372.5
12/28/07 11:46	8705.4	9.9	2.8	6.4	57.1	373.8

SB915-PZ13-02I Serial # 06-20310

Typical Vibrating Wire Piezometer

Date Installed: 11/8/2006

Bentonite Seal =	0 to 18.3 ft
Sandpack =	18.3 to 20.4 ft
Depth to Piezometer Tip from Ground Surface =	19.9 ft
Ro =	9200.1
To =	11.7 degrees Celsius
Linear Gage Factor (psi) =	0.01773 psi/digit
Thermal Factor =	0.01637 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	430.34 ft
Piezometer Tip Elevation =	410.44 ft

Note:

A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9136.4	11.3	1.1	2.6	17.3	413.0
12/7/06 13:14	9079.8	11.3	2.1	4.9	15.0	415.3
12/14/06 11:17	9115.7	11.4	1.5	3.4	16.5	413.9
12/21/06 11:59	9132.8	11.3	1.2	2.7	17.2	413.2
12/28/06 11:53	9105.4	11.4	1.7	3.9	16.0	414.3
1/11/07 13:04	9031.6	11.6	3.0	6.9	13.0	417.3
2/8/07 11:48	9146.6	11.4	0.9	2.2	17.7	412.6
3/9/07 9:46	9168.6	11.5	0.6	1.3	18.6	411.7
4/12/07 10:25	8914.4	11.4	5.1	11.7	8.2	422.1
5/10/07 14:40	8969.8	11.5	4.1	9.4	10.5	419.9
6/21/07 11:41	9192.9	11.3	0.1	0.3	19.6	410.7
7/12/07 11:22	9208.4	11.2	-0.2	-0.4	>=19.9 ft	
8/15/07 11:45	9212.2	11.3	-0.2	-0.5	>=19.9 ft	
9/21/07 11:29	9193.7	11.2	0.1	0.2	19.7	410.7
10/26/07 11:55	9191.2	11	0.1	0.3	19.6	410.8
11/28/07 10:16	9188.8	11.1	0.2	0.4	19.5	410.9
12/28/07 11:30	9135.4	11.1	1.1	2.6	17.3	413.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-02D Serial # 06-20305

Typical Vibrating Wire Piezometer

Date Installed: 11/8/2006

Bentonite Seal =	0 to 35.1 ft
Sandpack =	35.1 to 37.2 ft
Depth to Piezometer Tip from Ground Surface =	36.5 ft
Ro =	9095.1
To =	11.6 degrees Celsius
Linear Gage Factor (psi) =	0.01608 psi/digit
Thermal Factor =	-0.00037 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	430.34 ft
Piezometer Tip Elevation =	393.84 ft

Note:

A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9071.7	12.1	0.4	0.9	35.6	394.7
12/7/06 13:15	9066.1	12	0.5	1.1	35.4	394.9
12/14/06 11:19	9067.7	12	0.4	1.0	35.5	394.9
12/21/06 12:00	9078	12	0.3	0.6	35.9	394.5
12/28/06 11:55	9086	12	0.1	0.3	36.2	394.2
1/11/07 13:07	9059.1	12	0.6	1.3	35.2	395.2
2/8/07 11:48	9094.8	12	0.0	0.0	36.5	393.8
3/9/07 9:47	9083.2	12	0.2	0.4	36.1	394.3
4/12/07 10:25	9054.5	11.9	0.7	1.5	35.0	395.3
5/10/07 14:41	9061.8	11.9	0.5	1.2	35.3	395.1
6/21/07 11:42	9100.1	11.9	-0.1	-0.2	>=36.5 ft	
7/12/07 11:23	9113.2	11.9	-0.3	-0.7	>=36.5 ft	
8/15/07 11:46	9125.6	11.9	-0.5	-1.1	>=36.5 ft	
9/21/07 11:30	9149.8	11.8	-0.9	-2.0	>=36.5 ft	
10/26/07 11:55	9170.5	11.8	-1.2	-2.8	>=36.5 ft	
11/28/07 10:16	9174.7	11.8	-1.3	-3.0	>=36.5 ft	
12/28/07 11:30	9099.6	11.8	-0.1	-0.2	>=36.5 ft	

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-02N Serial # 06-19778

Typical Vibrating Wire Piezometer
Date Installed: 11/7/2006

Bentonite Seal =	0 to 48.1 ft
Sandpack =	48.1 to 50.5 ft
Depth to Piezometer Tip from Ground Surface =	50 ft
Ro =	8954.3
To =	11.6 degrees Celsius
Linear Gage Factor (psi) =	0.01583 psi/digit
Thermal Factor =	0.00182 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	430.34 ft
Piezometer Tip Elevation =	380.34 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 13:16	8921	11.9	0.5	1.2	48.8	381.6
12/14/06 11:21	8900	11.9	0.9	2.0	48.0	382.3
12/21/06 12:01	8863.5	11.9	1.4	3.3	46.7	383.7
12/28/06 11:56	8839.3	11.9	1.8	4.2	45.8	384.5
1/11/07 13:08	8786.6	11.9	2.7	6.1	43.9	386.5
2/8/07 11:49	8807.4	11.9	2.3	5.4	44.6	385.7
3/9/07 9:48	8811.7	11.8	2.3	5.2	44.8	385.5
4/12/07 10:26	8643.3	11.8	4.9	11.4	38.6	391.7
5/10/07 14:41	8630.8	11.7	5.1	11.8	38.2	392.2
6/21/07 11:43	8755	11.7	3.2	7.3	42.7	387.6
7/12/07 11:24	8769.5	11.7	2.9	6.8	43.2	387.1
8/15/07 11:46	8847.2	11.7	1.7	3.9	46.1	384.2
9/21/07 11:31	8977.5	11.7	-0.4	-0.8	>=50 ft	
10/26/07 11:55	8981.5	11.7	-0.4	-1.0	>=50 ft	
11/28/07 10:16	8982.7	11.7	-0.4	-1.0	>=50 ft	
12/28/07 11:30	8966.1	11.7	-0.2	-0.4	>=50 ft	

SB915-PZ13-03S Serial # 06-20308

Typical Vibrating Wire Piezometer
Date Installed: 11/14/2006

Bentonite Seal =	0 to 19 ft
Sandpack =	19 to 21 ft
Depth to Piezometer Tip from Ground Surface =	20.5 ft
Ro =	8743.4
To =	11.5 degrees Celsius
Linear Gage Factor (psi) =	0.01744 psi/digit
Thermal Factor =	0.01058 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	429.17 ft
Piezometer Tip Elevation =	408.67 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8539.0	10.6	3.6	8.2	12.3	416.9
12/7/06 11:03	8487.4	10.7	4.5	10.3	10.2	419.0
12/14/06 9:38	8516.5	10.7	3.9	9.1	11.4	417.8
12/21/06 10:46	8541.4	10.7	3.5	8.1	12.4	416.8
12/28/06 10:19	8495.7	11.7	4.3	10.0	10.5	418.6
1/11/07 11:03	8449.3	10.7	5.1	11.8	8.7	420.5
2/8/07 10:27	8548.6	10.8	3.4	7.8	12.7	416.5
3/7/07 14:18	8493.8	10.8	4.3	10.0	10.5	418.7
4/12/07 9:32	8390.3	10.8	6.2	14.2	6.3	422.9
5/10/07 13:24	8427.6	10.8	5.5	12.7	7.8	421.4
6/21/07 10:29	8661.9	10.7	1.4	3.3	17.2	411.9
7/12/07 9:55	8695.2	10.7	0.8	1.9	18.6	410.6
8/15/07 10:25	8758.3	10.6	-0.3	-0.6	>=20.5 ft	
9/21/07 10:03	8748.2	10.5	-0.1	-0.2	>=20.5 ft	
10/26/07 10:20	8481.4	10.5	4.6	10.5	10.0	419.2
11/28/07 11:06	8450.6	10.9	5.1	11.8	8.7	420.4
12/28/07 9:55	8443.9	10.6	5.2	12.0	8.5	420.7

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-03I Serial # 06-19786

Typical Vibrating Wire Piezometer
Date Installed: 11/13/2006

Bentonite Seal =	0 to 38.7 ft
Sandpack =	38.7 to 40.7 ft
Depth to Piezometer Tip from Ground Surface =	40.2 ft
Ro =	9032.6
To =	8.8 degrees Celsius
Linear Gage Factor (psi) =	0.01811 psi/digit
Thermal Factor =	0.01963 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	429.17 ft
Piezometer Tip Elevation =	388.97 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8812.0	11.2	4.0	9.3	30.9	398.3
12/7/06 11:02	8772.4	11.2	4.8	11.0	29.2	400.0
12/14/06 9:37	8772.9	11.2	4.8	11.0	29.2	399.9
12/21/06 10:44	8765	11.2	4.9	11.3	28.9	400.3
12/28/06 10:18	8745.2	11.2	5.3	12.1	28.1	401.1
1/11/07 11:02	8620.4	11.2	7.5	17.3	22.9	406.3
2/8/07 10:26	8497.2	11.2	9.7	22.5	17.7	411.5
3/7/07 14:17	8524.1	11.2	9.3	21.4	18.8	410.3
4/12/07 9:31	8378.3	11.1	11.9	27.4	12.8	416.4
5/10/07 13:23	8402.9	11.1	11.4	26.4	13.8	415.4
6/21/07 10:28	8649.9	11.1	7.0	16.1	24.1	405.1
7/12/07 9:54	8731.6	11.1	5.5	12.7	27.5	401.7
8/15/07 10:25	8871.5	11.1	3.0	6.8	33.4	395.8
9/21/07 10:03	8947.7	11	1.6	3.6	36.6	392.6
10/26/07 10:20	8742.8	11	5.3	12.2	28.0	401.2
11/28/07 11:06	8601.9	11	7.8	18.1	22.1	407.1
12/28/07 9:55	8505.7	11	9.6	22.1	18.1	411.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-03D Serial # 06-19775

Typical Vibrating Wire Piezometer
Date Installed: 11/13/2006

Bentonite Seal =	0 to 57.7 ft
Sandpack =	57.7 to 60.8 ft
Depth to Piezometer Tip from Ground Surface =	59.5 ft
Ro =	9132
To =	8.1 degrees Celsius
Linear Gage Factor (psi) =	0.01639 psi/digit
Thermal Factor =	0.02458 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	429.17 ft
Piezometer Tip Elevation =	369.67 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8506.3	11.1	10.3	23.8	35.7	393.5
12/7/06 11:02	8392.4	11.2	12.2	28.1	31.4	397.8
12/14/06 9:36	8347.2	11.3	12.9	29.9	29.6	399.5
12/21/06 10:41	8350	11.3	12.9	29.8	29.7	399.4
12/28/06 10:17	8292.1	11.4	13.8	32.0	27.5	401.6
1/11/07 11:01	8183.2	11.3	15.6	36.1	23.4	405.7
2/8/07 10:23	8209.3	11.4	15.2	35.1	24.4	404.8
3/7/07 14:15	8234.3	11.3	14.8	34.1	25.4	403.8
4/12/07 9:30	7944.7	11.2	19.5	45.1	14.4	414.8
5/10/07 13:22	7955.2	11.2	19.4	44.7	14.8	414.4
6/21/07 10:27	8227.2	11.2	14.9	34.4	25.1	404.1
7/12/07 9:53	8394.6	11.1	12.2	28.1	31.4	397.7
8/15/07 10:24	8627	11.1	8.4	19.3	40.2	388.9
9/21/07 10:01	8716.4	11.2	6.9	15.9	43.6	385.6
10/26/07 10:20	8645.4	11	8.0	18.6	40.9	388.2
11/28/07 11:06	8380	11.1	12.4	28.6	30.9	398.3
12/28/07 9:55	8128.1	11.1	16.5	38.1	21.4	407.8

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-04S Serial # 06-19781

Typical Vibrating Wire Piezometer
Date Installed: 11/20/2006
Bentonite Seal = 0 to 14 ft
Sandpack = 14 to 16 ft
Depth to Piezometer Tip from Ground Surface = 15.5 ft
Ro = 9093.8
To = 8.8 degrees Celsius
Linear Gage Factor (psi) = 0.01692 psi/digit
Thermal Factor = 0.00745 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 419.10 ft
Piezometer Tip Elevation = 403.60 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8878.4	10.8	3.7	8.4	7.1	412.0
12/7/06 10:52	8783.8	10.9	5.3	12.1	3.4	415.7
12/14/06 9:51	8836.2	10.9	4.4	10.1	5.4	413.7
12/21/06 10:25	8877.9	11	3.7	8.5	7.0	412.1
12/28/06 10:08	8805.1	11	4.9	11.3	4.2	414.9
1/11/07 11:18	8724.8	11	6.3	14.4	1.1	418.0
2/8/07 10:39	8893.3	11.1	3.4	7.9	7.6	411.5
3/7/07 14:25	8978.1	11	2.0	4.6	10.9	408.2
5/15/07 9:48	8707.9	10.7	6.5	15.1	0.4	418.7
6/21/07 10:35	9070.3	10.6	0.4	0.9	14.6	404.6
7/12/07 10:05	9116.3	10.7	-0.4	-0.8	>=15.5 ft	
8/15/07 10:32	9118	10.7	-0.4	-0.9	>=15.5 ft	
9/21/07 10:11	9110.3	10.7	-0.3	-0.6	>=15.5 ft	
10/26/07 10:31	9107.5	10.8	-0.2	-0.5	>=15.5 ft	
11/28/07 11:16	9106	10.9	-0.2	-0.4	>=15.5 ft	
12/28/07 10:10	8851.6	11.1	4.1	9.5	6.0	413.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-04I Serial # 06-19774

Typical Vibrating Wire Piezometer
Date Installed: 11/20/2006

Bentonite Seal =	0 to 34 ft
Sandpack =	34 to 36 ft
Depth to Piezometer Tip from Ground Surface =	35.5 ft
Ro =	8917.1
To =	4.6 degrees Celsius
Linear Gage Factor (psi) =	0.01516 psi/digit
Thermal Factor =	0.01457 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	419.10 ft
Piezometer Tip Elevation =	383.60 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8131.7	11.4	12.0	27.7	7.8	411.3
12/7/06 10:50	8035	11.5	13.5	31.1	4.4	414.7
12/14/06 9:49	8090.6	11.5	12.6	29.1	6.4	412.7
12/21/06 10:29	8134.6	11.5	12.0	27.6	7.9	411.2
12/28/06 10:09	8065.3	11.5	13.0	30.0	5.5	413.6
1/11/07 11:16	7972.3	11.5	14.4	33.3	2.2	416.9
2/8/07 10:41	8146.5	11.5	11.8	27.2	8.3	410.8
3/7/07 14:27	8241.7	11.5	10.3	23.9	11.6	407.5
5/15/07 9:49	7946.2	11.4	14.8	34.2	1.3	417.8
6/21/07 10:37	8335	11.4	8.9	20.6	14.9	404.2
7/12/07 10:06	8442.6	11.4	7.3	16.8	18.7	400.4
8/15/07 10:33	8551	11.4	5.6	13.0	22.5	396.6
9/21/07 10:13	8630.4	11.4	4.4	10.3	25.2	393.9
10/26/07 10:31	8671.3	11.4	3.8	8.8	26.7	392.4
11/28/07 11:16	8430.1	11.3	7.5	17.3	18.2	400.9
12/28/07 10:10	8099.5	11.4	12.5	28.8	6.7	412.4

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-04D Serial # 06-19776

Typical Vibrating Wire Piezometer

Date Installed: 11/17/2006		
Bentonite Seal =	0 to 51	ft
Sandpack =	51 to 53	ft
Depth to Piezometer Tip from Ground Surface =	52.5	ft
Ro =	8524.5	
To =	11.2	degrees Celsius
Linear Gage Factor (psi) =	0.01691	psi/digit
Thermal Factor =	0.02002	psi/℃
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	419.10	ft
Piezometer Tip Elevation =	366.60	ft

Date and Time	R	T (℃)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	7476.9	11.3	17.7	40.9	11.6	407.5
12/7/06 10:49	7352.9	11.3	19.8	45.7	6.8	412.3
12/14/06 9:47	7396	11.3	19.1	44.0	8.5	410.6
12/21/06 10:31	7434	11.3	18.4	42.6	9.9	409.2
12/28/06 10:10	7376.1	11.3	19.4	44.8	7.7	411.4
1/11/07 11:14	7279.4	11.4	21.1	48.6	3.9	415.2
2/8/07 10:42	7438.4	11.3	18.4	42.4	10.1	409.0
3/7/07 14:29	7521.4	11.3	17.0	39.1	13.4	405.8
5/15/07 9:50	7284.2	11.2	21.0	48.4	4.1	415.0
6/21/07 10:39	7609.7	11.1	15.5	35.7	16.8	402.3
7/12/07 10:07	7707.8	11.1	13.8	31.9	20.6	398.5
8/15/07 10:35	7809.1	11.1	12.1	27.9	24.6	394.5
9/21/07 10:16	7875.3	11.1	11.0	25.3	27.2	391.9
10/26/07 10:31	7909.8	11	10.4	24.0	28.5	390.6
11/28/07 11:16	7749.9	11	13.1	30.2	22.3	396.8
12/28/07 10:10	7451	11	18.1	41.9	10.6	408.5

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-04N
Standpipe Piezometer

Date Installed:	11/16/2006	
Cement-Bentonite Grout =		0 to 97 ft
Bentonite Seal =		97 to 100.5 ft
Sandpack Set Depth =		100.5 to 113 ft
Screened Interval =		10 ft
Piezometer Set Depth =		113 ft
Casing Stickup =		2.3 ft
Top of Casing Elevation =		420.9 ft
Ground Surface Elevation =		418.6 ft
Standpipe Tip Elevation =		305.6 ft

Date and Time	Depth from Top of Casing (ft)	Depth Below Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 10:40	45.44	43.1	375.5
12/14/06 9:45	45.62	43.3	375.3
12/21/06 10:32	45.99	43.7	374.9
12/28/06 10:06	45.82	43.5	375.1
1/11/07 11:14	45.49	43.2	375.4
2/8/07 10:38	45.96	43.7	375.0
3/7/07 14:31	46.44	44.1	374.5
5/15/07 9:52	45.1	42.8	375.8
6/21/07 10:43	46.9	44.6	374.0
7/12/07 10:10	47.54	45.2	373.4
8/15/07 10:37	48	45.7	372.9
9/21/07 10:18	48.26	46.0	372.7
10/26/07 10:32	48.01	45.7	372.9
11/28/07 11:16	47.67	45.4	373.3
12/28/07 10:10	46.04	43.7	374.9

SB915-PZ13-05S Serial # 06-20311

Typical Vibrating Wire Piezometer
Date Installed: 11/6/2006
Bentonite Seal = 0 to 13.3 ft
Sandpack = 13.3 to 15.3 ft
Depth to Piezometer Tip from Ground Surface = 14.8 ft
Ro = 8963.9
To = 10 degrees Celsius
Linear Gage Factor (psi) = 0.01706 psi/digit
Thermal Factor = 0.00856 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 432.94 ft
Piezometer Tip Elevation = 418.14 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9003.6	12.1	-0.7	-1.5	>=14.8 ft	
12/7/06 14:05	8990.7	12.1	-0.4	-1.0	>=14.8 ft	
12/14/06 11:56	8999.9	12.2	-0.6	-1.4	>=14.8 ft	
12/21/06 12:42	8993.4	12.2	-0.5	-1.1	>=14.8 ft	
12/28/06 12:28	8985.8	12.2	-0.4	-0.8	>=14.8 ft	
1/11/07 13:44	8975.3	12.3	-0.2	-0.4	>=14.8 ft	
2/8/07 12:05	8980.3	12.2	-0.3	-0.6	>=14.8 ft	
3/9/07 10:06	8986.2	12.1	-0.4	-0.8	>=14.8 ft	
4/12/07 10:47	8866	11.8	1.7	3.9	10.9	422.0
5/10/07 15:07	8912.2	11.5	0.9	2.1	12.7	420.2
6/21/07 12:33	8995.9	11.1	-0.5	-1.2	>=14.8 ft	
7/12/07 12:29	9005.4	11	-0.7	-1.6	>=14.8 ft	
8/15/07 12:39	9009.1	11	-0.8	-1.8	>=14.8 ft	
9/21/07 12:03	9004	11.3	-0.7	-1.6	>=14.8 ft	
10/26/07 12:23	9001.6	11.6	-0.6	-1.5	>=14.8 ft	
11/28/07 10:46	8989.3	11.9	-0.4	-1.0	>=14.8 ft	
12/28/07 10:55	8992.3	12.1	-0.5	-1.1	>=14.8 ft	

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-05I Serial # 06-19785
Typical Vibrating Wire Piezometer
Date Installed: 11/3/2006
Bentonite Seal = 0 to 33.4 ft
Sandpack = 33.4 to 35.5 ft
Depth to Piezometer Tip from Ground Surface = 35 ft
Ro = 9051.9
To = 10.6 degrees Celsius
Linear Gage Factor (psi) = 0.01771 psi/digit
Thermal Factor = 0.00599 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 432.94 ft
Piezometer Tip Elevation = 397.94 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8999.0	11.5	0.9	2.2	32.8	400.1
12/7/06 14:04	8953.8	11.6	1.7	4.0	31.0	402.0
12/14/06 11:54	8943.3	11.6	1.9	4.5	30.5	402.4
12/21/06 12:43	8954.2	11.6	1.7	4.0	31.0	401.9
12/28/06 12:26	8942.7	11.6	1.9	4.5	30.5	402.4
1/11/07 13:42	8902.4	11.6	2.7	6.1	28.9	404.1
2/8/07 12:04	8970.4	11.6	1.4	3.3	31.7	401.3
3/9/07 10:05	9026	11.4	0.5	1.1	33.9	399.0
4/12/07 10:47	8859.9	11.5	3.4	7.9	27.1	405.8
5/10/07 15:06	8879.4	11.5	3.1	7.1	27.9	405.0
6/21/07 12:32	9054.3	11.5	0.0	-0.1	>=35 ft	
7/12/07 12:28	9066.6	11.4	-0.3	-0.6	>=35 ft	
8/15/07 12:37	9076.2	11.7	-0.4	-1.0	>=35 ft	
9/21/07 12:02	9078	11.4	-0.5	-1.1	>=35 ft	
10/26/07 12:23	9083.2	11.4	-0.5	-1.3	>=35 ft	
11/28/07 10:46	9085.9	11.4	-0.6	-1.4	>=35 ft	
12/28/07 10:55	9013.2	11.4	0.7	1.6	33.4	399.5

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-05N Serial # 06-19772

Typical Vibrating Wire Piezometer
Date Installed: 11/3/2006
Bentonite Seal = 0 to 54 ft
Sandpack = 54 to 56.5 ft
Depth to Piezometer Tip from Ground Surface = 56 ft
Ro = 9073.3
To = 6 degrees Celsius
Linear Gage Factor (psi) = 0.01666 psi/digit
Thermal Factor = 0.01085 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 432.94 ft
Piezometer Tip Elevation = 376.94 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 14:03	8837.8	11.3	4.0	9.2	46.8	386.1
12/14/06 11:53	8814.6	11.3	4.4	10.1	45.9	387.0
12/21/06 12:44	8818.3	11.3	4.3	9.9	46.1	386.9
12/28/06 12:24	8797.6	11.3	4.7	10.7	45.3	387.7
1/11/07 13:42	8696	11.5	6.3	14.6	41.4	391.6
2/8/07 12:03	8713.2	11.3	6.1	14.0	42.0	390.9
3/9/07 10:04	9034.3	11.3	0.7	1.6	54.4	378.6
4/12/07 10:46	8735.7	11.3	5.7	13.1	42.9	390.1
5/10/07 15:05	8733	11.3	5.7	13.2	42.8	390.2
6/21/07 12:32	8978.9	11.3	1.6	3.8	52.2	380.7
7/12/07 12:27	9044.4	11.3	0.5	1.2	54.8	378.2
8/15/07 12:36	9118.5	11.3	-0.7	-1.6	>=56 ft	
9/21/07 12:02	9117	11.3	-0.7	-1.5	>=56 ft	
10/26/07 12:23	9121.3	11.1	-0.7	-1.7	>=56 ft	
11/28/07 10:46	9126.1	11.1	-0.8	-1.9	>=56 ft	
12/28/07 10:55	9034.2	11.1	0.7	1.6	54.4	378.6

SB915-PZ13-06S Serial # 06-20307

Typical Vibrating Wire Piezometer
Date Installed: 11/7/2006
Bentonite Seal = 0 to 18 ft
Sandpack = 18 to 20 ft
Depth to Piezometer Tip from Ground Surface = 19.5 ft
Ro = 8766.2
To = 10.9 degrees Celsius
Linear Gage Factor (psi) = 0.01726 psi/digit
Thermal Factor = 0.01234 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 428.67 ft
Piezometer Tip Elevation = 409.17 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8664.5	10.1	1.7	4.0	15.5	413.2
12/7/06 11:37	8603.3	10.2	2.8	6.5	13.0	415.6
12/14/06 10:12	8640	10.3	2.2	5.0	14.5	414.2
12/21/06 11:04	8655.6	10.2	1.9	4.4	15.1	413.6
12/28/06 10:36	8603	10.4	2.8	6.5	13.0	415.7
1/11/07 11:39	8549.8	10.4	3.7	8.6	10.9	417.8
2/8/07 12:22	8683.7	10.5	1.4	3.3	16.2	412.4
3/7/07 14:50	8677.2	10.5	1.5	3.5	16.0	412.7
4/12/07 9:45	8455.6	10.5	5.4	12.4	7.1	421.5
5/10/07 13:52	8499.2	10.3	4.6	10.6	8.9	419.8
6/21/07 10:49	8781.1	10.3	-0.3	-0.6	>=19.5 ft	
7/12/07 10:21	8800.2	10.1	-0.6	-1.4	>=19.5 ft	
8/15/07 10:50	8779.9	10.1	-0.2	-0.6	>=19.5 ft	
9/21/07 10:34	8772.5	10	-0.1	-0.3	>=19.5 ft	
10/26/07 10:48	8770.2	9.9	-0.1	-0.2	>=19.5 ft	
11/28/07 11:31	8681.4	10.1	1.5	3.4	16.1	412.5
12/28/07 10:30	8646	10	2.1	4.8	14.7	413.9

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-06I Serial # 06-20306

Typical Vibrating Wire Piezometer
Date Installed: 11/6/2006

Bentonite Seal =	0 to 33 ft
Sandpack =	33 to 35 ft
Depth to Piezometer Tip from Ground Surface =	34.5 ft
Ro =	9063.7
To =	12.2 degrees Celsius
Linear Gage Factor (psi) =	0.01922 psi/digit
Thermal Factor =	0.0156 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	428.67 ft
Piezometer Tip Elevation =	394.17 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8776.3	10	5.5	12.7	21.8	406.8
12/7/06 11:39	8710.5	10.1	6.8	15.6	18.9	409.8
12/14/06 10:13	8746.6	10	6.1	14.0	20.5	408.2
12/21/06 11:06	8775	10	5.5	12.7	21.8	406.9
12/28/06 10:38	8718.5	10	6.6	15.2	19.3	409.4
1/11/07 11:40	8667.1	10	7.6	17.5	17.0	411.7
2/8/07 12:23	8807.1	10.1	4.9	11.3	23.2	405.5
3/7/07 14:51	8825	10.1	4.6	10.5	24.0	404.7
4/12/07 9:46	8583.6	10	9.2	21.2	13.3	415.4
5/10/07 13:51	8618.4	10	8.5	19.7	14.8	413.8
6/21/07 10:50	9082.8	9.9	-0.4	-0.9	>=34.5 ft	
7/12/07 10:22	9087.4	9.9	-0.5	-1.1	>=34.5 ft	
8/15/07 10:49	9076.5	9.9	-0.3	-0.7	>=34.5 ft	
9/21/07 10:33	9070.1	9.9	-0.2	-0.4	>=34.5 ft	
10/26/07 10:48	9066.8	9.9	-0.1	-0.2	>=34.5 ft	
11/28/07 11:31	9065.7	10	-0.1	-0.2	>=34.5 ft	
12/28/07 10:30	8770.8	9.9	5.6	12.9	21.6	407.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-06D Serial # 06-19771

Typical Vibrating Wire Piezometer

Date Installed: 11/6/2006

Bentonite Seal =	0 to 48 ft
Sandpack =	48 to 50 ft
Depth to Piezometer Tip from Ground Surface =	49.5 ft
Ro =	9006.5
To =	8 degrees Celsius
Linear Gage Factor (psi) =	0.01592 psi/digit
Thermal Factor =	0.0103 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	428.67 ft
Piezometer Tip Elevation =	379.17 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8335.8	10	10.7	24.7	24.8	403.9
12/7/06 11:40	8260.1	10.1	11.9	27.5	22.0	406.6
12/14/06 10:14	8299.8	10.1	11.3	26.0	23.5	405.2
12/21/06 11:07	8324.1	10.1	10.9	25.1	24.4	404.3
12/28/06 10:39	8256	10.1	12.0	27.6	21.9	406.8
1/11/07 11:41	8187.1	10.1	13.1	30.2	19.3	409.3
2/8/07 12:24	8338.4	10.1	10.7	24.6	24.9	403.8
3/7/07 14:52	8336.2	10.1	10.7	24.7	24.8	403.8
4/12/07 9:46	8062.7	10.1	15.0	34.7	14.8	413.9
5/10/07 13:50	8107.7	10	14.3	33.1	16.4	412.2
6/21/07 10:51	8624.7	10	6.1	14.1	35.4	393.2
7/12/07 10:23	8711.2	10	4.7	10.9	38.6	390.1
8/15/07 10:48	8824.4	10	2.9	6.7	42.8	385.9
9/21/07 10:32	8871	10	2.2	5.0	44.5	384.2
10/26/07 10:48	8776	10.1	3.7	8.5	41.0	387.7
11/28/07 11:31	8849.6	9.9	2.5	5.8	43.7	385.0
12/28/07 10:30	8287.2	9.9	11.5	26.5	23.0	405.6

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-06N Serial # 06-19769

Typical Vibrating Wire Piezometer

Date Installed: 11/3/2006

Bentonite Seal =	Approximately 0 to 63	ft
Sandpack =	Approximately 63 to 65	ft
Depth to Piezometer Tip from Ground Surface =	64	ft
Ro =	8982.1	
To =	9.6	degrees Celsius
Linear Gage Factor (psi) =	0.01714	psi/digit
Thermal Factor =	0.01667	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	428.67	ft
Piezometer Tip Elevation =	364.67	ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8711.3	10.1	4.6	10.7	53.3	375.4
12/7/06 11:41	8697.3	10.2	4.9	11.3	52.7	376.0
12/14/06 10:15	8704.1	10.2	4.8	11.0	53.0	375.7
12/21/06 11:09	8703.9	10.3	4.8	11.0	53.0	375.7
12/28/06 10:41	8699.5	10.2	4.9	11.2	52.8	375.9
1/11/07 11:42	8685.8	10.2	5.1	11.7	52.3	376.4
2/8/07 12:25	8716.5	10.2	4.6	10.5	53.5	375.2
3/7/07 14:53	8724.4	10.2	4.4	10.2	53.8	374.9
4/12/07 9:47	8669.2	10.2	5.4	12.4	51.6	377.1
5/10/07 13:50	8681.7	10.2	5.2	11.9	52.1	376.6
6/21/07 10:52	8750.2	10.2	4.0	9.2	54.8	373.9
7/12/07 10:24	8769.7	10.2	3.7	8.4	55.6	373.1
8/15/07 10:47	8785.2	10.1	3.4	7.8	56.2	372.5
9/21/07 10:31	8785	10.2	3.4	7.8	56.2	372.5
10/26/07 10:48	8776	10.1	3.5	8.2	55.8	372.8
11/28/07 11:31	8761.6	10	3.8	8.7	55.3	373.4
12/28/07 10:30	8714.3	10	4.6	10.6	53.4	375.3

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-07 Serial # 06-19782

Typical Vibrating Wire Piezometer

Date Installed: 11/14/2006		
Bentonite Seal =	0 to 52.5	ft
Sandpack =	52.5 to 59	ft
Depth to Piezometer Tip from Ground Surface =	54	ft
Ro =	9133.1	
To =	13.8	degrees Celsius
Linear Gage Factor (psi) =	0.01745	psi/digit
Thermal Factor =	0.01345	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	438.23	ft
Piezometer Tip Elevation =	384.23	ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9109.7	10.6	0.4	0.8	53.2	385.1
12/7/06 12:45	9114.6	10.7	0.3	0.6	53.4	384.9
12/14/06 10:59	9112.7	10.7	0.3	0.7	53.3	385.0
12/21/06 11:39	9105.2	10.6	0.4	1.0	53.0	385.3
12/28/06 11:07	9105.8	10.6	0.4	1.0	53.0	385.2
1/11/07 12:42	9100.6	10.6	0.5	1.2	52.8	385.4
2/8/07 11:26	9111	10.6	0.3	0.8	53.2	385.0
3/7/07 13:36	9103.7	10.6	0.5	1.1	52.9	385.3
4/12/07 10:11	9099.4	10.6	0.5	1.3	52.7	385.5
5/10/07 14:24	9096.4	10.6	0.6	1.4	52.6	385.6
6/21/07 11:26	9107.4	10.6	0.4	0.9	53.1	385.2
7/12/07 11:01	9111.1	10.7	0.3	0.8	53.2	385.0
8/15/07 11:25	9113.6	10.7	0.3	0.7	53.3	384.9
9/21/07 11:12	9111.3	10.6	0.3	0.8	53.2	385.0
10/26/07 11:38	9114.9	10.5	0.3	0.6	53.4	384.9
11/28/07 9:57	9115.1	10.5	0.3	0.6	53.4	384.9
12/28/07 11:55	9109	10.5	0.4	0.9	53.1	385.1

SB915-PZ13-08
Standpipe Piezometer

Date Installed:	11/27/2006	
Cement-Bentonite Grout =	0 to 25	ft
Bentonite Seal =	25 to 28	ft
Sandpack Set Depth =	28 to 41	ft
Screened Interval =	10	ft
Piezometer Set Depth =	40	ft
Casing Stickup =	-0.43	ft
Top of Casing Elevation =	430.9	ft
Ground Surface Elevation =	431.35	ft
Standpipe Tip Elevation =	391.35	ft

Note:
A 36-inch long extension was added to the standpipe on 1/12/2007.

Date and Time	Depth from Top of Casing (ft)	Depth Below Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 12:51	39.4	39.8	391.5
12/14/06 11:16	39.39	39.8	391.5
12/21/06 11:55	39.4	39.8	391.5
12/28/06 11:50	39.41	39.8	391.5
1/11/07 13:00	39.43	39.9	391.5
2/8/07 11:45	dry		
3/9/07 9:40	dry		
4/12/07 10:18	dry		
5/10/07 14:36	dry		
6/21/07 11:40	dry		
7/12/07 11:21	dry		
8/15/07 11:39	dry		
9/21/07 11:25	dry		
10/26/07 11:50	dry		
11/28/07 10:12	dry		
12/28/07 11:40	dry		

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-09 Serial # 06-19783

Typical Vibrating Wire Piezometer
Date Installed: 11/16/2006
Bentonite Seal = 0 to 35 ft
Sandpack = 35 to 37.5 ft
Depth to Piezometer Tip from Ground Surface = 36.5 ft
Ro = 9389.1
To = 11.5 degrees Celsius
Linear Gage Factor (psi) = 0.01681 psi/digit
Thermal Factor = 0.0056 psi/°C
Unit Weight of Water = 62.4 pcf
Initial Ground Surface Elevation = 432.48 ft
Piezometer Tip Elevation = 395.98 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	9381	11.3	0.1	0.3	36.2	396.3
12/7/06 13:28	9379	11.4	0.2	0.4	36.1	396.4
12/14/06 11:26	9380.2	11.5	0.1	0.3	36.2	396.3
12/21/06 12:06	9369.9	11.4	0.3	0.7	35.8	396.7
12/28/06 12:01	9368.8	11.4	0.3	0.8	35.7	396.8
1/11/07 13:14	9368	11.5	0.4	0.8	35.7	396.8
2/8/07 11:54	9383.2	11.5	0.1	0.2	36.3	396.2
3/9/07 9:54	9366.5	11.7	0.4	0.9	35.6	396.9
4/12/07 10:30	9389.5	11.4	0.0	0.0	>=36.5 ft	
5/10/07 14:46	9383.9	11.4	0.1	0.2	36.3	396.2
6/21/07 11:47	9386	10.9	0.0	0.1	36.4	396.1
7/12/07 11:31	9386.1	10.8	0.0	0.1	36.4	396.1
8/15/07 11:50	9386	10.9	0.0	0.1	36.4	396.1
9/21/07 11:39	9383	10.9	0.1	0.2	36.3	396.2
10/26/07 12:01	9381.9	11	0.1	0.3	36.2	396.2
11/28/07 10:26	9380.3	11.1	0.1	0.3	36.2	396.3
12/28/07 11:07	9385.6	11.3	0.1	0.1	36.4	396.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-10

Standpipe Piezometer

Date Installed:	11/29/2006	
Cement-Bentonite Grout =		0 to 18 ft
Bentonite Seal =		18 to 20 ft
Sandpack Set Depth =		20 to 32 ft
Screened Interval =		10 ft
Piezometer Set Depth =		32 ft
Casing Stickup =		-0.56 ft
Top of Casing Elevation =		396.89 ft
Ground Surface Elevation =		397.45 ft
Standpipe Tip Elevation =		365.45 ft

Note:

A 28-inch long extension was added to the standpipe on 1/12/2007.

Date and Time	Depth from Top of Casing (ft)	Depth Below Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 12:35	22.4	23.0	374.5
12/14/06 10:41	22.61	23.2	374.3
12/21/06 11:28	22.94	23.5	374.0
12/28/06 11:00	22.81	23.4	374.1
1/11/07 12:34	22.46	23.0	374.4
2/8/07 11:20	25.72	23.9	373.5
3/7/07 15:15	26.18	24.4	373.0
4/12/07 10:05	24.13	22.4	375.1
5/10/07 14:14	24.66	22.9	374.6
6/21/07 11:17	26.75	25.0	372.5
7/12/07 10:53	27.35	25.6	371.9
8/15/07 11:15	27.83	26.1	371.4
9/21/07 11:01	28.1	26.3	371.1
10/26/07 11:30	27.86	26.1	371.4
11/28/07 11:51	27.42	25.6	371.8
12/28/07 12:10	25.73	24.0	373.5

SB915-PZ13-11 Serial # 06-19787
Typical Vibrating Wire Piezometer
Date Installed: 11/17/2006

Bentonite Seal =	0 to 39.5 ft
Sandpack =	39.5 to 42 ft
Depth to Piezometer Tip from Ground Surface =	41 ft
Ro =	8850.1
To =	11.9 degrees Celsius
Linear Gage Factor (psi) =	0.01674 psi/digit
Thermal Factor =	0.00736 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	432.44 ft
Piezometer Tip Elevation =	391.44 ft

Note:
A blank entry in the piezometric elevation column indicates the calculated elevation is below the piezometer tip.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8852.4	11.8	0.0	-0.1	>=41 ft	
12/7/06 13:53	8849	12	0.0	0.0	41.0	391.5
12/14/06 11:47	8852.1	12	0.0	-0.1	>=41 ft	
12/21/06 12:36	8841.7	11.9	0.1	0.3	40.7	391.8
12/28/06 12:19	8840.2	12	0.2	0.4	40.6	391.8
1/11/07 13:35	8840.2	12.1	0.2	0.4	40.6	391.8
2/8/07 11:57	8854.4	12.2	-0.1	-0.2	>=41 ft	
3/9/07 9:59	8838	12.2	0.2	0.5	40.5	391.9
4/12/07 10:42	8860.8	11.9	-0.2	-0.4	>=41 ft	
5/10/07 15:02	8854.7	11.9	-0.1	-0.2	>=41 ft	
6/21/07 12:27	8856.9	11.6	-0.1	-0.3	>=41 ft	
7/12/07 12:22	8856.6	11.4	-0.1	-0.3	>=41 ft	
8/15/07 12:31	8857.3	11.2	-0.1	-0.3	>=41 ft	
9/21/07 11:58	8850.9	11.2	0.0	0.0	>=41 ft	
10/26/07 12:19	8847.9	11.4	0.0	0.1	40.9	391.5
11/28/07 10:42	8845.5	11.7	0.1	0.2	40.8	391.6
12/28/07 11:03	8851.4	11.8	0.0	-0.1	>=41 ft	

SB915-PZ13-12

Standpipe Piezometer

Date Installed:	11/28/2006	
Cement-Bentonite Grout =		0 to 10.6 ft
Bentonite Seal =		10.6 to 12.8 ft
Sandpack Set Depth =		12.8 to 26 ft
Screened Interval =		10 ft
Piezometer Set Depth =		25 ft
Casing Stickup =		-0.34 ft
Top of Casing Elevation =		431.17 ft
Ground Surface Elevation =		431.51 ft
Standpipe Tip Elevation =		406.51 ft

Notes:

1. A 28-inch long extension was added to the standpipe on 1/12/2007.
2. On 12/28/06, it was observed that surface runoff had entered the standpipe.

Date and Time	Depth from Top of Casing (ft)	Depth Below Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 14:15	24.41	24.8	406.8
12/14/06 12:06	24.07	24.4	407.1
12/21/06 12:50	24.31	24.7	406.9
12/28/06 12:35	14.6	14.9	416.6
1/11/07 13:51	18.95	19.3	412.2
2/8/07 12:13	22.9	20.9	410.6
3/9/07 10:19	24.15	22.2	409.4
4/12/07 10:49	24.85	22.9	408.7
5/10/07 15:11	25.39	23.4	408.1
6/21/07 12:40	26.02	24.0	407.5
7/12/07 12:38	26.26	24.3	407.2
8/15/07 12:44	26.7	24.7	406.8
9/21/07 12:06	26.75	24.8	406.8
10/26/07 12:28	26.8	24.8	406.7
11/28/07 10:52	dry		
12/28/07 10:50	dry		

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-13 Serial # 06-19779

Typical Vibrating Wire Piezometer
Date Installed: 11/21/2006

Bentonite Seal =	0 to 29	ft
Sandpack =	29 to 31	ft
Depth to Piezometer Tip from Ground Surface =	30	ft
Ro =	8996.4	
To =	11.9	degrees Celsius
Linear Gage Factor (psi) =	0.01688	psi/digit
Thermal Factor =	0.01655	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	434.26	ft
Piezometer Tip Elevation =	404.26	ft

Note:
Since 1/15/07, the thermistor on PZ13-13 has not been functioning; therefore, a temperature reading of 11.3 degrees Celsius is assumed for all calculations after that date.

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8877.1	11.2	2.0	4.6	25.4	408.9
12/7/06 12:08	8859.1	11.4	2.3	5.3	24.7	409.6
12/14/06 10:27	8864.3	11.2	2.2	5.1	24.9	409.4
12/21/06 11:11	8869.1	11.2	2.1	4.9	25.1	409.2
12/28/06 10:48	8859.6	11.4	2.3	5.3	24.7	409.6
1/11/07 12:18	8836.8	11.3	2.7	6.2	23.8	410.5
2/8/07 11:04	8892.4	11.3	1.7	4.0	26.0	408.3
3/7/07 15:00	8917.7	11.3	1.3	3.0	27.0	407.3
4/12/07 9:54	8832.7	11.3	2.8	6.4	23.6	410.6
5/10/07 14:02	8845.1	11.3	2.5	5.9	24.1	410.1
6/21/07 11:04	8933.6	11.3	1.1	2.4	27.6	406.7
7/12/07 10:38	8950.4	11.3	0.8	1.8	28.2	406.0
8/15/07 11:09	8964.6	11.3	0.5	1.2	28.8	405.5
9/21/07 10:48	8962.8	11.3	0.6	1.3	28.7	405.5
10/26/07 11:16	8965.5	11.3	0.5	1.2	28.8	405.4
11/28/07 10:55	8963.1	11.3	0.6	1.3	28.7	405.5
12/28/07 10:47	8882.3	11.3	1.9	4.4	25.6	408.7

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-14 Serial # 06-19780

Typical Vibrating Wire Piezometer
Date Installed: 11/27/2006

Bentonite Seal =	0 to 29 ft
Sandpack =	29 to 31 ft
Depth to Piezometer Tip from Ground Surface =	30 ft
Ro =	9141
To =	10.7 degrees Celsius
Linear Gage Factor (psi) =	0.0154 psi/digit
Thermal Factor =	0.01318 psi/°C
Unit Weight of Water =	62.4 pcf
Initial Ground Surface Elevation =	443.67 ft
Piezometer Tip Elevation =	413.67 ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
11/30/06 12:00	8793.4	10.2	5.3	12.3	17.7	426.0
12/7/06 11:18	8742.7	10.2	6.1	14.1	15.9	427.8
12/14/06 10:10	8750.9	10.2	6.0	13.8	16.2	427.5
12/21/06 10:56	8782.8	10.2	5.5	12.7	17.3	426.4
12/28/06 10:28	8742.2	10.4	6.1	14.2	15.8	427.8
1/11/07 11:30	8683.3	10.3	7.0	16.3	13.7	429.9
2/8/07 11:00	8796.3	10.2	5.3	12.2	17.8	425.9
3/7/07 14:43	8917.1	10.4	3.4	7.9	22.1	421.6
4/12/07 9:37	8657.5	10.2	7.4	17.2	12.8	430.8
5/10/07 13:59	8688.2	10.2	7.0	16.1	13.9	429.8
6/21/07 11:01	8968.6	10.3	2.6	6.1	23.9	419.8
7/12/07 10:34	9024.9	10.1	1.8	4.1	25.9	417.8
8/15/07 11:05	9062.3	10.1	1.2	2.8	27.2	416.5
9/21/07 10:45	9076.5	10.1	1.0	2.3	27.7	415.9
10/26/07 11:12	9082.5	10.1	0.9	2.1	27.9	415.7
11/28/07 10:58	9020.7	10.1	1.8	4.3	25.7	417.9
12/28/07 10:44	8705.1	10.1	6.7	15.5	14.5	429.1

OL Phase II PDI
Wastebed 13 Piezometers

SB915-PZ13-15 Serial # 06-19770

Typical Vibrating Wire Piezometer
Date Installed: 11/29/2006

Bentonite Seal =	0 to 29	ft
Sandpack =	29 to 31	ft
Depth to Piezometer Tip from Ground Surface =	30	ft
Ro =	8879.4	
To =	12.6	degrees Celsius
Linear Gage Factor (psi) =	0.01548	psi/digit
Thermal Factor =	0.01491	psi/°C
Unit Weight of Water =	62.4	pcf
Initial Ground Surface Elevation =	446.56	ft
Piezometer Tip Elevation =	416.56	ft

Date and Time	R	T (°C)	Pressure (psi)	ft- water	Piezometric Level as Depth Below Original Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 14:21	8562.4	10.9	4.9	11.3	18.7	427.8
12/14/06 9:26	8585.7	10.8	4.5	10.4	19.6	427.0
12/21/06 10:05	8613.8	10.7	4.1	9.4	20.6	426.0
12/28/06 9:56	8601.5	10.7	4.3	9.9	20.1	426.4
1/11/07 10:52	8529.9	10.7	5.4	12.4	17.6	429.0
2/8/07 10:13	8643.4	10.7	3.6	8.4	21.6	424.9
3/7/07 14:05	8714.8	10.8	2.5	5.8	24.2	422.4
4/12/07 9:22	8490.9	10.7	6.0	13.8	16.2	430.4
5/10/07 13:15	8534.8	10.8	5.3	12.2	17.8	428.8
6/21/07 10:18	8736.5	10.8	2.2	5.0	25.0	421.6
7/12/07 9:41	8771.2	10.6	1.6	3.8	26.2	420.4
8/15/07 10:09	8810.4	10.6	1.0	2.4	27.6	419.0
9/21/07 9:48	8838	10.6	0.6	1.4	28.6	418.0
10/26/07 10:10	8858.6	10.5	0.3	0.7	29.3	417.2
11/28/07 9:47	8843	10.6	0.5	1.2	28.8	417.8
12/28/07 9:44	8611.3	10.6	4.1	9.5	20.5	426.1

SB915-PZ13-16

Standpipe Piezometer

Date Installed:	11/22/2006	
Cement-Bentonite Grout =		0 to 14.6 ft
Bentonite Seal =		14.6 to 17 ft
Sandpack Set Depth =		17 to 31 ft
Screened Interval =		10 ft
Piezometer Set Depth =		30 ft
Casing Stickup =		-0.73 ft
Top of Casing Elevation =		440.3 ft
Ground Surface Elevation =		441.08 ft
Standpipe Tip Elevation =		411.08 ft

Note:

A 30-inch long extension was added to the standpipe on 1/12/2007.

Date and Time	Depth from Top of Casing (ft)	Depth Below Ground Surface (ft)	Piezometric Elevation (ft)
12/7/06 14:30	15.3	16.0	425.0
12/14/06 10:58	15.19	15.9	425.2
12/21/06 12:56	15.15	15.9	425.2
12/28/06 13:06	15.14	15.9	425.2
1/11/07 14:00	14.77	15.5	425.6
2/8/07 12:50	18	16.2	424.8
3/7/07 13:40	18.52	16.8	424.3
4/12/07 10:56	15.37	13.6	427.5
5/10/07 13:13	16.11	14.3	426.7
6/21/07 12:47	18.16	16.4	424.7
7/12/07 12:44	18.67	16.9	424.2
8/15/07 12:53	19.78	18.0	423.1
9/21/07 12:14	22.25	20.5	420.6
10/26/07 12:33	25.75	24.0	417.1
11/28/07 9:53	22.36	20.6	420.5
12/28/07 11:57	18.8	17.0	424.0

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

Attachment 3

Summary Tables of Lab Test Results

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

2004 Lab Results

(Presented in Appendix A of the report titled "*Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Data Summary Report*" prepared by Parsons and Geosyntec 2008a)

TABLE 2-1

ESTIMATED WATER TABLE ELEVATIONS FROM PORE WATER DISSIPATION TESTS

CPT Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)	CPT Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)
PW-128	68.9	49.6	PW-13D	86.5	49.6
PW-107	67.1	49.6	PW-12B	66.4	49.6
PW-140	49.4	49.6	PW-131	79.4	49.6
PW-13A	14.3 35.3 80.2	8 18.1 52.6	PW-12E	61.7	49.6
PW-11D	78.7	49.6	PW-113	Not Available	Not Available
PW-10B	Not Available	Not Available	PW-119	20.5 36.6 50.0 56.0	9.3 15.6 46.2 48.5
PW-122	52.8	41.4	PW-10A	64.0	52.1
PW-11F	64.6	50.4	PW-11C	Not Available	Not Available
PW-134	44.3	49.6	PW-125	75.1	50.8
PW-116	Not Available	Not Available	PW-137	80.2	51.9

TABLE 3-1

SUMMARY OF LABORATORY TESTING PROGRAM

Description	ASTM Designation	Number of Samples	
		Solvay Waste	Native Soils
Index Tests			
Water Content	D2216	74	60
Specific Gravity	D854	17	8
Atterberg Limits	D4318	10	7
Grain-Size	D422 & D1140	19	8
Hydrometer	D422	5	4
Performance Tests			
Unconsolidated Undrained Triaxial	D2850	7	0
Consolidated Undrained Triaxial with Pore Pressure Measurements	D4767	8	0
Consolidation	D2435	6	0
Hydraulic Conductivity	D5084	5	0

TABLE 3-2
GEOTECHNICAL DATA SUMMARY - WASTEBED 13 DIKES

Boring #	Depth (ft)	Average Depth (ft)	Water Content (Percent)	Plastic Limit	Liquid Limit	Plasticity Index	Specific Gravity	Passing the #200 Sieve
Dikes								
SB-23	0.0-2.0	1.0	5.0					
	2.0-4.0	3.0	5.0					
	4.0-6.0	5.0	6.0					
	6.0-8.0	7.0	7.5					
	8.0-10.0	9.0	9.0					
	10.0-12.0	11.0	2.7					
	12.0-14.0	13.0	5.6					
	14.0-16.0	15.0	12.7					
	16.0-18.0	17.0	11.1	13	25	12	2.75	60.7
	18.0-20.0	19.0	9.4					
	20.0-22.0	21.0	12.3					
	22.0-24.0	23.0	11.1					
	24.0-26.0	25.0	8.5					
	26.0-28.0	27.0	11.2					
	28.0-30.0	29.0	12.6					
	30.0-32.0	31.0	9.9					
	32.0-34.0	33.0	11.5					
	34.0-36.0	35.0	3.6					
	36.0-38.0	37.0	17.7					
	38.0-40.0	39.0	18.7	Non-Plastic			2.68	
	40.0-42.0	41.0	23.9					56.7
	42.0-44.0	43.0	12.2					
	44.0-46.0	45.0	6.3					
	46.0-48.0	47.0	11.7					
	48.0-50.0	49.0	5.9					
SB-24	20.0-22.0	21	13.2					
	22.0-24.0	23	10.9	11	17	6	2.74	66
	24.0-26.0	25	11.5					
	40.0-42.0	41	21.8					
	42.0-44.0	43	23.3	Non-Plastic			2.64	91.8
	44.0-46.0	45	22.5					
SB-25	0.0-2.0	1	9.7					
	2.0-4.0	3	13					
	8.0-10.0	9	8.0					
	10.0-12.0	11	10.9					
	12.0-14.0	13	13.5					
	14.0-16.0	15	11.9	13	23	10	2.71	54.5
	16.0-18.0	17	9.8					
	18.0-20.0	19	11.1					
	20.0-22.0	21	15.2					
	24.0-26.0	25	15.3					
	26.0-28.0	27	10.6					
	28.0-30.0	29	13.8					
	30.0-32.0	31	12.8					
	32.0-34.0	33	9.5					
	34.0-36.0	35	9.7	14	25	11	2.73	42
	36.0-38.0	37	11.1					
	38.0-38.8	39	12					
	40.0-42.0	41	83.1					
	42.0-44.0	43	9.0	16	19	3	2.80	39.7
	44.0-46.0	45	8.7					
	46.0-48.0	47	10.2					
	48.0-50.0	49	10.8					
Minimum			2.7	11	17	3	2.64	40
Maximum			83.1	16	25	12	2.80	92
Average			13	13	22	8	2.72	59
Native Materials Underlying Wastebed 13								
SB-21	50.0-52.4	51.2	7.8					
SB-22	64.0-68.0	66	15					
	70.0-74.0	72	14.1					
PZ-02	68.0-70.0	69	8.6				2.72	55.1
	72.0-76.0	74	13.3					
	76.0-80.0	78	11.3					
	80.0-84.0	82	12.5					
Minimum			7.8					
Maximum			15					
Average			11.8				2.72	55.1

TABLE 3-3
GEOTECHNICAL DATA SUMMARY - WASTEBED 13
SOLVAY WASTE

Boring #	Depth (ft)	Average Depth (ft)	Water Content (Percent)	Plastic Limit	Liquid Limit	Plasticity Index	Specific Gravity	Passing the #200 Sieve	Hydraulic Conductivity (cm/sec)	Dry Density (pcf)	Total Density (pcf)	UU Cohesion (psi)	UU Cohesion (psf)
Wastebed													
PZ-01	2.0-4.0	3	294.1										
	4.0-6.0	5	254										
	6.0-8.0	7	344.1										
	8.0-10.0	9	77.8		Non-Plastic		2.40	79.4					
	10.0-12.0	11	204.2				2.37			22.8	69	3.66	527
		11	402.8						1.54E-05	20.6	104		
	12.0-14.0	11	333										
	14.0-16.0	15	269.3										
	16.0-18.0	17	258.2										
	18.0-20.0	19	265.5					73.3					
	20.0-22.0	21					1.76						
	22.0-24.0	23	243.1										
	26.0-28.0	27	249.6										
	28.0-30.0	29	275		Non-Plastic			80.9					
	30.0-32.0	31	191.6							26.2	76		
		31	251.9							21.4	75		
		31	288.9							19.4	75		
	32.0-34.0	33	139.2										
	36.0-38.0	37	206.9										
	38.0-40.0	39	240.8										
	42.0-44.0	43	185.8										
	44.0-46.0	45	172.2				1.81			29	79	10.27	1479
		45	146.4						2.24E-06	32.7	81		
	46.0-48.0	47	157.5					35					
	48.0-50.0	49	114.7				2.35						
	50.0-52.0	51	120.5							35.9	79		
		51	199.9							27.1			
		51	89.4							45.2			
	52.0-54.0	53	235.9										
	56.0-58.0	57	134.3		Non-Plastic			38.5					
	58.0-60.0	59	235										
PZ-02	0.0-2.0	1	72.8										
	2.0-4.0	3	177.2										
	4.0-6.0	5	170.4										
	6.0-8.0	7	207.3										
	8.0-10.0	9	218.9				2.43	74.2					
	10.0-12.0	11	224.4							23.7	77		
		11	141.7							34	82		
	12.0-14.0	13	298.2										

TABLE 3-3
GEOTECHNICAL DATA SUMMARY - WASTEBED 13
SOLVAY WASTE

Boring #	Depth (ft)	Average Depth (ft)	Water Content (Percent)	Plastic Limit	Liquid Limit	Plasticity Index	Specific Gravity	Passing the #200 Sieve	Hydraulic Conductivity (cm/sec)	Dry Density (pcf)	Total Density (pcf)	UU Cohesion (psi)	UU Cohesion (psf)
	14.0-16.0	15	328.6										
	16.0-18.0	17	222.5										
	18.0-20.0	19	192.4		Non-Plastic			83.2					
	20.0-22.0	21	337.6							16.9	74	5.33	768
		21	272.9										
	22.0-24.0	23	250.9										
	24.0-26.0	25	253										
	26.0-28.0	27	290.1										
	28.0-30.0	29	299.2				2.48	86.7					
	30.0-32.0	31	162.5							28.9	76		
		31	212							24.3	76		
		31	157.3							30.6	79		
	32.0-34.0	33	97.6										
	34.0-36.0	35	124.8										
	36.0-38.0	37	141.5										
	38.0-40.0	39	211.1										
	40.0-42.0	41	183.8				2.48						
	42.0-44.0	43	54										
	44.0-46.0	45	135.7										
	46.0-48.0	47	166.7										
	48.0-50.0	49	98.3		Non-Plastic			52.3					
	50.0-52.0	51	138.9										
	52.0-54.0	53	188.8										
	54.0-56.0	55	187.8										
	56.0-58.0	57	112.9							38.9	83	4.99	719
		57	66.9						3.34E-06	53.9	90		
	58.0-60.0	59	193.2										
	60.0-64.0	62	177.3										
	64.0-66.0	65	84.1							48.7	90		
		65	145.7							33.8	83		
		65	144.5							33.6	82		
SB-21	0.0-4.0	2	95.9										
	6.0-8.0	7	173.2										
	8.0-10.0	9	291.4		Non-Plastic			99.3					
	10.0-12.0	11	214.2				2.39			23.7	74	4.69	675
		11	228.3						8.58E-06	25	82		
	12.0-14.0	13	235.5										
	14.0-16.0	15	138.6				2.47	57.5					
	16.0-20.0	17	236.7										
	20.0-22.0	21	128.7							37	85		

TABLE 3-3
GEOTECHNICAL DATA SUMMARY - WASTEBED 13
SOLVAY WASTE

Boring #	Depth (ft)	Average Depth (ft)	Water Content (Percent)	Plastic Limit	Liquid Limit	Plasticity Index	Specific Gravity	Passing the #200 Sieve	Hydraulic Conductivity (cm/sec)	Dry Density (pcf)	Total Density (pcf)	UU Cohesion (psi)	UU Cohesion (psf)
		21	130.4							35.2	81		
		21	163.9							30.5	80		
	22.0-24.0	23	66.8										
	26.0-30.0	28	113.8										
	32.0-34.0	33	82.8		Non-Plastic			33					
	36.0-40.0	38	155.8				2.36	42.6					
	42.0-44.0	43	31.4				2.61						
	46.0-48.0	47	27.6										
	48.0-50.0	49	25.3		Non-Plastic			96					
SB-22	0.0-4.0	2	110.3										
	6.0-8.0	7	346.7										
	8.0-10.0	9	225.6				2.45	79.4					
	10.0-12.0	11	102.1							41	83		
		11	142.9							33.1	80		
		11	99.5							44.5	89		
	12.0-16.0	14	91.8										
	16.0-18.0	17	302.5		Non-Plastic			98.2					
	18.0-20.0	19	140.5										
	20.0-22.0	21	61.5				1.79			56.3	91	4.61	664
		21	123.3						1.83E-05	37.7	84		
	22.0-24.0	23	170.1										
	26.0-28.0	27	144.2										
	28.0-30.0	29	66.1					21.5					
	30.0-32.0	31	82.5							52	94.9	37.6	5414
	32.0-34.0	33	67.8										
	36.0-40.0	38	139										
	40.0-42.0	41	124.67							38.1	85.6		
		41	99							44.8	89.2		
		41	46.28							71	103.9		
	42.0-44.0	43	54.4		Non-Plastic			21.2					
	46.0-50.0	48	113.8										
	52.0-54.0	53	155.8				2.16	62					
	56.0-60.0	58	110.7										
Minimum			25.3		Non-Plastic		1.76	21.2	2.2E-06	16.9	69	3.66	530
Maximum			403		Non-Plastic		2.61	99.3	1.8E-05	71	104	37.6	5400

TABLE 3-4
SUMMARY OF CONSOLIDATED UNDRAINED TEST RESULTS

Boring	Depth (ft)	Initial Confining Stress (psi)	Peak Deviator Stress (psi)	Peak Pore Water Pressure (psi)	Residual Deviator Stress (psi)	Residual Pore Pressure (psi)	CU Total Stress			CU Effective Stress		
							Cohesion (psi)	Cohesion (psf)	Friction Angle	Cohesion (psi)	Cohesion (psf)	Friction Angle
PZ-01	31	6.9	13.5	4.1	13.3	4.3	0	0	25.9	0	0	51.1
	31	34.7	48.9	26.1	41.3	28.4						
	31	69.4	109.8	54.7	91.4	58.1						
PZ-01	51	6.9	22.7	4.4	19.6	4.9	4.4	634	18.5	0	0	54.8
	51	34.7	38.3	28.8	26.2	29.9						
	51	69.4	79.6	61.3	66.7	61.3						
PZ-02	11	34.7	39.7	28.1	33.3	28.3	10	1440	10.6	4.1	590	39
	11	69.4	55.3	58.2	52.2	58						
PZ-02	31	6.9	18.6	16.7	18.2	24.4	3.4	490	21.6	10.3	1483	37.9
	31	34.7	49.1	27.1	39.1	26.9						
	31	69.4	91.2	57.1	71.3	57.3						
PZ-02	65	6.9	17.6	3.7	17.6	3.7	4.9	706	18.5	0	0	49
	65	34.7	50.4	25.4	40.6	27.1						
	65	69.4	75.9	57.2	59.5	58.3						
SB-21	21	6.9	16.2	4.1	16.2	2.8	3.5	504	20.2	0.6	86.4	44
	21	34.7	48.8	24.5	43.1	24.5						
	21	69.4	82.3	52.1	71	52.8						
SB-22	11	6.9	15	5.7	15	5.7	1.2	173	22.8	0	0	62.5
	11	34.7	43	31.5	36	30.9						
	11	69.4	93.5	63.7	93.1	63.3						
SB-22	41	6.9	18	3	18	3	0	0	35.4	0	0	43.9
	41	34.7	57	23	57	23						
	41	69.4	205	24	185	15						

TABLE 3-5
SOLVAY WASTE CONSOLIDATION DATA SUMMARY

Boring	Depth	P_c (tsf)	C_c	C_r	e_o (measured)	e_o (calculated)
PZ-01	10-12'	0.97	7.1	0.20	9.92	8.36
PZ-01	44-46'	0.76	0.73	0.010	2.48	4.23
PZ-02	20-22'	0.88	2.1	0.030	4.83	3.86
PZ-02	40-42'	1.08	1.2	0.050	4.73	2.74
SB-21	10-12'	1.05	3.0	0.040	5.96	7.64
SB-22	20-22'	0.85	0.67	0.030	2.12	3.08
Average		0.93	2.5	0.060	5.01	4.98

Note:
1. The variables are defined as follows:

P_c = preconsolidation pressure

C_c = compression index

C_r = recompression index

e_o (measured) = initial void ratio estimated from water content of trimmings

e_o (calculated) = initial void ratio backcalculated from final water content of sample after consolidation

Phase I Lab Results

(Presented in the report titled "*Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Data Summary Report, Onondaga County, New York*" prepared by Parsons and Geosyntec [2008a])

Table 2.1
Instrumentation and Testing Summary per Location

Location	CPT ID	Inclinometer /Extensometer ID	Piezometer ID[2]	Settlement Plate ID	Quantity of Laboratory Testing								
					Water Content (ASTM D2216)	Atterberg Limits[3]	Grain Size (ASTM D422)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373)	Bulk Density (EM-1110-2-1906)	CU (ASTM D4767)	UU (ASTM D2850)	Consolidation (ASTM D2435)
A-1	SB915-CPT-5	SB915-INEX-A1	SB915-PZ-A1(15') SB915-PZ-A1(45') SB915-PZ-A1(Native)	SP-1	22	7[4]	9		7				
A-2		SB915-INEX-A2	SB915-PZ-A2(15') SB915-PZ-A2(30') SB915-PZ-A2(45')	SP-2	9	3	3	4	3	3	3	3	3
A-3	SB915-CPT-A3		SB915-PZ-A3(15') SB915-PZ-A3(30') SB915-PZ-A3(Native)	SP-3									
A-4	SB915-CPT-A4		SB915-PZ-A4(15') SB915-PZ-A4(30') SB915-PZ-A4(55')	SP-4	23								
A-5	SB915-CPT-A5		SB915-PZ-A5(15') SB915-PZ-A5(30') SB915-PZ-A5(55')	SP-5									
A-6	SB915-CPT-A6		SB915-PZ-A6(15') SB915-PZ-A6(30') SB915-PZ-A6(45')	SP-6									
A-7	SB915-CPT-A7	SB915-INEX-A7	SB915-PZ-A7(15')	SP-7	3			1		2	3	2	2
A-8	SB915-CPT-A8	SB915-INEX-A8	SB915-PZ-A8(30')	SP-8				1					
A-9	SB915-CPT-A9		SB915-PZ-A9(15')	SP-9									1
A-10	SB-915-CPT-4	SB915-INEX-A10	SB915-PZ-A10(45')	SP-10	7	2	2	1		1		1	1
A-11	SB915-CPT-A11		SB915-PZ-A11(30')	SP-11	12								
A-12	SB915-CPT-A12		SB915-PZ-A12(45')	SP-12									
A-13		SB915-IN-A13[1]		SP-13									
A-14				SP-14									
A-15				SP-15									
A-16	SB915-CPT-6			SP-16									
A-17				SP-17									
A-18				SP-18									
A-19				SP-19									
A-20	SB915-CPT-A20			SP-20									
Total Number of Tests					76	12	14	7	10	6	6	6	7

Notes:

1. Only an inclinometer was installed at this location.
2. Numbers in parentheses after IDs indicate the piezometer tip installation depth (i.e., feet below initial ground surface). Native indicates piezometers were installed in the native soil beneath the Solvay waste.
3. The Atterberg limits were determined using ASTM D4318. In addition, the liquid limit was also evaluated using the laboratory cone penetration method (BS 1377-2:1990).
4. Only six laboratory cone penetration tests (i.e., BS 1377-2:1990) were performed at this location.

Table 2.2
Estimated Water Table Levels from CPT Pore Water Pressure Dissipation Tests

CPT Location	Measurement Depth (ft below waste surface)	Estimated Water Table Depth (ft below waste surface)
SB915-CPT-2	80.05	58.59
SB915-CPT-3	80.05	58.96
SB915-CPT-A3	15.09 27.07 30.02 79.40	16.58 21.93 26.54 58.98
SB915-CPT-A4	80.05	59.04
SB915-CPT-A5	45.44	41.27
SB915-CPT-A7	73.82	59.37
SB915-CPT-A8	80.05	57.69
SB915-CPT-A9	80.05	58.56
SB915-CPT-A11	46.42	41.22

Table 2.3
Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216) (%)	Liquid Limit (Cone Penetration BS 1377-2:1990) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Atterberg Limits Plastic Limit (%)	Atterberg Limits Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Grain Size Percent Sand (%)	Grain Size Percent Fines (clay & silt) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373) (%)	Density (EM 1110-2-1906) Bulk Density (pcf)	Density Dry Density (pcf)
SB915-EXC-1	SB915-6001-05	10.0-12.0	11	127											
SB915-EXC-2	SB915-6001-06	10.0-12.0	11	258											
SB915-EXC-3	SB915-6001-07	10.0-12.0	11	40											
SB915-PZ-A1[1]	SB915-6005-01	0.0-6.0	3	134											
	SB915-6005-02	6.0-8.0	7	270											
	SB915-6005-03	8.0-10.0	9	331	198	226	126	100	0	0.8	99.2		57		
	SB915-6005-04	12.0-14.0	13	125											
	SB915-6005-05	16.0-18.0	15	155											
	SB915-6005-06	19.0-21.0	20	218	159	158	102	56	0	15	85		61		
	SB915-6005-07	24.0-26.0	15	190											
	SB915-6005-08	29.0-31.0	30	251	173	201	74	127	0	4	96		57		
	SB915-6005-09	33.0-34.0	33.5	171											
	SB915-6005-10	36.0-38.0	37	186											
	SB915-6005-11	39.0-41.0	40	154											
	SB915-6005-12	41.0-43.0	42	210	194	227	89	138	0	40.9	59.1		26		
	SB915-6006-01	44.0-46.0	45	193											
	SB915-6006-02	48.0-49.0	48.5	165											
	SB915-6006-03	49.0-51.0	50	284	209	234	105	129	0	5.9	94.1		39		
	SB915-6006-04	54.0-56.0	55	110		134	89	45	0	80	20		43		
	SB915-6006-05	58.0-59.0	58.5	93											
	SB915-6006-06	64.0-66.0	65	185	120	120	97	23	0	7.4	92.6		52		
	SB915-6006-07	68.0-69.0	68.5	294											
	SB915-6006-08	73.0-74.0	73.5	202											
	SB915-6006-09	76.0-78.0	77	5					38.5	32.7	28.8				
	SB915-6006-10	73.7-75.7	74.7	24					36.1	41.1	22.8				
SB915-INEX-A2	SB915-6001-01	10.0-12.0	11	466								2.47	52	67	12
	SB915-6001-02	20.0-22.0	21		178	182	89	93	0	9.8	90.2	2.5	52		
	SB915-6001-03	30.0-32.0	31	105										79	38
	SB915-6000-10	34.0-36.0	35	263								2.71		78	21
	SB915-6001-04	38.0-40.0	39									2.53	57		
	SB915-6000-11	44.0-46.0	45	166	164		Non-Plastic		0	4.9	95.1				
			45	236											
			45	162											
	SB915-6000-12	64.0-66.0	65	118	160		Non-Plastic		0	5.9	94.1				
	SB915-6000-12		65	63											
	SB915-6000-12		65	59											
SB915-PZ-A4	SB915-6003-01	0.0-2.0	1	181											
	SB915-6003-02	2.0-4.0	3	261											
	SB915-6003-03	6.0-8.0	7	417											
	SB915-6003-04	8.0-10.0	9	427											
	SB915-6003-05	10.0-12.0	11	286											
	SB915-6003-06	12.0-14.0	13	240											
	SB915-6003-07	14.0-16.0	15	219											
	SB915-6003-08	16.0-18.0	17	224											
	SB915-6003-09	18.0-20.0	19	254											
	SB915-6003-10	20.0-22.0	21	237											
	SB915-6003-11	22.0-24.0	23	243											
	SB915-6003-12	24.0-26.0	25	239											
	SB915-6004-01	26.0-28.0	27	240											
	SB915-6004-02	28.0-30.0	29	224											
	SB915-6004-03	30.0-32.0	31	212											
	SB915-6004-04	32.0-34.0	33	265											
	SB915-6004-05	36.0-38.0	37	181											
	SB915-6004-06	38.0-40.0	39	183											
	SB915-6004-07	40.0-42.0	41	209											
	SB915-6004-08	42.0-44.0	43	166											
	SB915-6004-09	44.0-46.0	45	172											
	SB915-6004-10	46.0-48.0	47	210											
	SB915-6004-11	48.0-50.0	49	245											

Table 2.3
Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216) (%)	Liquid Limit (Cone Penetration BS 1377-2:1990) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Atterberg Limits (ASTM D4318) Plastic Limit (%)	Atterberg Limits (ASTM D4318) Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Grain Size (ASTM D422) Percent Sand (%)	Grain Size (ASTM D422) Percent Fines (clay & silt) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373) (%)	Density (EM 1110-2-1906) Bulk Density (pcf)	Density (EM 1110-2-1906) Dry Density (pcf)
SB915-INEX-A7	SB915-6000-02	15.0-17.0	16	276								2.54		55	15
	SB915-6000-04	44.0-46.0	45	204										79	26
	SB915-6000-05	59.0-61.0	60	86											
SB915-INEX-A8	SB915-6000-01	15.0-17.0	16												
SB915-INEX-A10	SB915-6000-06	10.0-12.0	11	494	167	168	103	65	0	19.8	80.2	2.7			
	SB915-6000-06		11	396											
	SB915-6000-06		11	304											
	SB915-6000-07	24.0-26.0	25	267											
	SB915-6000-08	39.0-41.0	40	203	179	183	89	94	0	11.8	88.2	2.72		74	20
	SB915-6000-08		40	214											
	SB915-6000-08		40	243											
SB915-PZ-A11	SB915-6002-01	0.0-2.0	1	228											
	SB915-6002-02	2.0-4.0	3	165											
	SB915-6002-03	4.0-6.0	5	109											
	SB915-6002-04	8.0-10.0	9	222											
	SB915-6002-05	10.0-12.0	11	347											
	SB915-6002-06	12.0-14.0	13	912											
	SB915-6002-07	14.0-16.0	15	242											
	SB915-6002-08	16.0-18.0	17	134											
	SB915-6002-09	18.0-20.0	19	243											
	SB915-6002-10	20.0-22.0	21	205											
	SB915-6002-11	22.0-24.0	23	162											
	SB915-6002-12	24.0-26.0	25	130											

Note:
1. This location ID is consistent with the test results provided by GeoTesting Express; however, samples were actually taken from the SB915-INEX-A1 boring, which is very close to the SB915-PZ-A1 boring.

Table 2.4
Consolidated Undrained with Pore Water Pressure Measurements Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Initial Water Content (%)	Dry Density (pcf)	Initial Confining Stress (psf)	Peak Deviator Stress (psf)	Strain at Failure (%)	CU Total Stress		CU Effective Stress	
									Cohesion (psf)	Friction Angle (degrees)	Cohesion (psf)	Friction Angle (degrees)
SB915-INEX-A2	SB915-6000-09	15-17	16	345	16.3	1209	1360	3.5	0	16.7	13.1	45.2
				204.7	24.5	2501	2046	3.2				
				292.8	18.8	5001	3480	2.0				
SB915-INEX-A2	SB915-6001-03	30-32	31	104.8	38.3	2001	2048	4.1	68.4	17.4	NA[1]	
				135.2	32.7	4002	3358	3.3				
				161.4	31.3	8001	6852	15.0				
SB915-INEX-A2[2]	SB915-6000-10	34-36	35	222.6	24.0	1999	2156	3.7	304	14.7	125	41.8
						4001	3504	2.8				
						7998	6240	2.1				
SB915-INEX-A7[2]	SB915-6000-02	15-17	16	213.7	24.4	1200	1577	1.9	301	14.6	267	44.5
						2496	2486	1.5				
						4999	4150	1.8				
SB915-INEX-A7[2]	SB915-6000-03	29-31	30	205.8	24.5	1998	2212	3.2	367	14.4	353	42.1
						3998	3680	5.3				
						8001	6210	2.3				
SB915-INEX-A7	SB915-6000-04	44-46	45	204.4	25.9	2000	1805.2	5.8	292	16.5	NA[1]	
				157.6	32.1	4000	4530	15.0				
				173.4	29.7	7992	6704	2.3				

Notes:
1. NA indicates not applicable. Additional interpretation is required to use these test results.
2. These tests were performed as staged triaxial tests; thus, the same sample was used for all three tests.

Table 2.5
Unconsolidated Undrained Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (%)	Dry Density (pcf)	Undrained Strength (psf)	Strain at Failure (%)
SB915-INEX-A2	SB915-6000-10	34-36	35	250.8	21.2	625.8	9.9
SB915-INEX-A2	SB915-6001-04	38-40	39	109.6	39.7	2044.8	10.2
SB915-INEX-A2	SB915-6001-04	38-40	39	172.3	28.5	1071.1	4.6
SB915-INEX-A7	SB915-6000-02	15-17	16	224.8	22.5	642.4	11.8
SB915-INEX-A7	SB915-6000-03	29-31	30	220.1	25.2	794.3	9.2
SB915-INEX-A10	SB915-6000-07	24-26	25	253.2	21.2	419.5	2.0

Table 2.6
Consolidation Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Modified Compression Index[1] ($C_{c\varepsilon}$)	Modified Recompression Index[1] ($C_{r\varepsilon}$)	Initial Void Ratio (e_o)	Initial Water Content (%)	Preconsolidation Pressure[1] (psf)
SB915-INEX-A2	SB-915-6000-10	34-36	35	0.51	0.0069	9.4	338.1	2200
SB915-INEX-A2	SB-915-6001-01	10-12	11	0.56	0.0074	12.1	466.0	1800
SB915-INEX-A2	SB-915-6001-04	38-40	39	0.40	0.0072	6.6	259.1	3400
SB915-INEX-A7	SB-915-6000-02	15-17	16	0.61	0.0100	12.4	453.0	1800
SB915-INEX-A7	SB-915-6000-02	15-17	16	0.41	0.0039	7.2	273.3	2800
SB915-INEX-A8	SB-915-6000-01	15-17	16	Disturbed Sample				
SB915-INEX-A10	SB-915-6000-07	24-26	25	0.49	0.0061	8.3	304.8	2600

Note:
1. Parameters are from Memorandum to NYSDEC on SCA Design Accommodation of Potential Foundation Differential Settlements Onondaga Lake, New York (GeoSyntec, 2006).

Phase II Lab Results

(Provided to Geosyntec by Parsons and included in the report "*Onondaga Lake Pre-Design Investigation: Phase II Data Summary Report*" prepared by Parsons [2008c])

Onondaga Lake Pre-Design Investigation
Phase II Geotechnical Data Summary
Syracuse, New York

Wastebed 13 CIU Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Initial Water Content (%)	Initial Confining Stress (psf)	Dry Density before Shear (pcf)	Peak Deviator Stress (psf)	Undrained Strength (psf)	Strain at Failure (%)	CIU Total Stress Cohesion (psf)	CIU Total Stress Friction Angle (degrees)	CIU Effective Stress Cohesion (psf)	CIU Effective Stress Friction Angle (degrees)
SB915-SB13-01	OL-0297-01	8-10	9	323.2	2500	19.73	1883.2	941.6	4.43	NA		NA	
				110.9	4998	41.78	8168	4084	7.46				
SB915-SB13-03	OL-0297-14	30-32	31	278.7	2001	24.35	2164	1082	8.58	359	14	307	34.8
				334.4	4000	19.91	3254	1627	3.62				
				334.4	7999	26.2	6006	3003	8.81				
SB915-SB13-04A	OL-0297-19	17-19	18	320.6	1499	15.45	2042	1021	4.95	421	16.1	270	44
				348.3	2999	19.31	3576	1788	5.73				
				371.8	6000	21.14	4760	2380	6.29				
SB915-SB13-04A	OL-0298-01	44-46	45	216.1	2000	32.06	2434	1217	11.4	461	14.8	41.1	42
				227.2	4000	29.55	3642	1821	5.72				
				160.7	7999	34.49	6676	3338	5.07				
SB915-SB13-04A	OL-0298-03	72-74	73	183.1	3000	29.94	3208	1604	3.63	NA		NA	
				168.4	6000	25.24	5208	2604	3.56				
				173.3	11990	30.01	6222	3111	0.929				
SB915-SB13-05	OL-0298-05	17-19	18	255.7	1500	17.39	2270	1135	3.99	456	15.8	485	34
				454.8	3000	18.07	3460	1730	5.13				
				407.8	5999	21.12	5378	2689	5.96				
SB915-SB13-05	OL-0298-09	52-54	53	204.6	2501	27.26	2842	1421	15	718	15	575	42.5
				132.3	5000	39.86	6646	3323	15				
				204.8	10000	30.42	7424	3712	2.84				
SB915-SB13-09	OL-0299-06	8-10	9	289.9	1199	22.68	2168	1084	15	753	9	524	31.5
				280.2	2499	18.07	2648	1324	3.05				
				367.3	5003	23.15	3612	1806	15				
SB915-SB13-09	OL-0299-10	48-50	49	229.3	2500	25.46	3536	1768	3.83	1160	12	772	35.9
				176.4	5000	34.77	6502	3251	10.1				
				148.2	9998	32.93	7688	3844	3.64				
SB915-SB13-12	OL-0300-06	8-10	9	273.6	1200	16.55	1526	763	5.47	365	12.8	205	36.5
				327.9	2500	21.45	2162	1081	3.34				
				415.6	4999	26.92	3142	1571	2.81				
SB915-SB13-12	OL-0300-10	42-44	43	279.8	1998	21.51	2848	1424	5.35	751	14.2	104	46.4
				273.2	3999	22.64	4580	2290	4.32				
				270.5	7987	26.87	6998	3499	7.47				
SB915-PZ13-01	OL-0295-04	26-28	27	374	2000	20.39	2674	1337	3.52	467	15.4	667	36.6
				216.6	3998	22.52	3862	1931	4.06				
				274.6	8001	27.75	5346	2673	3.39				
SB915-PZ13-04	OL-0295-16	8-10	9	352.4	1200	14.24	1484.8	742.4	3.24	397	10.8	49.4	39.7
				319.1	2498	17.94	2018	1009	4.1				
				351.2	4999	27.53	3334	1667	7.78				
SB915-PZ13-04	OL-0295-18	28-30	29	341.8	1999	19.99	2744	1372	8.36	943	9.7	995	22
				331.8	3998	20.91	4406	2203	8.39				
				320.5	8001	25.01	5014	2507	4.64				
SB915-PZ13-14	OL-0296-17	22-24	23	159.2	2000	42.03	2634	1317	5.03	598	12.4	278	40.7
				186	4003	21.88	3598	1799	2.39				
				224.1	7998	26.57	6074	3037	4.01				
SB915-PZ13-14	OL-0296-18	47-49	48	16	2499	101.6	6124	3062	5.47	2080	10.4	1420	17.8
				21.2	5000	99.78	7210	3605	6.21				
				23.2	9999	100.3	9440	4720	11.3				

Note:
1. NA indicates not applicable. Additional interpretation is needed to use these test results.

Onondaga Lake Pre-Design Investigation
Phase II Geotechnical Data Summary
Syracuse, New York

Wastebed 13 Consolidation Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Initial Water Content (%)	Initial Void Ratio	Compression Index (Cc)	Recompression Index (Cr)	Modified Compression Index (Ccε)	Modified Recompression Index (Crε)	Preconsolidation Pressure (psf)	Preconsolidation Pressure (tsf)
SB915-PZ13-02	OL-0295-06	10-12	11	236.1	7.46	3.35	0.10	0.40	0.012	2322	1.2
SB915-PZ13-02	OL-0295-08	27-29	28	62.4	1.74	Disturbed Sample					
SB915-PZ13-03	OL-0295-11	10-12	11	192.1	5.17	1.65	0.08	0.27	0.012	2729	1.4
SB915-PZ13-03	OL-0295-13	30-32	31	249.2	6.11	3.31	0.09	0.47	0.013	4000	2.0
SB915-PZ13-04	OL-0295-17	10-12	11	536.8	14.44	9.26	0.29	0.60	0.019	1958	1.0
SB915-PZ13-04	OL-0295-19	33-35	34	377.4	10.47	4.89	0.27	0.43	0.024	1361	0.7
SB915-PZ13-04A	OL-0295-20	53-55	54	235.0	6.48	2.08	0.08	0.28	0.011	3597	1.8
SB915-SB13-01	OL-0297-02	10-12	11	111.0	3.09	Disturbed Sample					
SB915-SB13-01	OL-0297-05	28-30	29	101.2	3.11	0.77	0.04	0.19	0.010	2042	1.0
SB915-SB13-03	OL-0297-13	4-6	5	366.3	10.46	5.85	0.13	0.51	0.011	1936	1.0
SB915-SB13-03	OL-0297-15	32-34	33	394.4	10.32	6.88	0.21	0.61	0.018	2582	1.3
SB915-SB13-03	OL-0297-17a[1]	58-60	59	225.1	5.83	Disturbed Sample					
SB915-SB13-04A	OL-0297-18	12-14	13	236.8	6.99	3.47	0.13	0.43	0.016	2223	1.1
SB915-SB13-04A	OL-0297-20	38-40	39	300.7	7.83	5.44	0.20	0.62	0.023	2904	1.5
SB915-SB13-04A	OL-0298-02	70-72	71	245.0	6.7	2.56	0.08	0.33	0.011	3681	1.8
SB915-SB13-05	OL-0298-04	14-16	15	363.0	9.83	5.22	0.17	0.48	0.016	1936	1.0
SB915-SB13-05	OL-0298-07	30-32	31	187.8	5.05	2.10	0.09	0.35	0.014	2636	1.3
SB915-SB13-06	OL-0298-12	8-10	9	82.0	1.4	0.85	0.04	0.36	0.016	2500	1.3
SB915-SB13-06	OL-0298-14	30-32	31	168.0	4.97	0.90	0.07	0.15	0.011	2582	1.3
SB915-SB13-09	OL-0299-07	10-12	11	405.7	10.54	5.76	0.23	0.50	0.020	1633	0.8
SB915-SB13-09	OL-0299-09	30-32	31	238.7	6.56	2.34	0.15	0.31	0.020	3000	1.5
SB915-SB13-12	OL-0300-08	12-14	13	427.5	11.48	6.73	0.27	0.54	0.021	1875	0.9
SB915-SB13-12	OL-0300-09	30-32	31	322.7	8.65	6.88	0.25	0.71	0.025	3597	1.8
SB915-SB13-12	OL-0300-11	44-46	45	324.4	8.29	3.34	0.23	0.36	0.025	2254	1.1
SB915-SB13-13	OL-0300-12	10-12	11	498.1	12.65	6.43	0.21	0.47	0.015	900	0.5
SB915-SB13-13	OL-0300-14	20-22	21	127.9	3.66	Disturbed Sample					

Note:

1. This sample was part Solvay waste and part clay. The test results provided here are from the Solvay waste portion of the sample.

Onondaga Lake Pre-Design Investigation
Phase II Geotechnical Data Summary - Index Test Results
Syracuse, New York

Wastebed 13 Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216)	Liquid Limit (BS 1377-2:1990) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Atterberg Limits Plastic Limit (%)	Atterberg Limits Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Percent Sand (%)	Percent Fines (clay & silt) (%)	Clay-sized Particle Content (0.005 mm) (%)	Clay-sized Particle Content (0.002 mm) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373)	Bulk Density (EM-1110-2-1906)
SB915-PZ13-01	OL-0295-01	10-12	11	347.6	214.5	176	133	43	0	7.9	92.1	51	20	2.59	35	68
SB915-PZ13-01	OL-0295-03	24-26	25	125.8	164.5	143	113	30	3.8	33.1	63.1	6	3	2.35	26	73
SB915-PZ13-01	OL-0295-04	26-28	27	218	215.5	187	131	56	17.6	16.5	65.9	4	1		35	
SB915-PZ13-01	OL-0300-16	34-36	35	252	205.5	181	139	42	0	11.1	88.9	49	17	2.52	30	77
SB915-PZ13-01	OL-0301-07	55-57	56	54.5		57	42	15	0	39.2	60.8	18	15	2.68		
SB915-PZ13-02	OL-0295-06	10-12	11	91.3	118	102	84	18	0	27.3	72.7	18	8	2.6	22	
SB915-PZ13-02	OL-0295-08	27-29	28	85.6	130	112	93	19	17.4	48.3	34.3	5	2	2.43	17	
SB915-PZ13-02	OL-0301-08	43-45	44	10.2		Non-Plastic			43.9	41.8	14.3	5	4	2.58		
SB915-PZ13-03	OL-0295-11	10-12	11	120.5	151.5	168	124	44	26.7	27.9	45.4	5		2.6	26	
SB915-PZ13-03	OL-0295-13	30-32	31	143.4	136	158	119	39	9	22.4	68.6	10	3	2.44	30	
SB915-PZ13-03	OL-0301-09	68-75	71.5	12.6		23	17	6	34.1	44.5	21.4	6	3	2.66		
SB915-PZ13-04	OL-0295-16	8-10	9	352.4											43	
SB915-PZ13-04	OL-0295-17	10-12	11	9.6	283.5	220	161	59	0	2.8	97.2	11	6	2.6	35	
SB915-PZ13-04	OL-0295-18	28-30	29	292.5	222.5	184	123	61	0	6.4	93.6	17	11	2.71	26	
SB915-PZ13-04	OL-0295-19	33-35	34	359.6	219	193	151	42	0	1.2	98.8	31	24	2.71	52	
SB915-PZ13-04	OL-0301-10	63-65	64	13.1		Non-Plastic			0.8	73.4	25.8	10	6	2.73		
SB915-PZ13-04	OL-0301-11	108-110	109	14.3		Non-Plastic			11.4	80.4	8.2	4	3	2.72		
SB915-PZ13-04A	OL-0295-20	53-55	54	70.9	104.5	89	62	27	25.2	32.1	42.7	16	9	2.73	35	
SB915-PZ13-05	OL-0296-01	8-10	9	106.3	164	141	108	33	23.7	23.5	52.8	13	4	2.61	26	
SB915-PZ13-05	OL-0296-04	25-27	26	87.4	165	195	144	51	51.5	43.5	5	2	1	2.63	13	
SB915-PZ13-05	OL-0301-12	48-50	49	19.7		34	18	16	16.8	35.1	48.1	22	16	2.63		
SB915-PZ13-06	OL-0296-06	10-12	11	349.4	265	182	136	46	0	3.5	96.5	12	6	2.61	35	67
SB915-PZ13-06	OL-0296-08	32-34	33	271	222.5	220	151	69	0.8	8.7	90.5	61	34	2.62	39	69
SB915-PZ13-06	OL-0296-10	46-48	47	252.6	192	186	139	47	0	0.7	99.3	62	41	2.68	43	75
SB915-PZ13-06	OL-0301-13	55-65	60	19.1		44	35	9	43.6	44.4	12	3	2	2.54		
SB915-PZ13-07	OL-0301-16	25-27	26	33.1		66	49	17	11	57	32	3	1	2.63		
SB915-PZ13-08	OL-0301-17	15-17	16	11		26	15	11	18.7	21.7	59.6	37	29	2.62		
SB915-PZ13-09	OL-0301-18	10-17	13.5	10.1		21	12	9	5.8	31.4	62.8	30	24	2.78		
SB915-PZ13-11	OL-0301-19	25-27	26	9.7		23	13	10	9.4	26.1	64.5	35	26	2.79		
SB915-PZ13-12	OL-0301-20	35-37	36	17.1		28	15	13	0	37.9	62.1	26	22	2.78		
SB915-PZ13-13	OL-0302-03	10-12	11	8.5		22	12	10	12.1	33.8	54.1	28	21	2.71		
SB915-PZ13-13	OL-0301-14	40-42	41	24.4		45	22	23	0	0.8	99.2	51	37	2.76		
SB915-PZ13-14	OL-0296-17	22-24	23	256.4	247	203	144	59	3.6	5.2	91.2	43	26	2.59	35	
SB915-PZ13-14	OL-0296-18	47-49	48	24.9	55	54	24	30	0	0.1	99.9	78	59	2.76	9	
SB915-PZ13-14	OL-0302-04	50-52	51	23.4		21	16	5	0	7.7	92.3	15	11	2.7		
SB915-PZ13-15	OL-0302-01	55-57	56	37.5		57	40	17	2.2	34.5	63.3	25	11	2.67		
SB915-PZ13-16	OL-0302-02	0-7	3.5	8.4		25	18	7	38.7	35.3	26	9	6	2.59		
SB915-PZ13-16	OL-0301-15	55-57	56	24.5		26	19	7	0	3.1	96.9	19	14	2.69		
SB915-SB13-01	OL-0297-01	8-10	9	126.5	204	172	116	56	31	14.9	54.1	11	7		35	
SB915-SB13-01	OL-0297-02	10-12	11	154.4	147.5	131	100	31	21.4	25.2	63.4	13	8	2.54	35	
SB915-SB13-01	OL-0297-05	28-30	29	181.6	137.5	145	114	31	19.8	28	52.2	7	2	2.57	22	
SB915-SB13-01	OL-0301-01	53-60	56.5	12.2		23	16	7	28.2	48.4	23.4	9	6	2.59		
SB915-SB13-01	OL-0301-02	118-120	119	8.2		14	10	4	9.4	43.2	47.4	20	13	2.73		
SB915-SB13-02	OL-0297-06	8-10	9	353.7	227	209	144	65	0	1.4	98.6	52	23	2.54	43	67
SB915-SB13-02	OL-0297-08	25-27	26	328.5	247.5	211	156	55	0	4.5	95.5	47	24	2.51	39	69
SB915-SB13-02	OL-0297-10	42-44	43	142.8	178.5	154	116	38	35.5	41.6	22.9	12	7	2.67	35	80
SB915-SB13-02	OL-0301-03	65-67	66	8.2		Non-Plastic			63.1	28.3	8.6	3	1	2.71		
SB915-SB13-03	OL-0297-13	4-6	5	363	214	181	131	50	0	0.5	99.5	11	8	2.73	43	
SB915-SB13-03	OL-0297-14	30-32	31	334.4											39	
SB915-SB13-03	OL-0297-15	32-34	33	318.6	234	227	159	68	0	2.8	97.2	14	7	2.55	35	
SB915-SB13-03	OL-0297-17a (SOLW)	58-60	59	271.9	230	230	111	119	0	2	98	58	30	2.59	35	
SB915-SB13-03	OL-0297-17b (Clay)	58-60	59	72	61.5	60	43	17	6.6	30.2	63.2	27	15	2.74		
SB915-SB13-04A	OL-0297-18	12-14	13	283.8	209	177	129	48	0	1.6	98.4	36	15	2.63	22	
SB915-SB13-04A	OL-0297-19	17-19	18	371.8											35	
SB915-SB13-04A	OL-0297-20	38-40	39	151.6	152	129	100	29	14.5	28.7	56.8	4	3	2.55	30	
SB915-SB13-04A	OL-0298-01	44-46	45	216.1											26	
SB915-SB13-04A	OL-0298-02	70-72	71	220.8	147.5	152	117	35	0	10.1	89.9	15	5	2.59	39	
SB915-SB13-04A	OL-0298-03	72-74	73	168.4											48	

Onondaga Lake Pre-Design Investigation
Phase II Geotechnical Data Summary - Index Test Results
Syracuse, New York

Wastebed 13 Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216)	Liquid Limit (BS 1377-2:1990) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Percent Sand (%)	Percent Fines (clay & silt) (%)	Clay-sized Particle Content (0.005 mm) (%)	Clay-sized Particle Content (0.002 mm) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373)	Bulk Density (EM-1110-2-1906)
SB915-SB13-05	OL-0298-04	14-16	15	302	182	158	119	39	0	1.9	98.1	15	10	2.62	22	
SB915-SB13-05	OL-0298-05	17-19	18	249.1											35	
SB915-SB13-05	OL-0298-07	30-32	31	226.7	157	161	109	52	0	1.7	98.3	52	30	2.52	26	
SB915-SB13-05	OL-0298-09	52-54	53	208.6											26	
SB915-SB13-06	OL-0298-12	8-10	9	110.9	133.5	109	83	26	28.7	35.3	36	9	5	2.6	26	
SB915-SB13-06	OL-0298-13	28-30	29	166.6											35	
SB915-SB13-06	OL-0298-14	30-32	31	121.1	141.5	241	167	74	28.7	26.6	44.7	10	4	2.64	17	
SB915-SB13-06	OL-0298-15	46-48	47	28.1	192										0	
SB915-SB13-06	OL-0301-04	103-105	104	65.6		22	17	5	20.3	59.2	20.5	4	2	2.7		
SB915-SB13-07	OL-0298-17	8-10	9	302.7	178.5	162	124	38	0	0	100	32	9	2.59	39	
SB915-SB13-07	OL-0298-20	30-32	31	181.4	159	158	125	33	0	7.9	92.1	47	30	2.49	52	
SB915-SB13-08	OL-0299-01	9-11	10	68	111.5	101	79	22	27.7	64.4	7.9	3	1		35	85
SB915-SB13-08	OL-0299-03	22-24	23	174.4	201.5	151	116	35	0	18	82	28	9		35	76
SB915-SB13-08	OL-0299-05	39-41	40	300.3	193.5	194	150	44	0	2.5	97.5	10	5		35	72
SB915-SB13-08	OL-0301-05	68-70	69	8.3		Non-Plastic			13.2	64.8	22	5	2	2.75		
SB915-SB13-09	OL-0299-06	8-10	9	237.2											39	
SB915-SB13-09	OL-0299-07	10-12	11	170.7	156.5	120	93	27	21.4	28.4	50.2	10	4	2.47	22	
SB915-SB13-09	OL-0299-09	30-32	31	121.1	168	151	120	31	75.2	19.4	5.4	2	2	2.63	26	
SB915-SB13-09	OL-0299-10	48-50	49	186.7	169	146	96	50	8	13.5	78.5	22	5	2.65	30	
SB915-SB13-09	OL-0301-06	58-65	61.5	12.8		Non-Plastic			34.9	54	11.1	3	2	2.52		
SB915-SB13-10	OL-0299-12	5-7	6	142.4	166.5	147	107	40	20.9	7.8	71.3	27	10		30	
SB915-SB13-10	OL-0299-14	15-17	16	333.3	197	217	158	59	0	3.4	96.6	10	3		35	
SB915-SB13-10	OL-0299-18	38-40	39	236.6	166.5	163	131	32	0	1.1	98.9	11	6		30	
SB915-SB13-11	OL-0300-01	10-12	11	278.6	195	182	134	48	0	2.4	97.6	44	21		43	72
SB915-SB13-11	OL-0300-03	32-34	33	227.9	148	131	101	30	0	7.1	92.9	15	5		43	77
SB915-SB13-11	OL-0300-05	60-62	61	226	187	172	140	32	0	4.1	95.9	27	8		35	72
SB915-SB13-12	OL-0300-06	8-10	9	273.6											35	
SB915-SB13-12	OL-0300-08	12-14	13	363	259	181	133	48	0	3.7	96.3	36	13	2.6	43	
SB915-SB13-12	OL-0300-09	30-32	31	271.9	228.5	197	146	51	0	2.1	97.9	24	6	2.55	43	
SB915-SB13-12	OL-0300-10	42-44	43	279.8											39	
SB915-SB13-12	OL-0300-11	44-46	45	301.1	227.5	194	152	42	0	1.5	98.5	18	7	2.54	35	
SB915-SB13-13	OL-0300-12	10-12	11	244.1	193.2	171	125	46	0	4.7	95.3	38	15	2.41	35	
SB915-SB13-13	OL-0300-14	20-22	21	65.8	90.2	80	68	12	14.2	59.9	25.9	5	2	2.64	17	

Onondaga Lake Pre-Design Investigation
Phase II Geotechnical Data Summary
Syracuse, New York

Wastebed 13 UU Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (%)	Dry Density (pcf)	Undrained Strength (psf)	Strain at Failure (%)
SB915-SB13-01	OL-0297-02	10-12	11	190.9	27.02	565.4	6.03
SB915-SB13-01	OL-0297-05	28-30	29	120.4	35.53	916.4	7.34
SB915-SB13-03	OL-0297-15	32-34	33	318.1	17.47	852.3	9.89
SB915-SB13-03	OL-0297-17a[1]	58-60	59	265.5	19.75	320	15
SB915-SB13-04A	OL-0297-18	12-14	13	259.9	18.15	601.6	2.78
SB915-SB13-04A	OL-0297-20	38-40	39	189	27.35	474.9	13.5
SB915-SB13-05	OL-0298-04	14-16	15	300	18.27	747.7	4.79
SB915-SB13-06	OL-0298-12	8-10	9	98.3	46.13	5125	2.22
SB915-SB13-09	OL-0299-07	10-12	11	218.8	24.07	766.6	5.14
SB915-SB13-09	OL-0299-09	30-32	31	135.1	36.07	991	5.76
SB915-SB13-13	OL-0300-12	10-12	11	244.7	21.01	443.7	4.07
SB915-SB13-13	OL-0300-14	20-22	21	71.4	54.84	1431	5.84
SB915-PZ13-02	OL-0295-08	27-29	28	70.2	52.86	3007	5.3
SB915-PZ13-03	OL-0295-13	30-32	31	179.1	28.33	1353	7.25
SB915-PZ13-04	OL-0295-17	10-12	11	472.5	11.62	602.5	4.13
SB915-PZ13-05	OL-0296-04	25-27	26	64.1	55.78	3693	12.7

Note:
1. This sample was part Solvay waste and part clay. The test results provided here are from the Solvay waste portion of the sample.

Phase III Lab Results

(Provided to Geosyntec by Parsons and included in Appendix E of "*Onondaga Lake Pre-Design Investigation Phase III Data Summary Report*" prepared by Parsons in 2008)

WB 13 Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Percent Sand (%)	Percent Fines (clay & silt) (%)	Clay-sized Particle Content (0.005 mm) (%)	Clay-sized Particle Content (0.002 mm) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373)	Bulk Density (ASTM D2937)
Within Wastebed 13															
SB915-SB13-14	OL-0465-01	10-12	11	332.4	175	118	57	0.2	2.7	97.1	53	34		48	
SB915-SB13-14	OL-0465-04	62-64	63	229	137	115	22	0	6.1	93.9	14	2	2.62	17	73
SB915-SB13-14	OL-0465-06	90-92	91	10.4		Non-Plastic		30.4	45.7	23.9	10	6	2.59		
SB915-SB13-15	OL-0465-07	0-2	1	305.1	245	209	36	0	10.7	89.3	57	36	2.53	48	
SB915-SB13-15	OL-0465-08	42-44	43	242.3	199	138	61	0	3	97	16	4	2.46	26	74
SB915-SB13-16	OL-0465-12	20-22	21	277	185	127	58	0	10.6	89.4	46	17		39	
SB915-SB13-16	OL-0465-16	52-54	53	209.6	176	105	71	0	6.9	93.1	20	2	2.59	26	75
SB915-SB13-16	OL-0465-17	60-62	61	10.2		Non-Plastic		34.6	52.5	12.9	6	4	2.65		
SB915-SB13-16	OL-0465-18	65-67	66	11.6		Non-Plastic		29.6	58	12.4	4	3	2.49		
SB915-SB13-17	OL-0465-19	30-32	31	210.8	171	94	77	0	3.6	96.4	35	9		26	
SB915-SB13-17	OL-0465-22	66-68	67	221.3	184	95	89	0	7.3	92.7	31	8	2.35	0	77
SB915-SB13-17	OL-0465-24	80-82	81	17.8		Non-Plastic		7.2	61.9	30.9	16	10	2.75		
SB915-SB13-18	OL-0465-25	10-12	11	267.6	214	147	67	0	1.6	98.4	30	13	2.39	35	
SB915-SB13-18	OL-0465-26	20-22	21	252.2	183	116	67	0	16.9	83.1	23	14	2.39	35	
SB915-SB13-19	OL-0465-27	15-17	16	338.1	204	135	69	0	2.5	97.5	69	53	2.52	9	
SB915-SB13-19	OL-0465-28	30-32	31	277.4										30	
SB915-SB13-19	OL-0465-29	35-37	36	15.8		Non-Plastic		31.9	38.4	29.7	19	14	2.48		
SB915-SB13-20	OL-0465-30	15-17	16	267.7										57	
SB915-SB13-20	OL-0465-31	30-32	31	214.2	149	105	44	0	8.3	91.7	25	14	2.67	43	
SB915-SB13-20	OL-0465-32	60-62	61	11.3		Non-Plastic		36.9	36.1	27	7	3	2.6		
SB915-SB13-20	OL-0465-33	65-67	66	9.8		Non-Plastic		31.4	48.3	20.3	6	3	2.67		
SB915-SB13-21	OL-0465-34	40-42	41	142.1	143	91	52	10.1	47.6	42.3	6	2	2.5	35	
SB915-SB13-21	OL-0465-35	60-62	61	57.7										9	
SB915-SB13-21	OL-0465-36	85-87	86	11.3		Non-Plastic		42.6	38.2	19.2	6	3	2.67		
SB915-SB13-22	OL-0465-37	15-17	16	263.7										35	
SB915-SB13-22	OL-0465-38	30-32	31	245.8	190	123	67	2.3	6	91.7	74	32	2.23	43	
SB915-SB13-22	OL-0465-39	65-67	66	15.7	53	36	17	47.1	30.7	22.2	4	2	2.68		
SB915-SB13-23	OL-0465-40	30-32	31	313.4	195	114	81	0	6.9	93.1	70	30	2.3	35	
SB915-SB13-23	OL-0465-41	45-47	46	207.5										0	
SB915-SB13-23	OL-0465-42	60-62	61	13	32	22	10	57.5	28.7	13.8	6	5	2.65		
SB915-SB13-23	OL-0465-43	65-67	66	11.3		Non-Plastic		46.2	33.8	20	8	4	2.75		
Total in Wastebed				31		26				26			23	20	4

WB 13 Index Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Water Content (ASTM D2216) (%)	Atterberg Limits (ASTM D4318) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Grain Size (ASTM D422) Percent Gravel (%)	Percent Sand (%)	Percent Fines (clay & silt) (%)	Clay-sized Particle Content (0.005 mm) (%)	Clay-sized Particle Content (0.002 mm) (%)	Specific Gravity (ASTM D854)	Carbonate Content (ASTM D4373)	Bulk Density (ASTM D2937)
In the Dikes															
SB915-SB13-24	OL-0465-44	20-22	21	14.2	30	15	15	9.4	28	62.6	36	26	2.76		
SB915-SB13-24	OL-0465-45	25-27	26	13.2	25	13	12	2.1	24.3	73.6	46	35	2.76		
SB915-SB13-24	OL-0465-46	35-37	36	5.4	20	14	6	18.9	40.8	40.3	15	8			
SB915-SB13-24	OL-0465-47	40-42	41	10.9	21	13	8	45.7	32.6	21.7	11	8			
SB915-SB13-25	OL-0465-48	5-7	6	7.4	19	11	8	6.8	40	53.2	26	14	2.7		
SB915-SB13-25	OL-0465-49	20-22	21	13.1											
SB915-SB13-25	OL-0465-50	35-37	36	12	25	13	12	19.9	28.8	51.3	30	20	2.69		
SB915-SB13-25	OL-0465-51	40-42	41	18.9	30	16	14	9.5	22.8	67.7	25	16	2.68		
SB915-SB13-26	OL-0465-52	10-12	11	7.8	19	12	7	7.4	27.8	64.8	34	22			
SB915-SB13-26	OL-0465-53	15-17	16	8.3	20	11	9	1.5	32.2	66.3	33	22			
SB915-SB13-26	OL-0465-54	55-57	56	3.5		Non-Plastic		23.3	56.8	19.9	7	4			
SB915-SB13-26	OL-0465-55	60-62	61	9.2		Non-Plastic		23.1	50.7	26.2	6	3			
SB915-SB13-27	OL-0465-56	20-22	21	9	24	14	10	3.9	32.8	63.3	29	21			
SB915-SB13-27	OL-0465-57	25-27	26	9.3	19	11	8	30.6	22.6	46.8	29	19			
SB915-SB13-27	OL-0465-58	55-57	56	7.8		Non-Plastic		64.6	22.1	13.3	7	5	2.63		
SB915-SB13-27	OL-0465-59	60-62	61	11		Non-Plastic		29.6	40.7	29.7	9	5	2.59		
SB915-SB13-28	OL-0465-60	15-17	16	335.4	187	132	55	0	5.3	94.7	20	7	2.37	43	
SB915-SB13-28	OL-0465-61	50-52	51	35.5	38	25	13	3.8	16.8	79.4	39	27	2.64		
SB915-SB13-28	OL-0465-62	55-57	56	24.1	21	17	4	0	7.1	92.9	8	3	2.68		
SB915-SB13-29	OL-0465-63	45-47	46	103.7	90	67	23	17	33.6	49.4	15	6		35	
SB915-SB13-30	OL-0465-64	5-7	6	87.6	91	69	22	0	71.6	28.4	10	4	2.57	17	
SB915-SB13-30	OL-0465-65	60-62	61	28.3	34	19	15	0.4	14.5	85.1	73	48	2.69		
SB915-SB13-31	OL-0465-66	40-42	41	212.7	126	86	40	21.8	31.7	46.5	18	3		9	
SB915-SB13-32	OL-0465-67	5-7	6	7.6	19	10	9	9.8	37.9	52.3	14	11	2.72		
SB915-SB13-32	OL-0465-68	35-37	36	13.4	24	13	11	8.4	18.5	73.1	50	36	2.76		
SB915-SB13-32	OL-0465-69	40-42	41	18.2		Non-Plastic		0.3	14.6	85.1	20	14	2.7		
SB915-SB13-33	OL-0465-70	55-57	56	4.9		Non-Plastic		38.4	35.9	25.7	9	4	2.73		
SB915-SB13-33	OL-0465-71	60-62	61	6.2		Non-Plastic		33.7	33.7	32.6	10	5	2.68		
SB915-SB13-34	OL-0465-72	5-7	6	9.1	21	13	8	11.2	28.5	60.3	31	21			
SB915-SB13-34	OL-0465-73	10-12	11	9.7	22	12	10	5	35.7	59.3	31	21			
SB915-SB13-35	OL-0465-74	50-52	51	26.3	19	14	5	0	25.7	74.3	11	8	2.65		
SB915-SB13-36	OL-0465-75	15-17	16	13.9	23	13	10	6	30.6	63.4	36	26	2.72		
Total in Dikes				32		31				31			19	4	0

WB 13 Consolidation Test Results Summary

Location ID	Field Sample ID	Depth (ft)	Average Depth (ft)	Compression Index (C_c)	Recompression Index (C_r)	Modified Compression Index ($C_{c\varepsilon}$)	Modified Recompression Index ($C_{r\varepsilon}$)	Initial Void Ratio (e_o)	Initial Water Content (%)	Preconsolidation Pressure (psf)
SB915-SB13-14	OL-0465-04	62-64	63	2.82	0.17	0.45	0.03	5.33	234.4	4000
SB915-SB13-15	OL-0465-08	42-44	43	3.21	0.11	0.46	0.02	5.94	209.7	3800
SB915-SB13-16	OL-0465-16	52-54	53	2.12	0.21	0.34	0.03	5.2	181.9	3000
SB915-SB13-17	OL-0465-22	66-68	67	2.43	0.15	0.42	0.03	4.77	201.0	4300

Attachment 4

Verification of Subsurface Model and Compressibility of SOLW Based on Test Pad Results

Part I: Prediction of Primary Consolidation Settlement Based on Field Test Data

Introduction

Terzaghi's one dimensional (1-D) consolidation theory was used to interpret the field test results from the Phase I Settlement Pilot Study and to predict the primary consolidation settlement. The initial excess pore water pressure was assumed to be constant throughout the SOLW layer and two-way drainage was assumed (i.e., at top and bottom of the waste). The average thickness of the SOLW layer under the test fill is calculated to be 72 ft. Hence, the longest drainage path H_{dr} is equal to one-half of the layer thickness (i.e., 36 ft). The major calculation steps included the following.

1. Use the excess pore water pressure measured in the field to develop the excess pore water pressure profile at each piezometer location for each time period that piezometers were monitored. The location of piezometers A-1 through A-11 are presented in Figure 4-1 of this attachment.
2. Use the excess pore water pressure profile at each piezometer to calculate the average degree of consolidation for the entire depth of the compressible SOLW layer at each monitoring time period.
3. Use the calculated average degree of consolidation for the SOLW layer at each monitoring time period to calculate the coefficient of consolidation.
4. Use the measured settlements and the calculated average degree of consolidation at each time period for each piezometer location to predict the primary consolidation settlement at that location.

Piezometer and settlement data that was recorded during the time period between October 15, 2005 and January 5, 2006 (i.e., approximately 100 days after the placement of test fill) was considered in prediction of the primary consolidation settlement. The predicted primary settlement is compared to field data measured on January 10, 2008 (i.e., approximately 2.3 years after the placement of test fill) in Part III of this attachment.

Calculation of Degree of consolidation

The degree of consolidation at any depth was calculated by

$$U(z,t) = 1 - \frac{u_z}{u_0}$$

where

u_z = excess pore water pressure at any depth at a given time *t*.

u_0 = initial excess pore water pressure

Measured excess pore water pressures were recorded in the field by Parsons as the equivalent water pressure (i.e., piezometric) head. Based on the fill loading process and the stress distribution below the test fill (see Part II of this attachment for discussion regarding stress distribution), the initial excess pore water pressure head used in subsequent analyses was assumed to be the measured excess pore water pressure after the end of fill placement. Based on the data provided by Parsons, these values were assumed to be: (i) 18 ft for locations A-1 through A-6; and (ii) 14.4 ft for locations A-7 through A-11. The typical piezometer response to loading that shows these initial excess pore water pressure heads after the end of fill placement as well as the excess pore water pressures at other monitoring periods is presented in Figure 4-2. Using these field monitoring results and the referenced equation, the degree of consolidation for each piezometer at selected monitoring time periods was calculated. Results from each piezometer location are presented in Figure 4-3. It is noted that rainfall and snowmelt in late December 2005 and early January 2006 combined to locally increase the water levels in most piezometers, resulting in a decrease in the calculated degree of consolidation in the SOLW layer relative to the previous time period.

Calculation of Average Degree of Consolidation

The average degree of consolidation for the entire depth of the compressible waste layer at any time can be determined by the following equation and shown schematically in Figure 4-4.

$$\overline{U}(t) = \frac{1}{2H_{dr}} \int_0^{2H_{dr}} U(t,z)dz = \frac{Area1}{Total\ \ Area}$$

Using the data plotted in Figure 4-3 explicitly, the area "Area 1" was calculated, and the average degree of consolidation at the selected monitoring time periods was evaluated. Results are shown in Figure 4-5.

Calculation of Coefficient of consolidation

The coefficient of consolidation was calculated by

$$C_v = \frac{T_v H_{dr}^2}{t}$$

where, H_{dr} is the longest drainage path and was assumed to be 36 ft for the SOLW under the test fill. T_v is the time factor and was determined according to the calculated average degree of consolidation ($\overline{U}$). The tabulated values of the time factors and their corresponding average degrees of consolidation can be found in most geotechnical engineering textbooks, or they may be approximated by the following relationship:

$$T_v = \frac{\pi}{4}\overline{U}^2 \qquad \text{for } \overline{U} = 0 \text{ to } 0.60$$

$$T_v = 1.781 - 0.933\log(100 - 100\overline{U}) \qquad \text{for } \overline{U} > 0.6$$

The calculated C_v are plotted in Figure 4-6 as a function of time.

Prediction of Primary Consolidation Settlement

The primary consolidation settlement (*S*) was calculated by

$$S = \frac{S_t}{\overline{U}}$$

where, S_t is the settlement measured by the settlement plates in the field at time *t*. $\overline{U}$ is the corresponding average degree of consolidation at that time. The calculation results for the primary consolidation settlement are presented in Table 4-1 and are plotted in Figure 4-7. The average of the values presented in column 3 (i.e., *S* at time t = 45 days) to column 7 (i.e., *S* at time t = 104 days) was calculated and recorded in the last column of Table 4-1. The values presented in the last column are subsequently referenced as the predicted primary consolidation settlement based on the field monitoring data at each piezometer location.

Part II. Prediction of Primary Consolidation Settlement Based on Laboratory Test Data

Introduction

The ultimate primary consolidation settlement was calculated based on the compression parameters derived from laboratory testing results. The calculation steps included the following:

1. Use the laboratory test results to derive the waste compression properties.
2. Calculate the initial stress distribution in the waste.
3. Apply the Boussinesq solution for elastic stress distribution to calculate the vertical stress increase caused by the loading from the test fill.
4. Break the waste profile into sub-layers and calculate the primary consolidation settlement of each sub-layer.
5. Add the calculated settlement of each sub-layer to obtain the total primary consolidation settlement.

The predicted primary settlement is compared to measurement on January 2008 in Part III of this attachment.

Material Properties

The recommended design parameters summarized in Table 21 in this package were used to calculate the primary consolidation settlement of SOLW under the load from the test fill.

Subsurface Geometry

As mentioned before, the average thickness of SOLW under the test fill was calculated to be 72 ft. The groundwater table was considered to be 50 ft bgs as discussed in this package.

Locations of Selected Calculation Points

Four locations were selected for the settlement calculation as shown in Figure 4-8. These four points coincide with the relative locations of settlement plates in the test fill. The calculation Point 1 represents the settlement plates A-1 and A-2; Point 2 represents A-3 to A-6; Point 3 represents A-7, A-9, and A-11; and Point 4 represents A-8 and A-10.

Loading

Loading from the 10-ft high test fill was simplified to be rectangular as shown in Figure 4-9. According to the Boussinesq solution for a rectangular loading, the vertical stress increase at depth z below the corner of a rectangular area is

$$\Delta\sigma = qI_3$$

where

$$I_3 = \frac{1}{4\pi}\left[\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+m^2n^2+1}\left(\frac{m^2+n^2+2}{m^2+n^2+1}\right)+\tan^{-1}\left(\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2-m^2n^2+1}\right)\right]$$

$$m = \frac{B}{z},\ n = \frac{L}{z}$$

The calculated stress increases at these four locations are plotted in Figure 4-10 with respect of depth.

Calculation of Primary Consolidation Settlement

The primary consolidation settlement was calculated using the conventional 1-D consolidation theory as expressed in the following equations (Figure 4-11):

$$S = C_{r\varepsilon}H\log\frac{\sigma_0' + \Delta\sigma'}{\sigma_0'} \qquad \text{for } \sigma_0' + \Delta\sigma' < p_c'$$

$$S = C_{r\varepsilon}H\log\frac{p_c'}{\sigma_0'} + C_{c\varepsilon}H\log\frac{\sigma_0' + \Delta\sigma'}{p_c'} \qquad \text{for } \sigma_0' < p_c' \text{ and } \sigma_0' + \Delta\sigma' > p_c'$$

$$S = C_{c\varepsilon}H\log\frac{\sigma_0' + \Delta\sigma'}{\sigma_0'} \qquad \text{for } \sigma_0' > p_c'$$

where,

S = primary consolidation settlement
H = thickness of compressible layer
σ_0' = initial effective stress
$\Delta\sigma'$ = effective stress increase due to fill placement
p_c' = pre-consolidation pressure
$C_{r\varepsilon}$ = modified recompression index
$C_{c\varepsilon}$ = modified compression index

The primary settlement was calculated using the Excel spreadsheet as presented in Table 4-2 at the four selected locations.

Part III. Comparison of Predicted Settlement with Measured Settlement on January 10, 2008

Table 4-3 summarizes the predicted primary consolidation settlement based on the field monitoring data and the laboratory testing data discussed in Part I and Part II, respectively, of this attachment. The settlement measured on January 10, 2008 is also presented in this table.

The predicted settlements are compared to the measured settlements as shown in Figures 4-12 and 4-13. The plotted data points are in general close to the 45 degree line, indicating a good agreement between the predicted settlement and the settlement measured from the field test on January 10, 2008.

There are several factors that may contribute to the slight difference between the predicted settlement and the measured settlement:

1. The shape of the test fill: The constructed test fill has an irregular shape (Figure 4-14); while in the stress distribution calculation it was idealized to have a 200 ft by 200 ft square footprint.
2. The thickness of SOLW: Under the footprint of the test fill, the thickness of SOLW varies slightly as presented in Table 4-4; while in the prediction calculation a uniform thickness of 72 ft was used.
3. Material properties: The SOLW beneath the test fill is heterogeneous with inter-layered hard and soft zones; while in the prediction calculation the SOLW was divided into two zones and within each zone the SOLW was assumed homogeneous.
4. Secondary consolidation settlement: The predicted settlement includes only the primary settlement; while the measured settlement on January 10, 2008 includes the primary settlement and part of the secondary consolidation settlement. The total secondary consolidation settlement was estimated to be about 10 inches over 30 years based on the lab consolidation test data.
5. Limitation of the 1-D consolidation theory: Consolidation of the SOLW material under the test fill is a 3-D process; while the 1-D consolidation theory, which has been widely accepted in typical engineering practice, was used to predict the consolidation settlement.

Part IV. Calculation of Time Rate of Consolidation for Test Pad

Methodology

Terzaghi's 1-D consolidation theory was used to calculate the time rate of the consolidation. The consolidation time *t* can be calculated using

$$t = \frac{T_v H_{dr}^2}{c_v}$$

where, H_{dr} is the longest drainage path and equals 36 ft for SOLW in the test pad area (assuming two-way drainage). T_v is the time factor and determined according to the degree of consolidation (*U*) using the following relationship

$$T_v = \frac{\pi}{4} U^2 \qquad \text{for } U = 0 \text{ to } 60\%$$

$$T_v = 1.781 - 0.933 \log(100 - 100U) \qquad \text{for } U > 60\%$$

c_v is the coefficient of consolidation. The recommended value of c_v is presented in Table 21 of this package. Using the above equations, the time *t* corresponding to a certain degree of consolidation *U(t)* can be calculated.

The settlement at the time *t*, i.e., *S(t)*, can be calculated using

$$S(t) = U(t) \cdot S_p$$

where, the S_p is the predicted primary consolidation settlement as presented in Part I of this attachment.

Results of Time Rate of Consolidation

The time rate of consolidation was calculated using the Excel spreadsheet as presented in Table 4-5 at the four selected locations. It is noted that the value of c_v interpreted from the field piezometer data was used in the calculation. The calculated consolidation settlement is plotted with respect to time in Figures 4-15 to 4-18 together with the field monitoring data at the four selected locations, respectively. The results indicate a good agreement between the predicted and measured time rate of consolidation.

Part V. Summary

The subsurface model and the design material properties (i.e., unit weight and compressibility parameters) of SOLW were verified using the results of the WB-13 settlement pilot test performed in 2005. The results indicate a good agreement between the prediction and the measurement for both the primary consolidation settlement and the time rate of settlement.

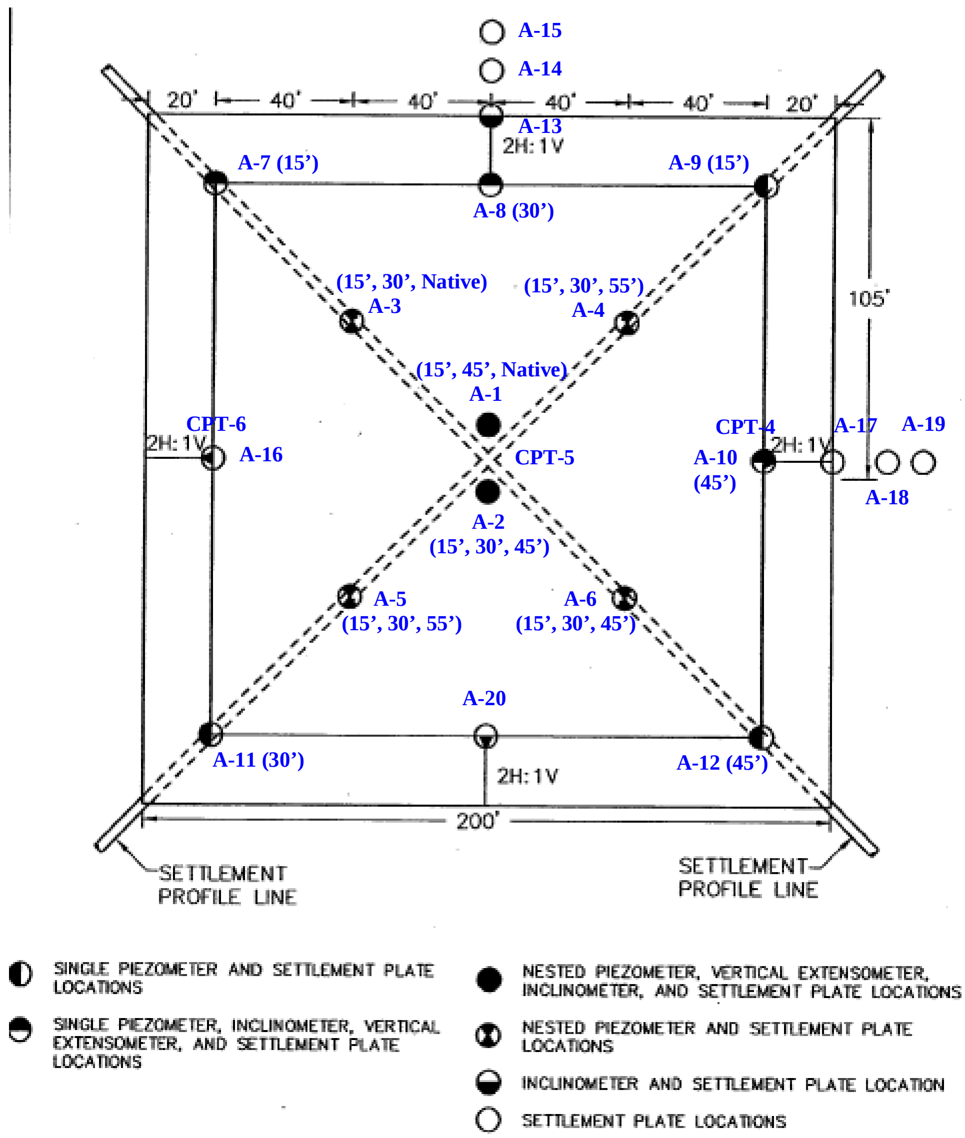

Figure 4-1. Locations of Monitoring Instruments Across Test Fill

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

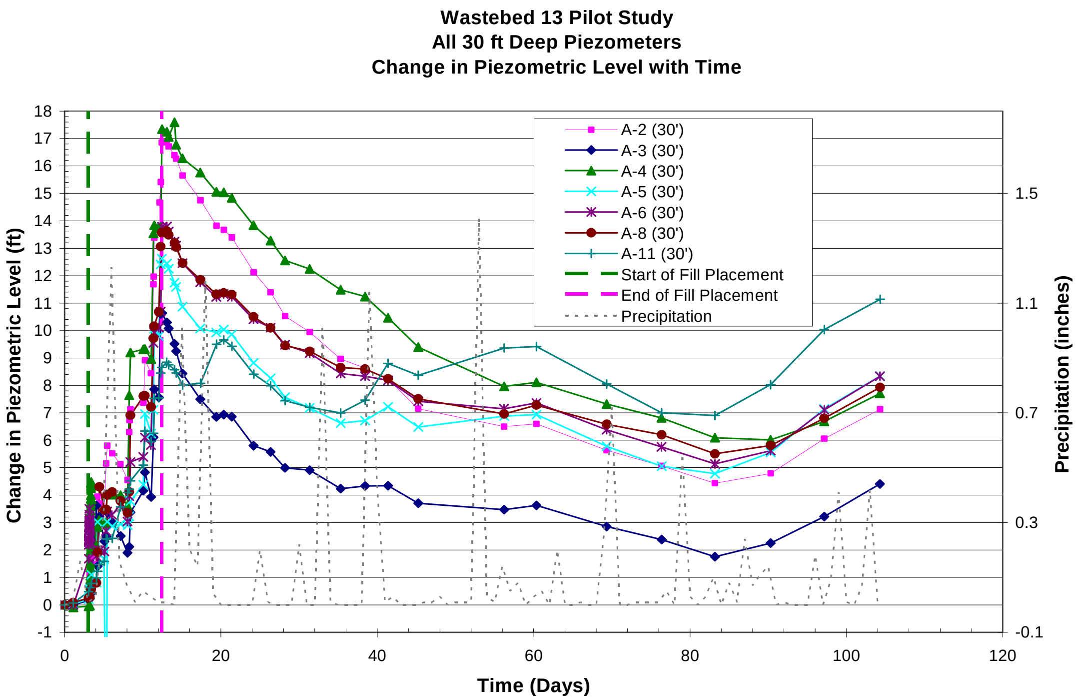

Figure 4-2. Typical Piezometer Response
(Data provided electronically by Parsons)

Note: Fill placement began at time t=0 (October 7, 2005)

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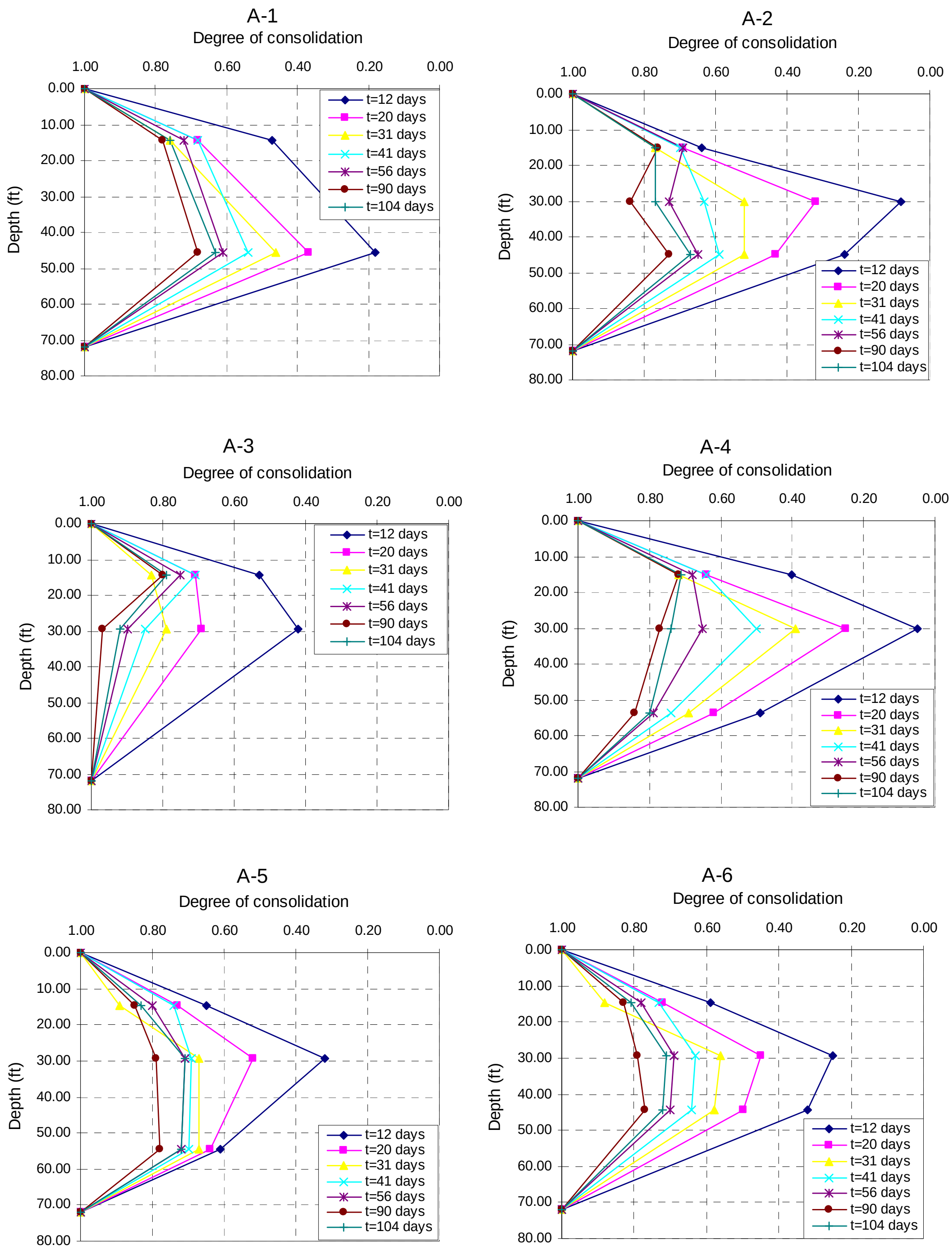

Figure 4-3. Calculation Results for Degree of Consolidation

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

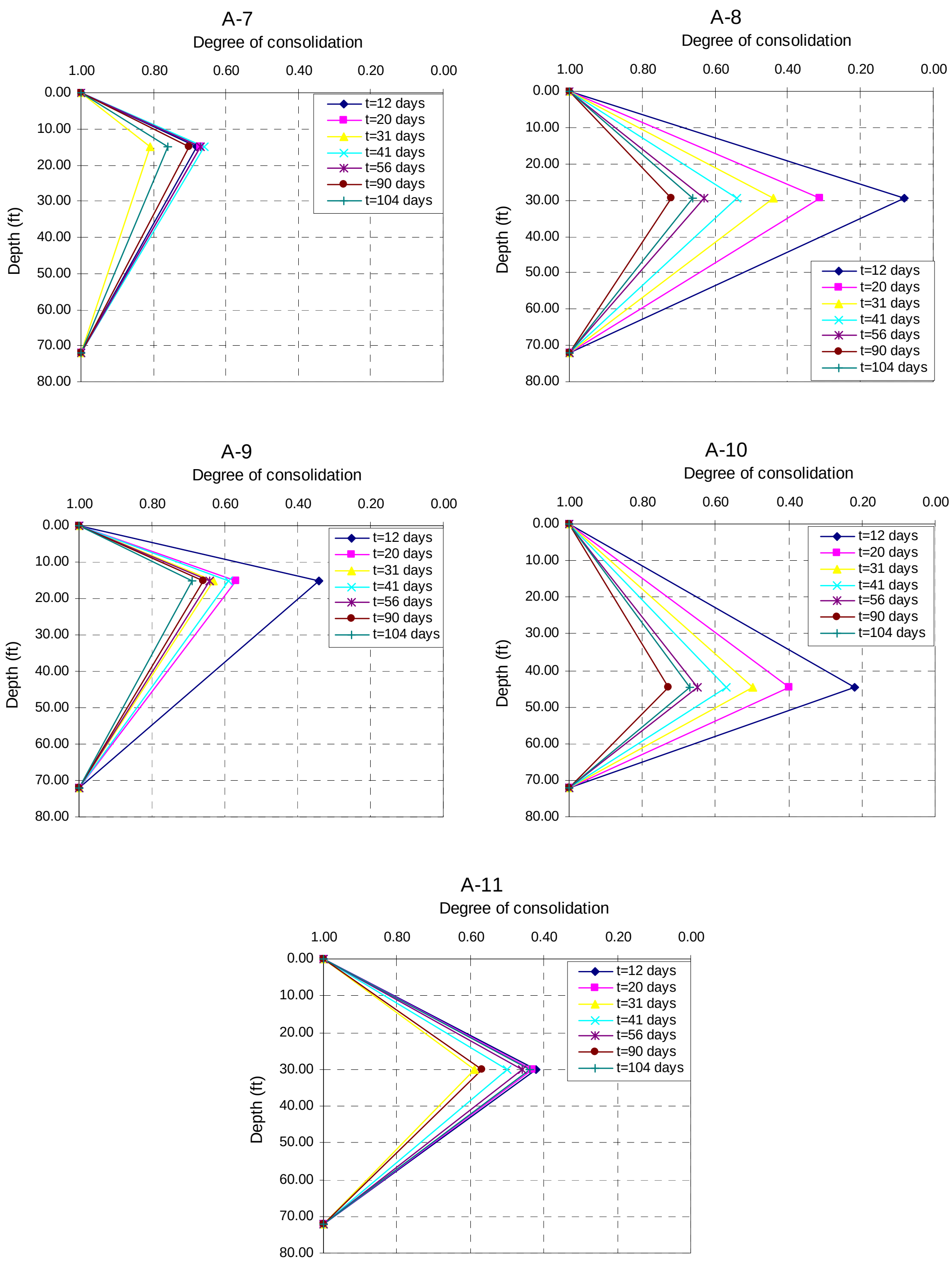

Figure 4-3. Calculation Results for Degree of Consolidation (Continued)

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

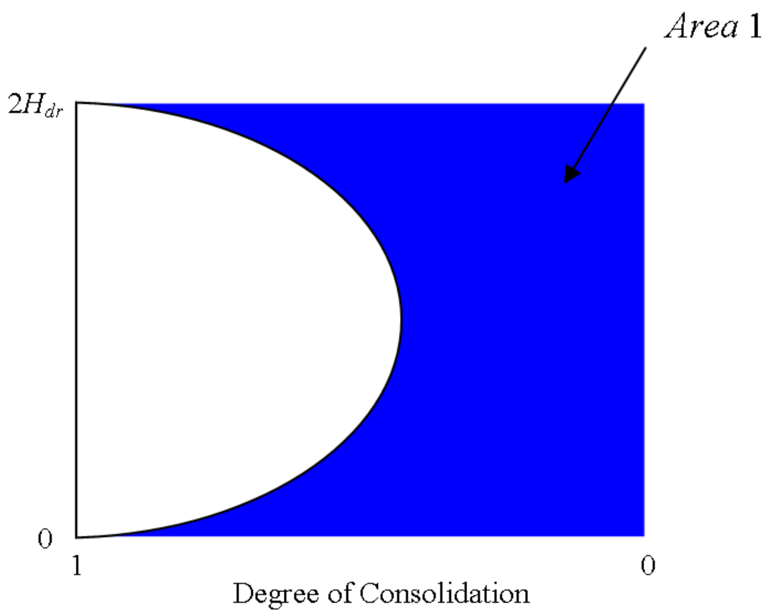

Figure 4-4. Calculation of Average Degree of Consolidation

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
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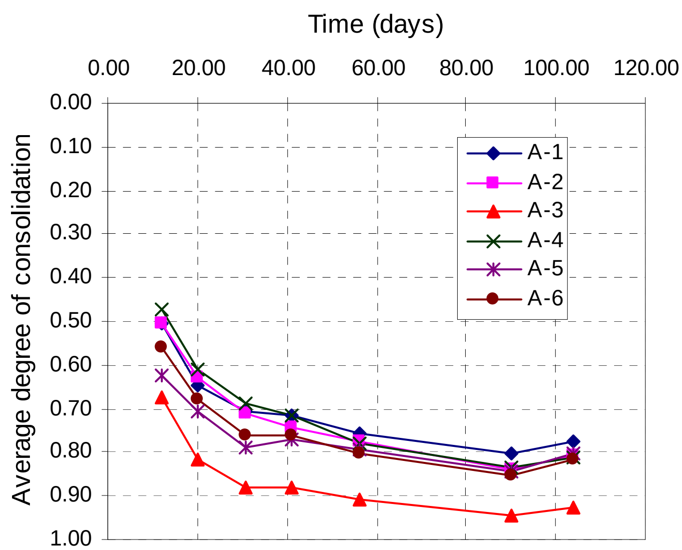

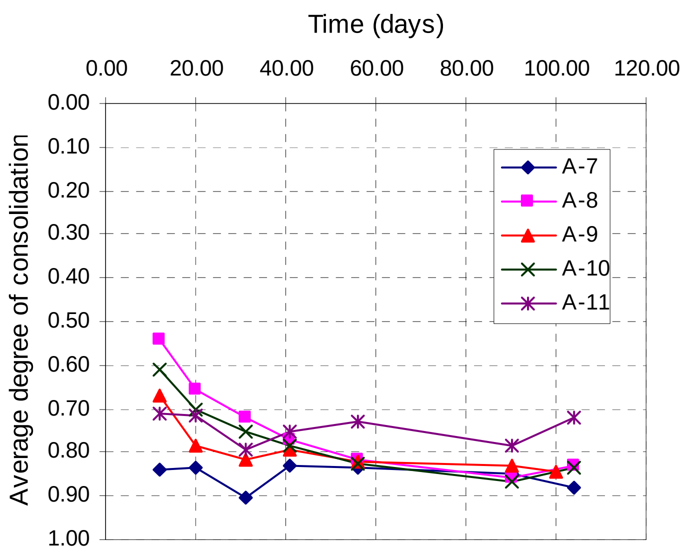

Figure 4-5. Calculated Average Degree of Consolidation

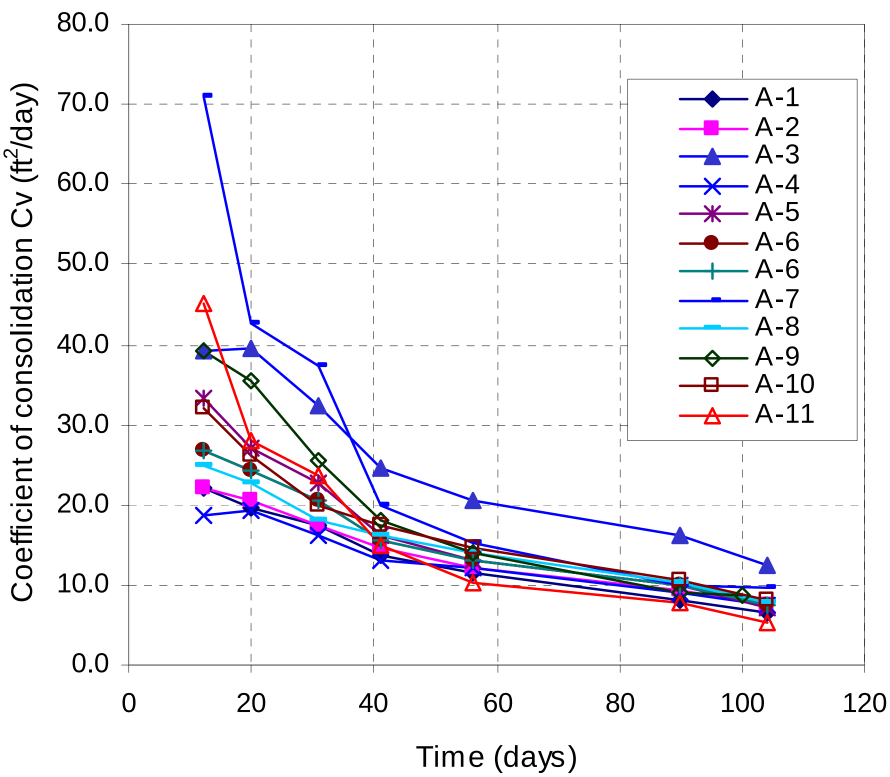

Figure 4-6. Calculated Coefficient of Consolidation

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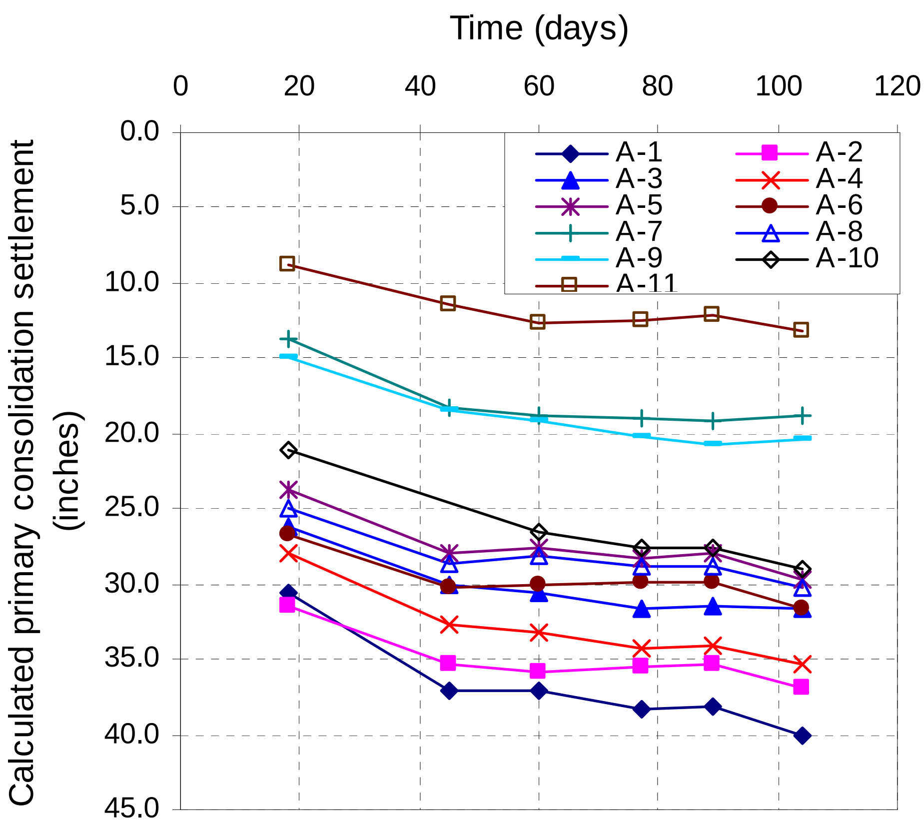


Figure 4-7. Predicted Primary Consolidation Settlement

Note: This figure shows the predicted primary consolidation settlement at a given time using the measured settlement and the corresponding calculated average degree of consolidation at this time.

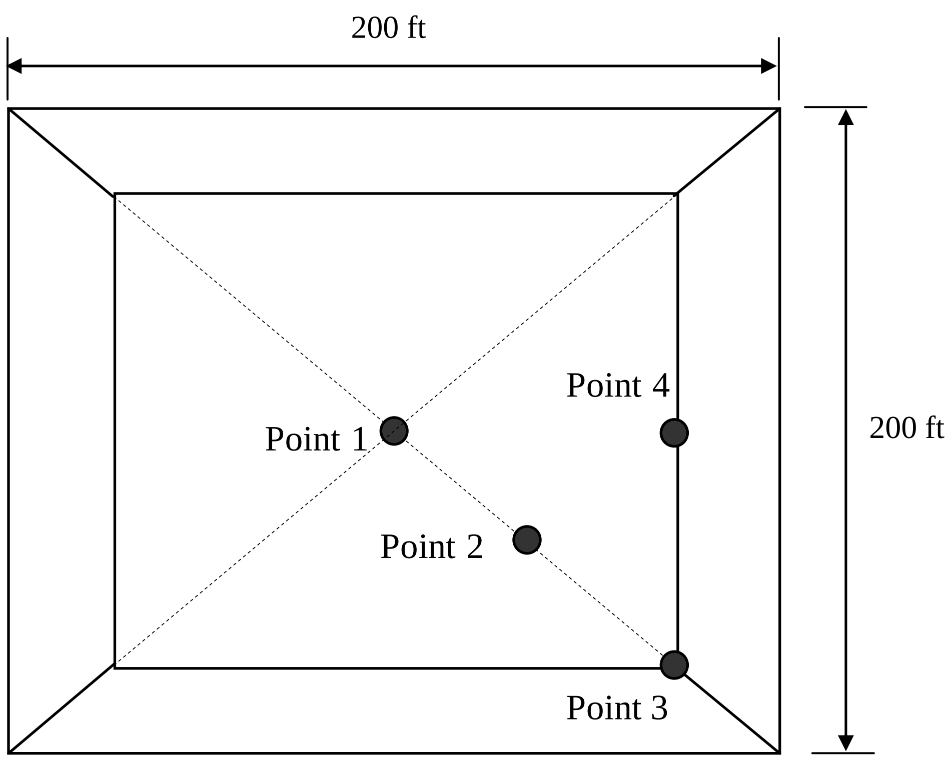
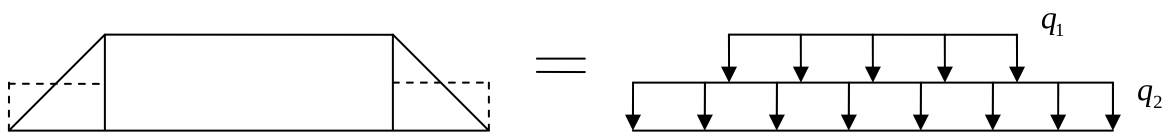


Figure 4-8. Location of Calculation Points



Height of test fill = 10 ft; Side length of bottom surface =200 ft;
Side length of top surface = 160 ft;
Sideslope = 2H:1V;
Total unit weight of test fill = 120 pcf

$$q = q_1 + q_2 = 120 \times 10 = 1200\,\text{psf}$$

$$\text{Total volume} = \frac{1}{3} \times 10 \times \left(160 \times 160 + 200 \times 200 + \sqrt{160 \times 160 \times 200 \times 200}\right) = 325333\,\text{ft}^3$$

$$q_2 = 120 \times \frac{325333 - 160 \times 160 \times 10}{200 \times 200 - 160 \times 160} = 578\,\text{psf}$$

$$q_1 = q - q_2 = 1200 - 578 = 622\text{ psf}$$

Figure 4-9. Calculation of Test Fill Loading

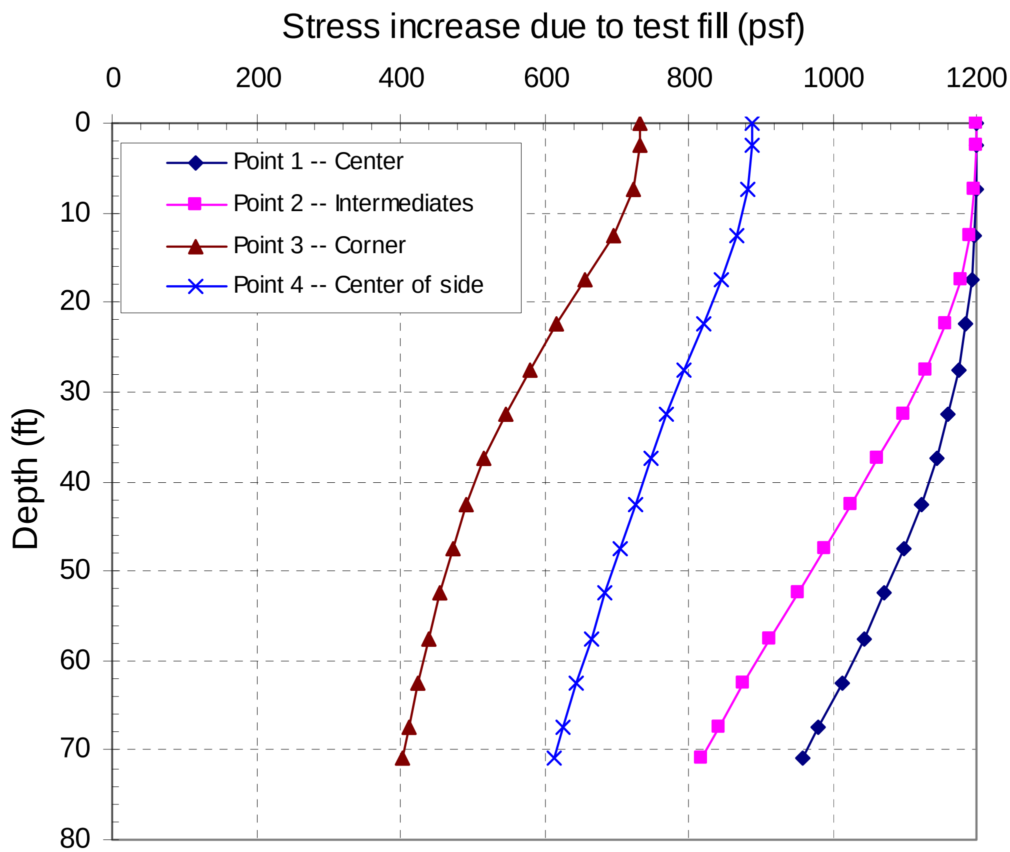


Figure 4-10. Calculated Stress Increase with Depth due to Loading from Test Fill

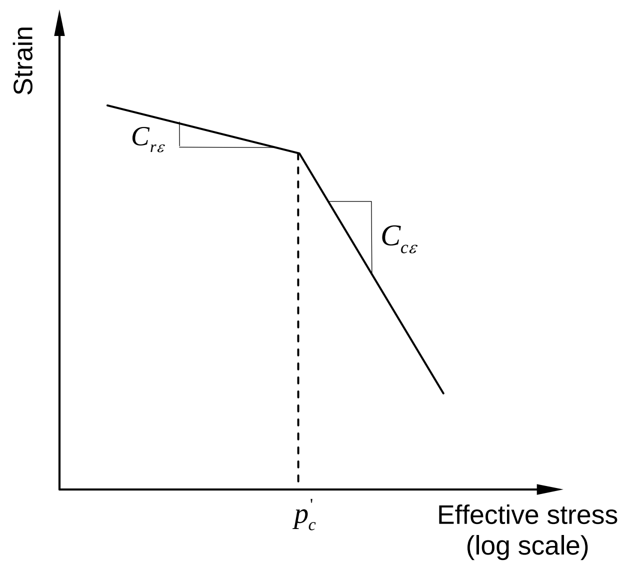


Figure 4-11. 1-D consolidation curve

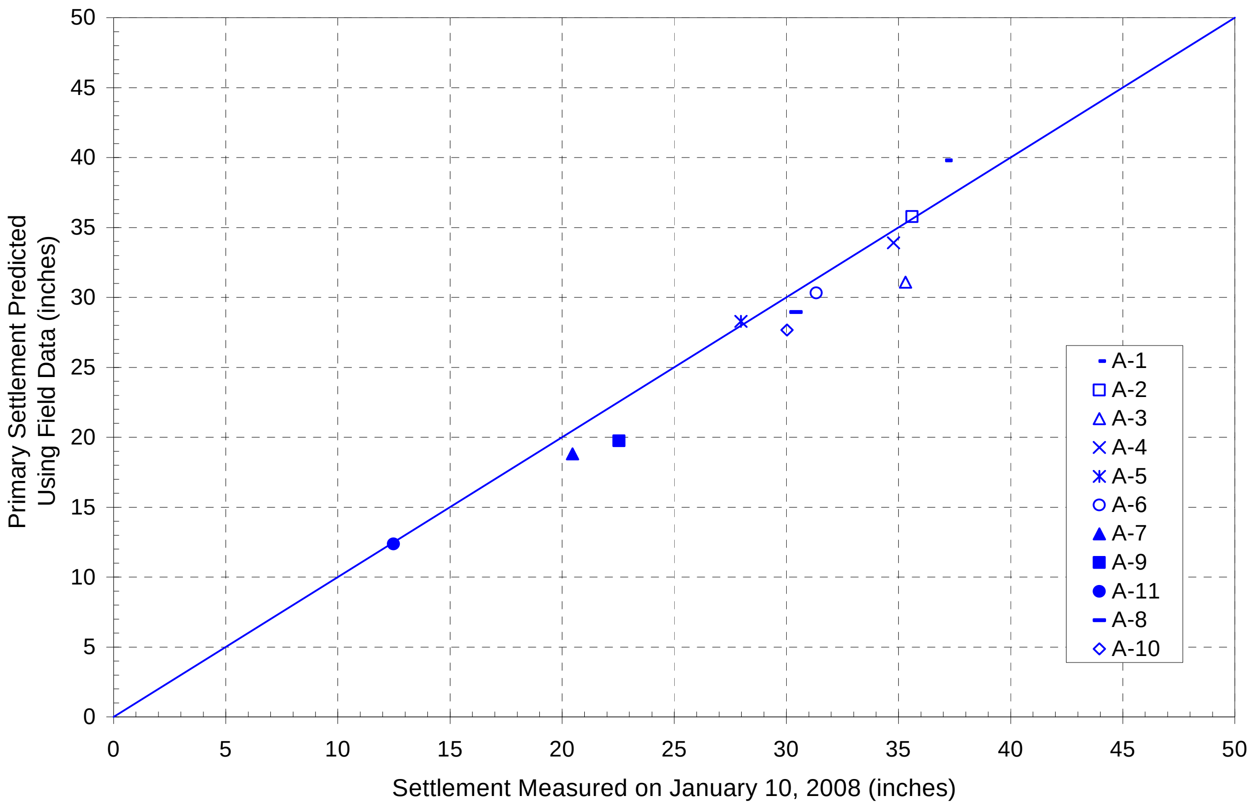


Figure 4-12. Comparison of Predicted Primary Settlement Based on Field Data with Measured Settlement

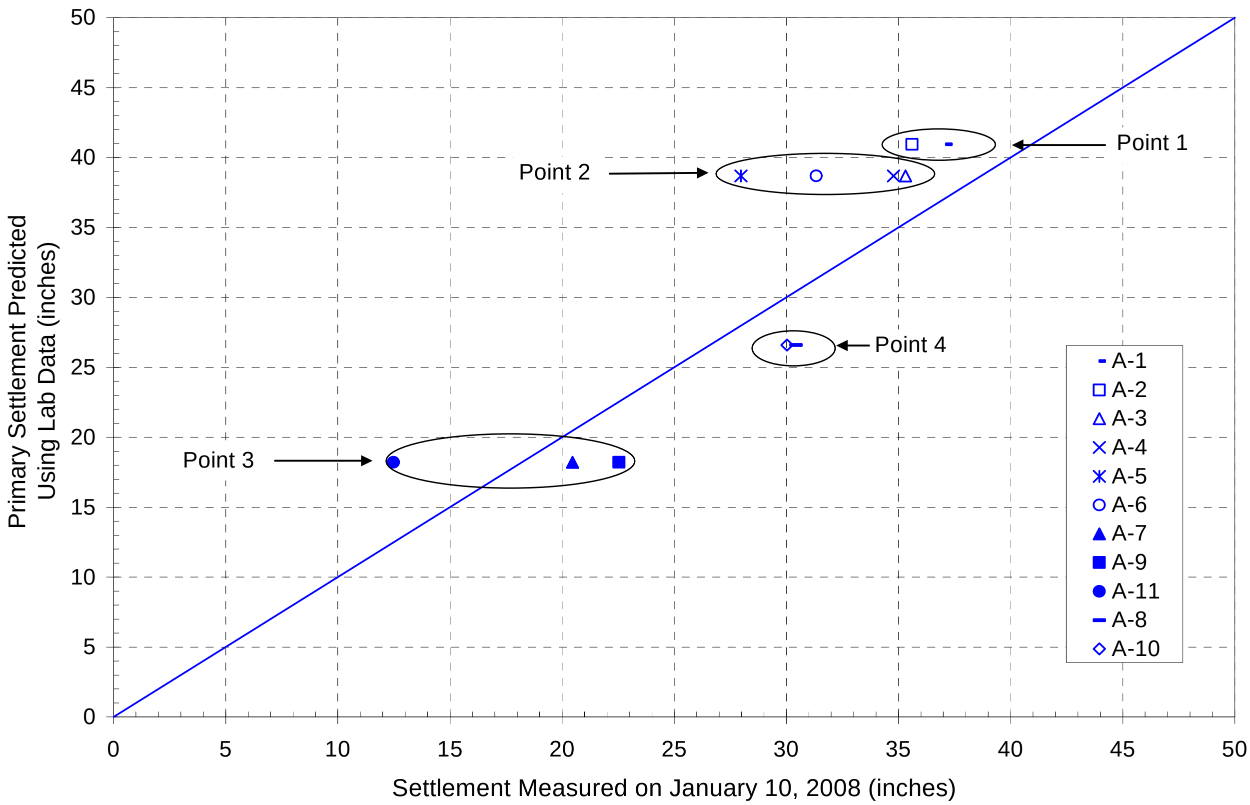


Figure 4-13. Comparison of Predicted Primary Settlement Based on Lab Data with Measured Settlement

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

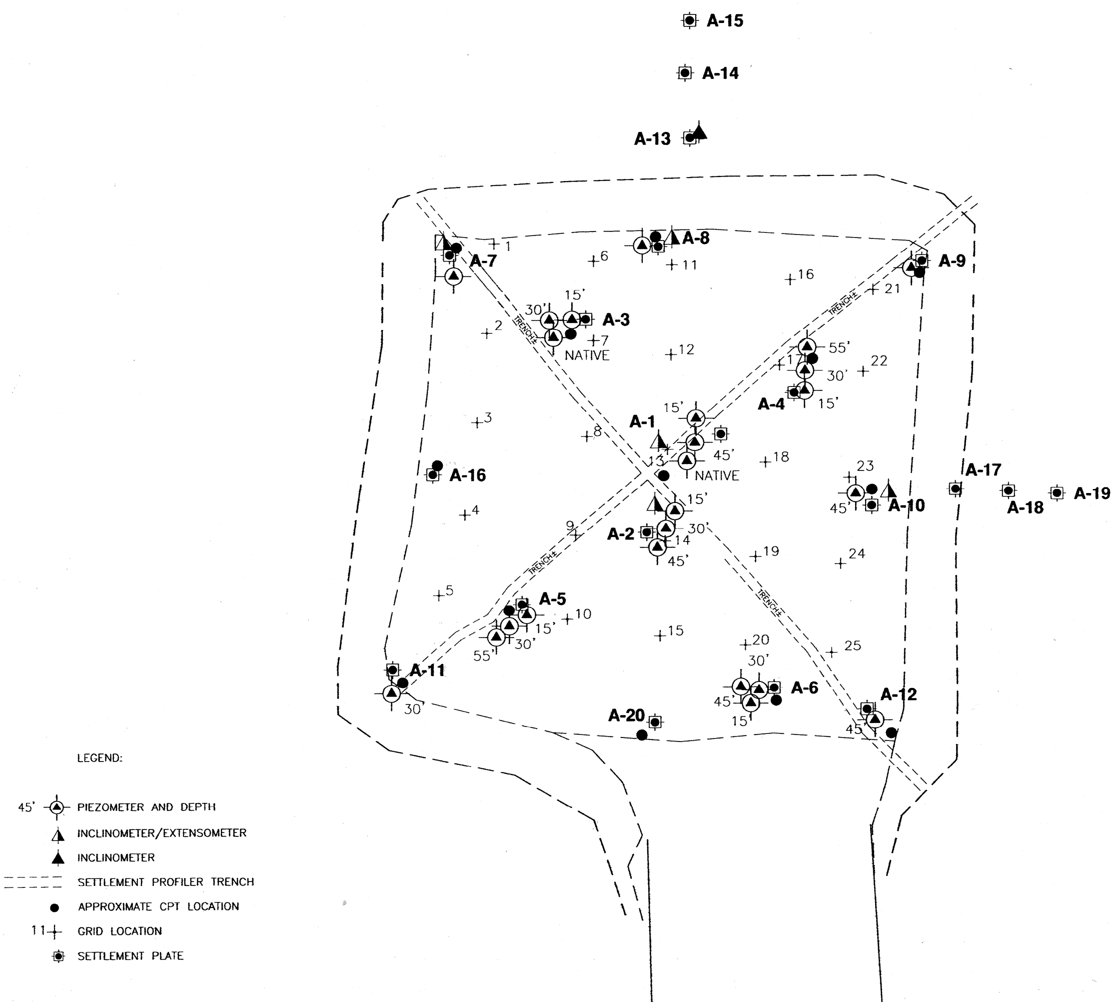


Figure 4-14. Constructed Test Fill

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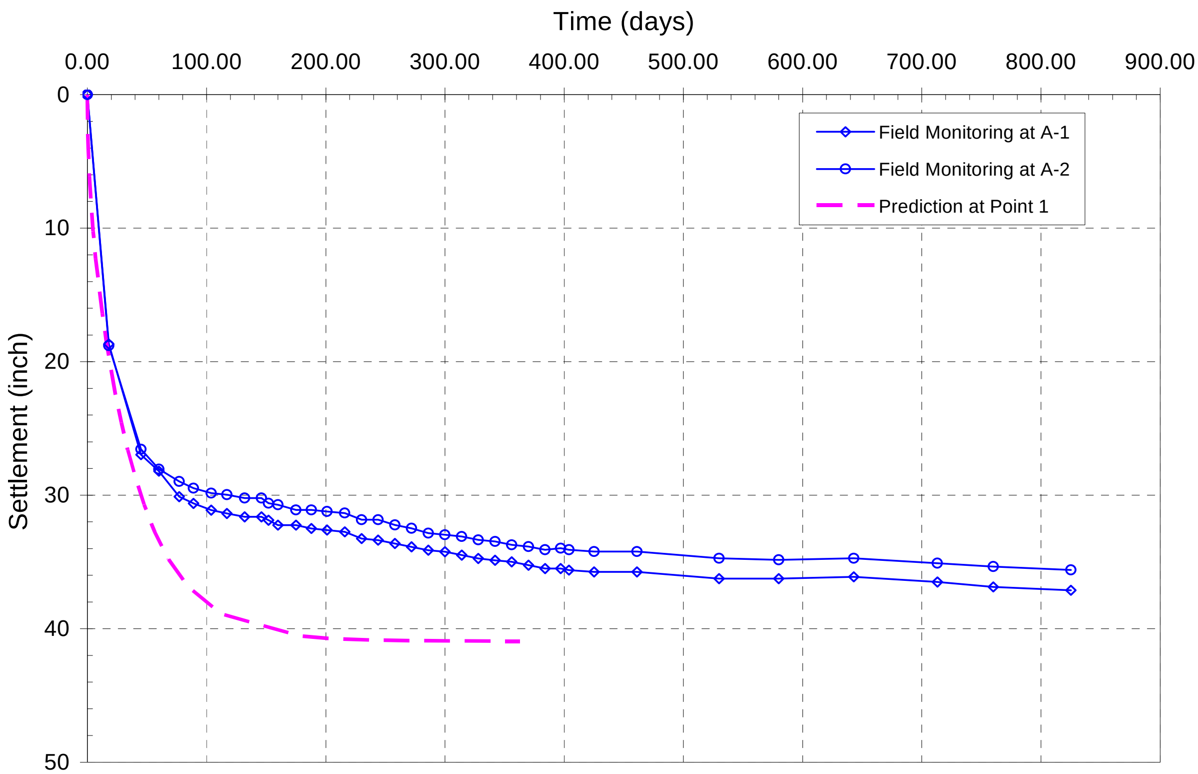

Figure 4-15. Calculation of Time Rate of Consolidation at Point 1

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Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

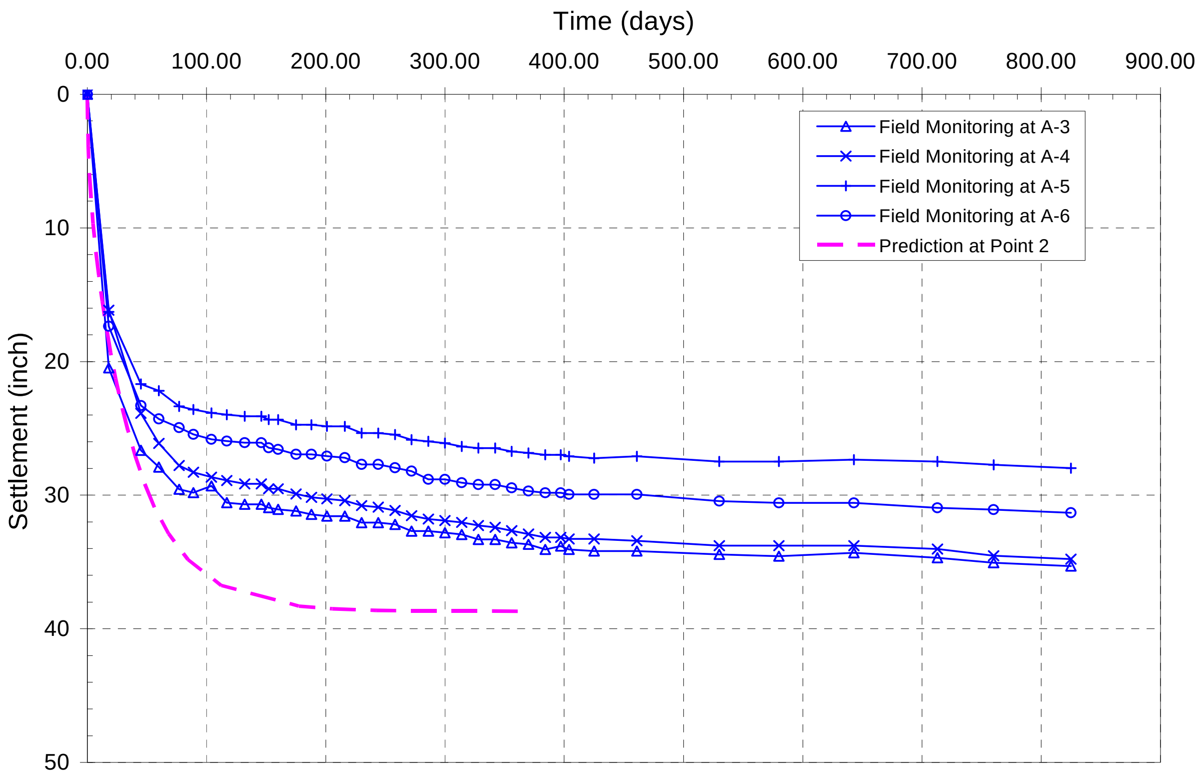

Figure 4-16. Calculation of Time Rate of Consolidation at Point 2

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

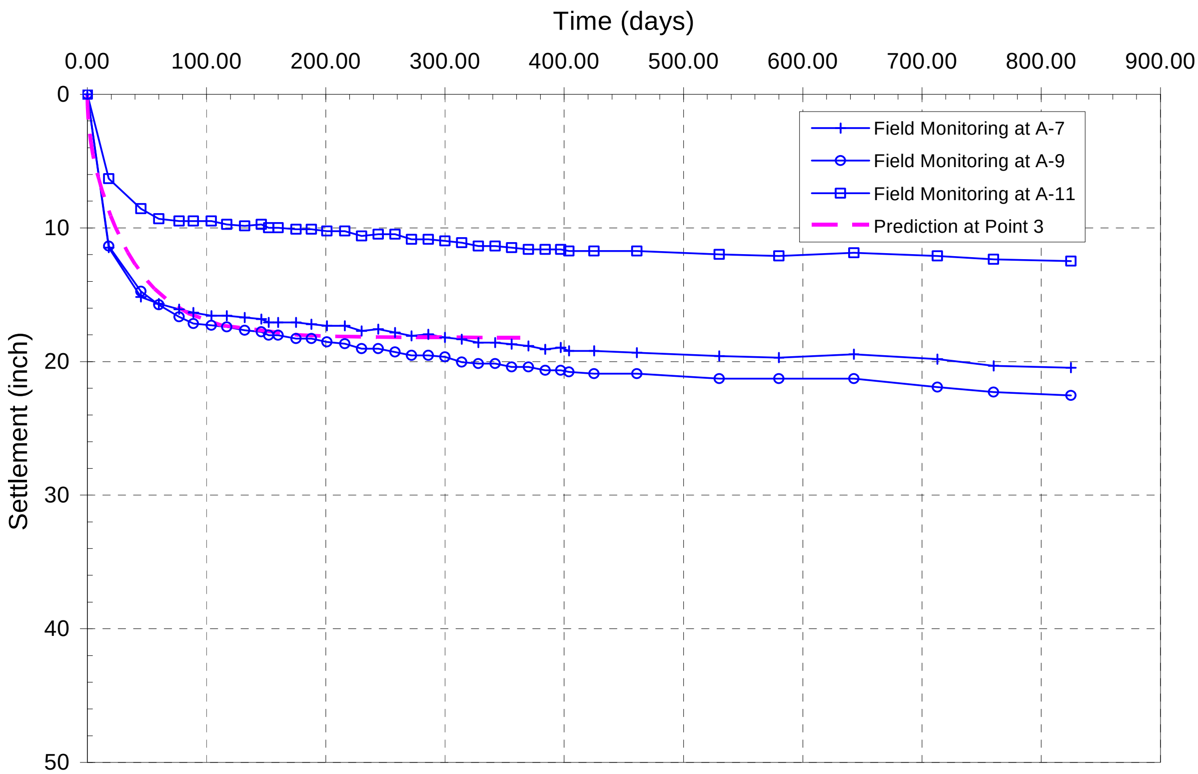

Figure 4-17. Calculation of Time Rate of Consolidation at Point 3

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

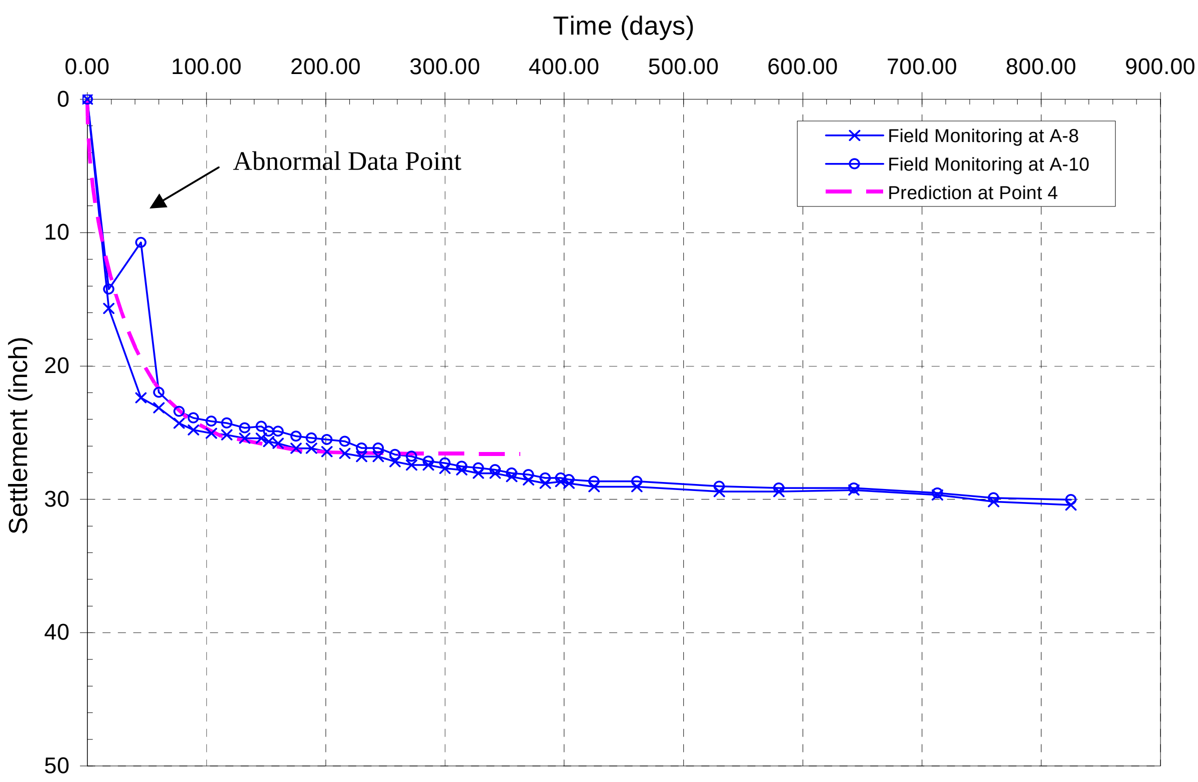

Figure 4-18. Calculation of Time Rate of Consolidation at Point 4

Written by:	**Ming Zhu**	Date:	**03/06/2008**	Reviewed by:	**R. Kulasingam/Jay Beech**	Date:	**03/06/2008**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA IDS**	Project/ Proposal No.:	**GD3944**	Task No.:	**04**

Table 4-1. Predicted Primary Consolidation Settlement Based on Calculated Average Degree of Consolidation

Piezometer ID	Time (days)						Average Settlement [1](ft)
	18	45	60	77	89	104	
A-1	30.5	37.1	37.1	38.4	38.2	40.1	38.2
A-2	31.4	35.4	35.8	35.6	35.2	36.9	35.8
A-3	26.2	30.0	30.5	31.7	31.5	31.7	31.1
A-4	28.0	32.6	33.3	34.2	34.0	35.3	33.9
A-5	23.8	27.9	27.7	28.2	27.9	29.7	28.3
A-6	26.7	30.2	30.1	29.9	29.9	31.6	30.3
A-7	13.7	18.2	18.7	19.0	19.2	18.8	18.8
A-8	25.0	28.6	28.2	28.8	28.9	30.2	28.9
A-9	15.0	18.4	19.2	20.2	20.7	20.3	19.7
A-10	21.0	---	26.5	27.5	27.7	28.9	27.7
A-11	8.9	11.5	12.7	12.4	12.1	13.2	12.4

Note:

[1]. The predicted primary consolidation settlements at time = 18 days were not considered in calculating the average settlement.

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

Table 4-2. Calculation of Primary Consolidation Settlement

SOLW Density (pcf)	82			
Ccε	Zone 2	0.46	Zone 3	0.38
Crε	Zone 2	0.014	Zone 3	0.021

Point 1

	Depth (ft)	Mid-point	S_initial	S_increment	S_final	water_pressure	effective_ini	Effective_final	OCR	Pc' (psf)	a1	a2	Strain	Settlement(ft)
	0	2.5	205.00	1199.98	1404.98	0	205.00	1404.98	4.5	923	0.653213	0.182703	0.093189	0.47
	5	7.5	615.00	1199.44	1814.44	0	615.00	1814.44	4.5	2768	0.469867	0	0.006578	0.03
	10	12.5	1025.00	1197.44	2222.44	0	1025.00	2222.44	2.0	2050	0.30103	0.035077	0.02035	0.10
Zone 2	15	17.5	1435.00	1193.17	2628.17	0	1435.00	2628.17	2.0	2870	0.262801	0	0.003679	0.02
	20	22.5	1845.00	1185.96	3030.96	0	1845.00	3030.96	1.0	1845	0	0.215584	0.099168	0.50
	25	27.5	2255.00	1175.39	3430.39	0	2255.00	3430.39	1.0	2255	0	0.182197	0.083811	0.42
	30	32.5	2665.00	1161.27	3826.27	0	2665.00	3826.27	1.0	2665	0	0.157078	0.072256	0.36
	35	37.5	3075.00	1143.60	4218.60	0	3075.00	4218.60	1.0	3075	0	0.137323	0.063169	0.32
	40	42.5	3485.00	1122.57	4607.57	0	3485.00	4607.57	1.0	3485	0	0.121269	0.046082	0.23
	45	47.5	3895.00	1098.49	4993.49	0	3895.00	4993.49	1.0	3895	0	0.107897	0.041001	0.21
	50	52.5	4305.00	1071.79	5376.79	0	4305.00	5376.79	1.0	4305	0	0.09655	0.036689	0.18
Zone 3	55	57.5	4715.00	1042.91	5757.91	468	4247.00	5289.91	1.0	4247	0	0.095366	0.036239	0.18
	60	62.5	5125.00	1012.32	6137.32	780	4345.00	5357.32	1.0	4345	0	0.090958	0.034564	0.17
	65	67.5	5535.00	980.50	6515.50	1092	4443.00	5423.50	1.0	4443	0	0.086603	0.032909	0.16
	70	71	5822.00	957.71	6779.71	1310	4511.60	5469.31	1.0	4512	0	0.083602	0.031769	0.06
	72													

Total =	**3.4**	ft
	40.9	in

Point 2

	Depth (ft)	Mid-point	S_initial	S_increment	S_final	water_pressure	effective_ini	Effective_final	OCR	Pc' (psf)	a1	a2	Strain	Settlement(ft)
	0	2.5	205.00	1199.92	1404.92	0	205.00	1404.92	4.5	923	0.653213	0.182685	0.09318	0.47
	5	7.5	615.00	1197.92	1812.92	0	615.00	1812.92	4.5	2768	0.469504	0	0.006573	0.03
	10	12.5	1025.00	1190.97	2215.97	0	1025.00	2215.97	2.0	2050	0.30103	0.033809	0.019767	0.10
Zone 2	15	17.5	1435.00	1177.29	2612.29	0	1435.00	2612.29	2.0	2870	0.260169	0	0.003642	0.02
	20	22.5	1845.00	1156.63	3001.63	0	1845.00	3001.63	1.0	1845	0	0.211361	0.097226	0.49
	25	27.5	2255.00	1129.83	3384.83	0	2255.00	3384.83	1.0	2255	0	0.176391	0.08114	0.41
	30	32.5	2665.00	1098.28	3763.28	0	2665.00	3763.28	1.0	2665	0	0.149869	0.06894	0.34
	35	37.5	3075.00	1063.46	4138.46	0	3075.00	4138.46	1.0	3075	0	0.128994	0.059337	0.30
	40	42.5	3485.00	1026.70	4511.70	0	3485.00	4511.70	1.0	3485	0	0.112137	0.042612	0.21
	45	47.5	3895.00	989.06	4884.06	0	3895.00	4884.06	1.0	3895	0	0.098274	0.037344	0.19
	50	52.5	4305.00	951.34	5256.34	0	4305.00	5256.34	1.0	4305	0	0.08671	0.03295	0.16
Zone 3	55	57.5	4715.00	914.11	5629.11	468	4247.00	5161.11	1.0	4247	0	0.08466	0.032171	0.16
	60	62.5	5125.00	877.74	6002.74	780	4345.00	5222.74	1.0	4345	0	0.079908	0.030365	0.15
	65	67.5	5535.00	842.48	6377.48	1092	4443.00	5285.48	1.0	4443	0	0.075408	0.028655	0.14
	70	71	5822.00	818.53	6640.53	1310	4511.60	5330.13	1.0	4512	0	0.072407	0.027515	0.06
	72													

Total =	**3.2**	ft
	38.7	in

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

Table 4-2. Calculation of Primary Consolidation Settlement (Continued)

Point 3

	Depth (ft)	Mid-point	S_initial	S_increment	S_final	water_pressure	effective_ini	Effective_final	OCR	Pc' (psf)	a1	a2	Strain	Settlement(ft)
Zone 2	0	2.5	205.00	733.06	938.06	0	205.00	938.06	4.5	923	0.653213	0.007263	0.012486	0.06
	5	7.5	615.00	723.14	1338.14	0	615.00	1338.14	4.5	2768	0.337626	0	0.004727	0.02
	10	12.5	1025.00	696.12	1721.12	0	1025.00	1721.12	2.0	2050	0.225088	0	0.003151	0.02
	15	17.5	1435.00	657.88	2092.88	0	1435.00	2092.88	2.0	2870	0.163892	0	0.002294	0.01
	20	22.5	1845.00	617.10	2462.10	0	1845.00	2462.10	1.0	1845	0	0.12531	0.057642	0.29
	25	27.5	2255.00	579.07	2834.07	0	2255.00	2834.07	1.0	2255	0	0.099264	0.045662	0.23
	30	32.5	2665.00	545.71	3210.71	0	2665.00	3210.71	1.0	2665	0	0.080904	0.037216	0.19
	35	37.5	3075.00	517.15	3592.15	0	3075.00	3592.15	1.0	3075	0	0.067509	0.031054	0.16
Zone 3	40	42.5	3485.00	492.83	3977.83	0	3485.00	3977.83	1.0	3485	0	0.057444	0.021829	0.11
	45	47.5	3895.00	472.02	4367.02	0	3895.00	4367.02	1.0	3895	0	0.049678	0.018878	0.09
	50	52.5	4305.00	454.03	4759.03	0	4305.00	4759.03	1.0	4305	0	0.043545	0.016547	0.08
	55	57.5	4715.00	438.27	5153.27	468	4247.00	4685.27	1.0	4247	0	0.042653	0.016208	0.08
	60	62.5	5125.00	424.29	5549.29	780	4345.00	4769.29	1.0	4345	0	0.040464	0.015376	0.08
	65	67.5	5535.00	411.69	5946.69	1092	4443.00	4854.69	1.0	4443	0	0.038485	0.014624	0.07
	70	71	5822.00	403.55	6225.55	1310	4511.60	4915.15	1.0	4512	0	0.037206	0.014138	0.03
	72													

Total =	**1.5**	ft
	18.2	in

Point 4

	Depth (ft)	Mid-point	S_initial	S_increment	S_final	water_pressure	effective_ini	Effective_final	OCR	Pc' (psf)	a1	a2	Strain	Settlement(ft)
Zone 2	0	2.5	205.00	888.76	1093.76	0	205.00	1093.76	4.5	923	0.653213	0.073955	0.043164	0.22
	5	7.5	615.00	883.30	1498.30	0	615.00	1498.30	4.5	2768	0.386723	0	0.005414	0.03
	10	12.5	1025.00	868.09	1893.09	0	1025.00	1893.09	2.0	2050	0.266447	0	0.00373	0.02
	15	17.5	1435.00	845.70	2280.70	0	1435.00	2280.70	2.0	2870	0.201217	0	0.002817	0.01
	20	22.5	1845.00	820.46	2665.46	0	1845.00	2665.46	1.0	1845	0	0.159777	0.073497	0.37
	25	27.5	2255.00	795.14	3050.14	0	2255.00	3050.14	1.0	2255	0	0.131173	0.060339	0.30
	30	32.5	2665.00	770.85	3435.85	0	2665.00	3435.85	1.0	2665	0	0.110337	0.050755	0.25
	35	37.5	3075.00	747.84	3822.84	0	3075.00	3822.84	1.0	3075	0	0.094541	0.043489	0.22
Zone 3	40	42.5	3485.00	725.97	4210.97	0	3485.00	4210.97	1.0	3485	0	0.082179	0.031228	0.16
	45	47.5	3895.00	705.01	4600.01	0	3895.00	4600.01	1.0	3895	0	0.072251	0.027455	0.14
	50	52.5	4305.00	684.75	4989.75	0	4305.00	4989.75	1.0	4305	0	0.064106	0.02436	0.12
	55	57.5	4715.00	665.05	5380.05	468	4247.00	4912.05	1.0	4247	0	0.06318	0.024009	0.12
	60	62.5	5125.00	645.79	5770.79	780	4345.00	4990.79	1.0	4345	0	0.06018	0.022868	0.11
	65	67.5	5535.00	626.91	6161.91	1092	4443.00	5069.91	1.0	4443	0	0.057324	0.021783	0.11
	70	71	5822.00	613.91	6435.91	1310	4511.60	5125.51	1.0	4512	0	0.055407	0.021055	0.04
	72													

Total =	**2.2**	ft
	26.6	in

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

Table 4-3. Summary of Predicted and Measured Consolidation Settlement

	Consolidation Settlement (inches)										
	Point 1		Point 2				Point 3			Point 4	
	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-9	A-11	A-8	A-10
Prediction based on field data	39.79	35.78	31.09	33.9	28.29	30.32	18.82	19.75	12.37	28.95	27.66
Prediction based on lab data	40.94		38.69				18.20			26.60	
Measurement on 1/10/2008	37.12	35.6	35.31	34.78	27.98	31.33	20.46	22.54	12.48	30.43	30.03

Written by:	Ming Zhu	Date:	03/06/2008	Reviewed by:	R. Kulasingam/Jay Beech	Date:	03/06/2008
Client:	Honeywell	Project:	Onondaga Lake SCA IDS	Project/ Proposal No.:	GD3944	Task No.:	04

Table 4-4. Thickness of SOLW Beneath Test Fill

Piezometer Location	Thickness of SOLW (ft)
A-1	74
A-2	74
A-3	73
A-4	70
A-5	71
A-6	75
A-7	74
A-8	74
A-9	74
A-10	76
A-11	67

Written by: **Ming Zhu** Date: **03/06/2008** Reviewed by: **R. Kulasingam/Jay Beech** Date: **03/06/2008**

Client: **Honeywell** Project: **Onondaga Lake SCA IDS** Project/ Proposal No.: **GD3944** Task No.: **04**

Table 4-5. Summary of Consolidation Settlement

Thickness of SOLW	72	ft
Drainage distance	36	ft
Cv of SOLW	0.14	cm^2/s
Predicted settlement		
Point 1	40.9	inch
Point 2	38.7	inch
Point 3	18.2	inch
Point 4	26.6	inch

$$t = \frac{T_v H_{dr}^2}{C_v}$$

Degree of Consolidation (U(t))	Time Factor (Tv)	Time (t, days)	Predicted Settlement (S(t), ft)			
			Point 1	Point 2	Point 3	Point 4
0%	0.0000	0	0.00	0.00	0.00	0.00
5%	0.0020	0	2.05	1.93	0.91	1.33
10%	0.0079	1	4.09	3.87	1.82	2.66
15%	0.0177	2	6.14	5.80	2.73	3.99
20%	0.0314	3	8.19	7.74	3.64	5.32
25%	0.0491	5	10.24	9.67	4.55	6.65
30%	0.0707	7	12.28	11.61	5.46	7.98
35%	0.0962	10	14.33	13.54	6.37	9.31
40%	0.126	13	16.38	15.48	7.28	10.64
45%	0.159	16	18.42	17.41	8.19	11.97
50%	0.196	20	20.47	19.35	9.10	13.30
55%	0.238	24	22.52	21.28	10.01	14.63
60%	0.286	28	24.57	23.22	10.92	15.96
65%	0.340	34	26.61	25.15	11.83	17.29
70%	0.403	40	28.66	27.09	12.74	18.62
75%	0.477	47	30.71	29.02	13.65	19.95
80%	0.567	56	32.75	30.96	14.56	21.28
85%	0.684	68	34.80	32.89	15.47	22.61
90%	0.848	84	36.85	34.83	16.38	23.94
95%	1.129	112	38.90	36.76	17.29	25.27
99%	1.781	177	40.53	38.31	18.02	26.33
99.5%	2.062	205	40.74	38.50	18.11	26.47
99.8%	2.433	242	40.86	38.62	18.16	26.55
99.9%	2.714	270	40.90	38.66	18.18	26.57
99.99%	3.647	363	40.94	38.69	18.20	26.60