Tank-automotive & Armaments Command

GEOTECHNICAL INVESTIGATION SUMMARY CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN

STRATFORD ARMY ENGINE PLANT STRATFORD, CONNECTICUT

CONTRACT DAAAM-02-97-D-0005
DELIVERY ORDER NO. 0003

DECEMBER 2000

Harding ESE
A MACTEC COMPANY

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN

STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

CONTRACT DAAAM-02-97-D-0005
DELIVERY ORDER NO. 0003

DECEMBER 2000

Printed On Recycled Paper

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

CONTRACT DAAAM-02-97-D-0005
DELIVERY ORDER NO. 0003

Prepared for:

U.S. Army Tank-automotive and Armaments Command
Stratford, Connecticut

Prepared by:

Harding ESE
A MÁCTEC Company
Portland, Maine

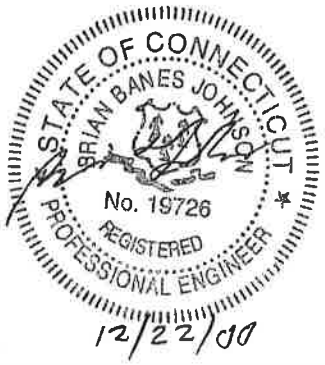
Project No. 50796
Task No. 1032

DECEMBER 2000

Gina L. Rustad

Gina L. Rustad, P.E.
Task Leader

Brian Johnson, P.E.
Geotechnical Leader



GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Harding ESE, a MACTEC company (Harding) (formerly Harding Lawson Associates [HLA]) has been contracted to complete geotechnical investigations in support of the Non-time Critical Removal Action (NCRA) design for the Causeway at the Stratford Army Engine Plant (SAEP) in Stratford, Connecticut. The removal action is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (U.S. Environmental Protection Agency [USEPA], 1990), and the Base Closure and Realignment (BRAC) Cleanup Plan Guidebook (Department of Defense, 1993). This technical memorandum describes the geotechnical investigations conducted by Harding on the Causeway and in the tidal flats surrounding the Causeway and summarizes the testing performed and the results of the investigations.

1.1 PURPOSE AND SCOPE

This technical memorandum presents the data collected during geotechnical investigations at the SAEP Causeway. In the Final Engineering Evaluation/Cost Analysis (EE/CA) (Foster Wheeler Environmental Corporation [FW]/HLA, 2000), geotechnical investigations were recommended to evaluate the global stability of the proposed Causeway Cover System.

Prior to the EE/CA, drilling completed during well installation indicated that the Causeway is underlain by soft sediments that are considered problematic with regard to geotechnical stability. Because the proposed remedy requires a cover to prevent receptor exposure to site contamination, further geotechnical investigation of the underlying sediments was proposed to assess their geotechnical characteristics. This memorandum presents the results of the recommended geotechnical investigation, including field testing and laboratory testing results. Geotechnical investigations were completed on the SAEP Causeway in the Fall of 2000.

1.2 SITE HISTORY

SAEP consists of approximately 124 acres, of which an estimated 76 acres are improved land consisting of 49 buildings, paved roadways and grounds, and five paved parking lots (Figure 1-1). Included in the improved land are an estimated 10 acres along the Housatonic River where fill was placed over tidal sediments during the development of SAEP facility, including the Causeway. Riparian rights are associated with the remainder of the SAEP facility. A riparian right is a right of access to, or use of, the shore, bed, or water of land on the bank of a natural watercourse. The riparian rights property consists of intertidal flats of the Housatonic River. An estimated two acres of property compose the Causeway, constructed to provide access to the river channel.

The Causeway was initially constructed and used as a means of launching seaplanes in the 1930s. Additional materials, of unknown origin, were deposited along the northern edge of the Causeway during the 1950s and 1960s. Building 59, an open-topped, concrete building, was constructed to house the nose cones of missiles, including the explosive charges used to open the nose cones. There is currently no unexploded ordnance present at the SAEP facility. The source of the fill used to construct the Causeway is unknown, but it has been found to contain soil, cobbles, and construction debris (e.g., concrete, brick, and asphalt). Smaller amounts of other material (e.g., wood, glass, cinders, ash and rebar) were also observed during field investigation activities. It was also reported that paint solvents and wastes were burned on the Causeway as part of fire-training operations. Appendix A provides a photographic log of the Causeway, identifying various features of the site.

Chemical sampling and analysis of soil collected from the Causeway identified concentrations of chlorinated and fuel-related volatile organic compounds (VOCs), semi-volatile organic compounds, polychlorinated biphenyls, and inorganics that exceeded the Connecticut Department of Environmental Protection Remediation Standard Regulation Direct Exposure Criteria and Pollutant Mobility Criteria. Low-level radiological contamination was also identified during sampling, and the affected areas were excavated in March 2000. This material was containerized and transported to an appropriate off-site licensed disposal facility. Evaluation of chemical analytical data is discussed in the Final Causeway Pre-design Investigation Report (FW/HLA, 2000a).

Based on the results of chemical sampling and an EE/CA report (FW/HLA, 2000b), it has been recommended that an erosion control cover system be placed over the Causeway to prevent possible receptor contact with contaminated soil and overland transport of contaminated soil into the tidal flats. Geotechnical investigations, the results of which are presented in this technical memorandum, were initiated because soil borings completed for chemical sampling purposes during previous investigations, were widely spaced throughout the large area that would likely be impacted by construction of the proposed Causeway cover system. In addition, data from some of these earlier borings indicated that the Causeway fill material and the underlying tidal sediment may not provide the strength necessary to support the proposed cover system, and construction of the cover could lead to a failure of the Causeway.

1.3 REPORT ORGANIZATION

This data report is organized into four sections. Section 1 identifies the purpose and scope of the geotechnical field investigations and this data report, and presents a brief history of the SAEP site and the SAEP Causeway. Section 2 discusses the methodology behind field investigation tasks completed as part of the geotechnical investigation, presents an interpretation of the subsurface geologic conditions on the Causeway, and provides a summary of data collected

during field investigations. Section 3 presents the results of laboratory testing completed on samples collected during field activities and briefly explains the laboratory testing methodology. Section 4 provides a summary of consolidation and shear strength theory, then presents the estimated physical properties of the soils and sediments present in the vicinity of the SAEP Causeway.

2.0 FIELD INVESTIGATION

Geotechnical investigations were initiated on September 18, 2000, and included two separate drilling phases. Drilling was performed in accordance with established SAEP Standard Operating Procedures (SOPs) (FW/HLA, 1999). Earth Exploration, Inc. of Hopkinton, Massachusetts, under contract to Harding, performed the drilling services. Figure 2-1 identifies the locations of the borings completed during the geotechnical investigations.

Phase 1 included the installation of five borings on the Causeway (GB-00-01 through GB-00-04 and GB-00-07A) and five borings in the tidal flats surrounding the Causeway (GB-00-05 through GB-00-09). These borings were installed between September 18, and October 19, 2000 using standard drive-and-wash drilling techniques (see Figure 2-1). The purpose of this investigation was to observe subsurface conditions, to conduct field tests, and to collect samples for off-site laboratory testing. Borings installed during Phase 1 were typically continuously sampled. Boring locations on and along the sides of the Causeway were accessed using an all-terrain vehicle drill rig, while boring locations sited within the tidal flats were accessed using a barge-mounted drill rig.

Phase 2, consisting of the installation of nine borings along the shoulders of the Causeway (GB-00-05A, GB-00-05B, GB-00-06A, GB-00-06B, GB-00-08A, GB-00-08B, GB-00-09A, GB-00-09B, and GB-00-10), were installed between November 6, and November 9, 2000 using air-rotary drilling techniques. The purpose of this investigation was to further define the vertical extent of fill along the sides of the Causeway; therefore, continuous sampling of these borings was not performed. A backhoe was used to provide access to drilling locations for the air-rotary rig.

Drilling activities were directed and observed by Harding and were designed to gather specific information. For the Phase 1, the specific information included:

- Geologic information: thickness and extent of fill and native material, including physical descriptions
- Field testing: shear strength testing and standard penetration testing (relative density)
- Soil samples for laboratory testing of physical characteristics, including moisture content, grain size distribution, organic content, density, Atterberg limits, specific gravity, shear strength, consolidation, and triaxial compression

For the Phase 2, the main purpose was to further define the vertical extent of fill along the sides of the Causeway. Also, soil samples for additional laboratory testing for moisture content determinations were collected during this phase.

Appendix B contains the soil boring logs. These logs show, along with the lithological descriptions, the types and depths at which samples were collected and any field testing that was performed. Table 2-1 lists a summary of the field investigation program, including the surface elevations of each soil boring, the total depths of each boring, and the number of tests completed in each boring. A summary of the field testing results is presented in Section 3 and the laboratory testing results are presented in Section 4.

Soil borings completed on the Causeway were surveyed horizontally and vertically by Meridian Engineering (Meridian) of Danvers, Massachusetts. For each of the borings completed within the tidal flats, a minimum of two landmarks were identified on the Causeway. Boring distance from these landmarks were recorded by Harding personnel during completion of the borings; the landmarks were then surveyed by Meridian and used to establish the boring locations. In addition, a topographic survey of the Causeway and the surrounding area was completed by Meridian. The topographic survey included the elevation (in 1-foot contours) of the Causeway, 100 linear feet of the SAEP dike on either side of the Causeway extending 50 feet toward the facility, and the tidal flat sediments within 75 feet of the Causeway. Appendix A contains a photographic log of the Causeway site, identifying various landmarks used during location of geotechnical borings.

HLA performed air monitoring with a photoionization detector (PID) and lower explosive limit/oxygen meter during drilling. Borings installed during Phase 1 were backfilled to ground surface with a cement-bentonite grout. The grout mixture was placed into the borehole using a tremmie pipe. Borings installed during Phase 2 were backfilled with soil cuttings directly from the surface. Excess drill cuttings generated during both mobilizations were spread on the surface of the Causeway. Materials tested at the laboratory will ultimately be transported back to the Causeway and spread on the ground surface.

Tests performed in the field included Standard Penetration Testing (American Society for Testing and Materials [ASTM] D1586), and vane shear testing (e.g., field vane testing in accordance with ASTM D2573), as summarized in Table 2-1. At selected locations around the Causeway, field vane testing using a hand-held Geonor™ (in accordance with ASTM D2573) was also performed. Laboratory testing was performed on thin-walled tube samples (i.e., Shelby tubes [ASTM D1587]) that were collected at selected depths from a number of the borings (see Table 2-1). Additional tests were performed on selected bulk samples collected from split-spoon samples, and on the soil samples collected from field vane flights, as described in Section 3.

Standard Penetration Testing. Data collected during standard penetration testing are used to develop N-values, which are defined as the number of blows required to advance a standard split-spoon sampler with a standard amount of energy from 6 to 18 inches below the bottom of the boring casing. Among other uses, these data provide an indication of the soil's relative density (for granular soils) or consistency (for cohesive soils). Data can also be used to provide estimates of settlement and shear strength. Appendix B contains soil boring logs for borings

completed during this geotechnical investigation. The boring logs contain blow counts measured during the completion of the soil borings.

Vane Shear Testing. A direct measure of in-situ soil strength can be obtained from vane shear testing. The test consists of placing a four-flighted vane in undisturbed soil and rotating it from the surface to determine the torsional force required to cause a cylindrical soil surface surrounding the vane flights to be sheared by the vane; this force is then converted to a unit shearing resistance of the cylindrical surface. The field vane used was an Acker system, which consists of a hand crank used to rotate the vane at a rate of approximately 6 degrees per minute (0.1 degrees per second) to minimize stress and pore pressure concentrations. The method is well-suited for fine-grained soil including clays, silts and fine sands. However, where highly organic soils, containing a high percentage of large objects (i.e., organic matter) are present, two factors may influence test results. First, the cylindrical shearing surface may be influenced by the organic matter, and second, the vane may displace these objects and disturb the soils within the cylindrical shearing surface.

The shear strength provided by a soil is dependent upon the amount of displacement developed within the soil mass. This means that when a load is applied to a soil, the soil deforms, and through this deformation it is able to resist the applied load, a phenomenon known as mobilization of shear strength. The field vane test allows for measurement of both rotational strain (movement) and applied stress (the stress mobilized in the soil to resist the applied rotational strain). The fine-grained nature of the native organic sediments (compared to classical peats), the relatively good correlation with the laboratory and other test indices, and the number of tests performed, indicate that the field vane testing provided representative data.

Estimates of soil shear strength were also obtained through testing using a hand-held Geonor™ vane. The Geonor™ vane estimates a soil's shear strength in much the same way vane shear testing provides results. A small vane is attached to a torque-measuring handle using the necessary length of rod, and the vane is inserted into the soil. Torque is applied to the handle of the vane and a reading of the maximum applied torque, prior to shearing of the soil, is obtained. The reading obtained in the field is converted to an estimated shear strength using Geonor™ conversion factors.

Geonor™ readings were collected from the ends of selected Shelby tube samples, from the subsurface in the area of borings installed within the mud flats, and along the western and eastern shores of the Causeway (Figure 2-2). Measurements collected from depth in the subsurface (0.5 to 2.0 meters) took into account the resistance of the soil in contact with the Geonor™ rods in addition to the resistance of the soil contacting the vane. The rod resistance was subtracted from the final reading, so that only the resistance of the soil contacting the vane was considered during evaluation of the soil's shear strength.

Shelby tube samples were collected to supply undisturbed soil samples from which laboratory tests were performed for additional design data. Typically, split-spoon sampling was conducted in the remainder of each boring installed during the first mobilization to provide a record of subsurface conditions, as well as to provide disturbed soil samples for additional laboratory testing. Sampling within the borings installed during Phase 2 was limited to split-spoon samples, collected for field observation of the depth of fill at these locations.

During boring advancement at GB-00-02, elevated PID readings were recorded on soils when the split spoons from certain depths were first opened (see GB-00-02 boring log in Appendix B). PID readings as high as 66 parts per million (ppm) were recorded at the 20- to 22-foot interval, and 49 ppm was recorded at the 16- to 18-foot interval. Based on these readings, it was decided that the boring would be completed as a monitoring well to allow for sampling and analysis of groundwater from the zone containing the highest PID readings. A 2-inch diameter polyvinyl chloride well with a 0.010-inch slotted well screen was installed from 16 feet to 26 feet below ground surface (bgs) and developed using surge and pump techniques. A groundwater sample was collected and analyzed at an off-site laboratory for VOCs on November 11, 2000 in accordance with SAEP SOPs (FW/HLA, 1999). Samples were shipped by overnight carrier to Severn Trent Laboratories (STL), Inc. in Pittsburgh, Pennsylvania for analysis. Results from the analysis of this groundwater sample will be included in a separate report that will also present results of Synthetic Precipitate Leaching Procedure analysis on soil samples collected in September from various locations on the Causeway.

Additionally, once sampling in GB-00-02 was completed, and before the well was installed, this boring was probed by driving drilling rods from 72 feet to a probe refusal depth of 94.7 feet bgs. Probing was performed to aid in determining the approximate depth to the top of bedrock at this location. The second deep exploration on the Causeway, GB-00-04, was to be probed in the same manner; however, this exploration was placed near MWCD-99-01B which had auger refusal at a depth of around 102 feet bgs (FW/HLA, 2000a), therefore, it was determined that probing would not be necessary.

At the completion of the geotechnical drilling program, the location of the end of fill/beginning of native sediments (e.g., toe of the fill) at several points around the Causeway were measured by Harding. This was completed by measuring from the survey-located landmarks, previously used to locate the borings completed within the tidal flats, to the break-in-slope between the Causeway fill soils and the natural mud flat sediments. Horizontal measurements from the survey-located landmarks to the toe of fill were made at four points near where barge borings were installed. Measurements were made at GB-00-05, GB-00-06, GB-00-08, and GB-00-09. Measurements were not made along the east end of the Causeway, nearest the river, because the toe of the fill in that area is under water at low tide. The locations of these toe of fill measurements are shown on Figure 2-1, and are labeled as "Approximate Contact of Fill/Riverine Sediments."

2.1 SUBSURFACE CONDITIONS

2.1.1 Lithology

Fill materials and soils encountered during the SAEP geotechnical investigation can be grouped into four distinct units. The following paragraphs provide typical physical descriptions of these units. Subsurface materials encountered beneath the Causeway consists of the following units, where present, from ground surface downward; fill, native organic sediment, sand and gravel, and very fine sand and silt. The deepest unit may be a finer gradation of the unit above. Figures 2-3 through 2-5 provide Interpretive Geologic Profiles through the Causeway, oriented as shown on Figure 2-2.

Fill: Materials observed within the fill include many types of fill material ranging from clean, well graded sands; to stained soils; as well as metal, wood, cobbles, asphalt, concrete, cemented ash, etc. Thicknesses of the fill range from around 20 feet near GB-00-01 at the end of the Causeway, to around 13 feet near GB-00-04. These thicknesses correlate well with borings and test pits installed during the Pre-Design Investigation (FW/HLA, 2000a). The fill material gradually thins out on the sides of the Causeway (as shown on Figures 2-4 and 2-5). The contact between the fill materials and the native organic sediments is not a clean one and includes a thin interval of mixing between these two units until eventually, there is an absence of fill. The differential settling of fill materials within the very soft native organic sediments has likely caused this to occur. Within this mixed interval, black, native organic sediments were observed to be either thoroughly mixed with fill material or, in some cases, interbedded with the fill.

Native Organic Sediments: The first native soils located beneath the fill material are the riverine sediments of the Housatonic River. These were described in the field as being black, mucky, soft to very soft, slightly-to-non-plastic silts in the upper portions of the unit, with increasing organic content with depth. Laboratory results of samples collected from this unit show it to be a sandy silt. A phenomenon of this unit noted during the drilling is that organic fibers, reeds or plant stems are usually present and that a strong sulfur odor is almost always present. Also, this unit tends to become more organic with depth in that thin peat lenses are sometimes present immediately above the underlying sand and gravel unit (see Sand & Gravel section below). This unit can be seen in the Interpretive Geologic Profiles A-A' through C-C' (Figures 2-3 through 2-5). The thinnest section of this unit was observed in GB-00-09 with a thickness of approximately 34 feet, which extends to an elevation of approximately –36 feet mean sea level (msl). This unit is approximately 38 feet thick beneath the Causeway at GB-00-02 and GB-00-04, extending to approximately –45 feet msl, then thickens to around 41 feet at GB-00-08 on the south side of the Causeway, where again the lower elevation is at around –44 feet msl.

Sand & Gravel: A unit consisting of non-homogeneous sand and gravel mixtures is present beneath the native organic sediments. Materials consist of loose to medium dense silty sands to clean sand and gravel mixtures. While not recovered due to size being larger than the split spoon diameter, it is suspected that gravel, and possibly cobbles, would be present in this unit. This sand and gravel unit ranges in thickness from around 12 feet in GB-00-02 to greater than 22 feet in GB-00-08 (see Figures 2-3 and 2-4).

Very Fine Sand & Silt: The bottom unit observed in this geotechnical investigation is composed of very fine sand and silt. This material may be a separate unit or may be, as shown in the Pre-Design Investigation Report (FW/HLA, 2000a), only a finer portion of a larger unit that also includes the coarser sand and gravel above. Because these finer soils would be expected to behave differently under induced stresses, these soils are treated as being a separate unit for purposes of the geotechnical evaluation. Within this unit are apparently continuous reddish clay lenses, present in the deeper borings (e.g., GB-00-05, GB-00-06, GB-00-09, see boring logs in Appendix B). This unit is first seen at an elevation of –50 feet msl in GB-00-02.

2.1.2 Groundwater

Monitoring well pairs MWCD-99-01A/B, and MWCD-99-02A/B were installed during the Pre-Design Investigation (FW/HLA, 2000a). Vertical gradients measured for the Pre-Design Investigation were determined for these well pairs; the deeper wells screen the top of the sand and gravel unit, and the shallow wells screen the water table which lies within the fill soils of the Causeway. A downward gradient, indicative of recharge, was observed at the time of the measurement in the well pair MWCD-99-01A/B at 0.0165 feet per foot. The second well pair, MWCD-99-02A/B, located at the far end of the Causeway, showed an upward gradient of 0.0445 feet per foot. Two rounds of synoptic water level measurements, one during high tide conditions and another during low tide conditions, are scheduled to be collected during January 2001. These measurements will help further define groundwater gradients that may exist on the Causeway.

2.2 FIELD RESULTS

Field data was generated during the advancement of soil borings through the completion of standard penetration tests (ASTM D1586), field vane shear tests (ASTM D2573), and hand-held Geonor™ tests. Standard penetration testing provides information related to the density of the soil being tested, while vane shear testing and Geonor™ testing provide a direct measure of the soil's shear strength. The boring logs contained in Appendix B present the blow counts measured during the completion of the soil borings as well as peak and remolded field vane shear results.

During the completion of field vane shear testing, both torque and angle of rotation were recorded. Due to the relatively low torque applied, the shallow testing depths, and the use of

large drilling rods (N-rods), the correction for rotational stiffness of the rods was not performed. Plots of angular strain (based on 90 degrees of rotation angle) versus shear resistance, presented in Appendix C for each test completed, indicate that the organic sediments under the Causeway typically reached peak shear strength at approximately 26 percent strain (a rotation of the rods of 23 degrees) while the organic sediments in the tidal flats reached peak shear strength at approximately 31 percent strain (a rotation of the rods of 28 degrees). Percent strain values ranged from a high of 42 to a low of 14 percent strain under the Causeway and from a high of 60 to a low of 15 in the tidal flats (see Appendix C).

The majority of the stress-strain plots produced from the field vane shear data indicated that low strain levels produced a nearly linear stress-strain plot. Following this linear portion, assumed to be the materials elastic range, the stress increased more slowly with increasing strain. This break is assumed to correspond to the start of plastic behavior of the material, where the soil likely experiences unrecoverable strain and the organic fibers are being reoriented. It is typically assumed that only shear strengths within the elastic range should be relied upon as part of standard design. If a structure is designed with plastic soil shear strengths, movement is typically considered excessive, resulting in a "failure" of the structure before the soil actually achieves its peak strength. Two additional sets of shear strength results are shown in the figures in Appendix C, the residual shear strength and the shear strength at 5 percent strain. Residual strength is a measure of the minimum strength provided by the soil, after it has been remolded and no reconstitution/consolidation has occurred, such as following a rotational failure. The 5 percent strain value is in the upper range of peak strains typically seen in granular soils, such as the overlying fills. This value is evaluated to reduce concerns for strain incompatibility issues between the two materials (fill and native organic sediments).

Figures 2-6 and 2-7 present plots of peak shear strength (measured in the field) versus elevation for locations under the Causeway and in the tidal flats, respectively. The figures include data gathered from field vane shear testing in the borings, Geonor™ testing completed in Shelby tubes collected from the borings, and Geonor™ testing completed in the shallow subsurface near the boring locations. Figures summarizing other shear strength values (including remoulded strengths, 5 percent strain strengths, and elastic strain strengths) versus elevation under and off the Causeway, are included in Appendix D.

3.0 LABORATORY TESTING

A significant number of samples collected during the pre-design geotechnical investigations were tested in the laboratory to determine their engineering properties for use in design of the Causeway cover system. Laboratory testing was performed by GeoTesting Express, of Boxborough, Massachusetts. Testing was performed as specified by Harding and in accordance with ASTM methods and standard geotechnical engineering practice. Testing included both tests for index properties (used to classify/categorize samples and to support interpolation of strength and consolidation characteristics) and physical properties (strength and consolidation characteristics). Samples tested were obtained from split-spoons, Shelby tubes and vane shear tests. Vane shear test samples were typically collected from materials retained between the vane blades after removal from the subsurface. Table 3-1 provides a summary of the tests performed.

Laboratory data results are summarized in tabular form in Tables 3-2 through 3-7, as follows:

TABLE NUMBER	TESTING TABLE NAME
3-2	Grain Size Determination
3-3	Moisture Content
3-4	Atterberg Limits
3-5	Organic Matter
3-6	Specific Gravity
3-7	Shelby Tube Openings

Figures 3-1 and 3-2 present plots of moisture content versus elevation for borings completed under the Causeway and in the tidal flats, respectively. Interpretation of testing results is provided in Section 4.

One-dimensional consolidation tests were performed on three Shelby tube samples in accordance with ASTM D2435. Samples were selected to span the range of existing stresses and were loaded to include anticipated possible loading conditions. Load increments ranged from 0.5 pounds per square inch (psi) to 32.0 psi and were applied to the samples in a load-unload-load sequence. Actual load and unload schedules was selected based on the estimated existing stress on the sample due to existing load conditions as well as possible cover scenarios. Each increasing load increment was applied for 24 hours, and the unloading increment was conducted until a minimum of 90 percent expansion had been observed. A 72-hour load period was utilized for the final load increment, which was intended to estimate the load from the Causeway cover system. Pore pressure was recorded for the last load increment in each test and laboratory results included plots of strain versus log and square root of time. Due to an equipment problem, pore pressure measurements made on samples GB-00-02, 40-42 feet and GB-00-05, 26-28 feet are not

considered to be representative of actual conditions. The laboratory provided electronic files containing test data, for use in further evaluations performed by Harding. Harding evaluated the consolidation characteristics, as discussed in Section 4.

Triaxial compression testing was performed on five Shelby tube samples in accordance with ASTM D4767. Tests were performed at three confining stresses for each sample, the magnitude of which was based on estimated existing stresses as well as possible cover scenarios. Tests were performed for three primary reasons: 1) to allow for a possible estimation of strength gain (not evaluated in detail in this technical memorandum); 2) to provide for a more accurate/controlled characterization of the stress-strain relationships and allow for correlation with field vane shear test results, and; 3) to support a deformation analysis, should one be required.

Test results were provided by the laboratory in two bound reports (GeoTesting Express, Inc. 2000a and 2000b). These reports have not been reproduced as part of this report, but are available for review upon request.

4.0 RESULTS

The following provides a summary of the results obtained through performing field and laboratory testing of the soils in the vicinity of the Causeway.

4.1 ESTIMATED PHYSICAL PROPERTIES

Physical characteristics for both fill and organic sediments have been evaluated, based on observations made during the pre-design geotechnical investigation and the results of laboratory testing. Physical characteristic analyses, including determinations of index properties, shear strength, stress history, and consolidation characteristics, were completed to provide inputs for subsequent geotechnical evaluations.

Literature sources were referenced during the field investigations and during data interpretation to support the analyses being conducted, due to site conditions (i.e., very soft organic sediments). In particular, references regarding shear strength reduction factors were considered when determining appropriate shear strength values for use in the stability model. Two specific reduction factors, the first related to the reliability of field vane shear testing, and the second related to the placement of stiff fill materials on soft organic sediments, were used. The reduction factors were applied to the average peak shear strength readings collected in the field. Figures 4-1 through 4-3 present the average shear strength values (peak, five percent strain, straight-line, residual, reduced, and proposed) versus elevation for soil under the Causeway, north of the Causeway and south of the Causeway, respectively.

A summary of the estimated geotechnical characteristics is presented for each of the materials encountered/tested, including Causeway fill and organic sediment. Actual test results are presented in the laboratory reports (GeoTesting Express, Inc., 2000a and 2000b).

Causeway Fill Characteristics:

Limited testing, including Standard Penetration Testing, grain size, and moisture content were performed on Causeway fill material. While a zone is present at the bottom of this unit where mixing has occurred with the organic sediments, it will be assumed in the design evaluations that the soil is homogeneous. The possibility for cracks under the center and along each side of the Causeway is high and should be accounted for in the design evaluations. Based on these test results, the Causeway fill material can be described as having the following estimated engineering characteristics:

- Total Unit Weight = 140 pounds per cubic foot (pcf)
- Submerged Unit Weight = 77.6 pcf
- Internal Friction Angle = 33 degrees (^{o})

- Cohesion = 0 pounds per square foot (psf) (conservative assumption, since large quantities of slag and semi-cemented ash were encountered along with large pieces of concrete).
- Relative Density = moderately dense to very dense
- Consistency = granular and non-cohesive

Organic Sediment Characteristics:

In addition to field testing (e.g., Standard Penetration Test measurements and vane shear testing), both disturbed (i.e., soil from split spoons and from field vane shear tests) and undisturbed (i.e., soil from Shelby Tubes) samples were collected and tested in the off-site laboratory, as identified in Table 3-1. Based on the available data, strengths for the organic sediments appear to increase with depth, while water contents also increase. This is likely due to the increased organic contents observed with depth. In order to evaluate the likely stability of the Causeway, both under existing conditions and following construction of the cover system, the available shear strength must be entered into the model. The shear strengths presented here, are independent of the overburden pressure, since it has already been included.

For the design evaluations, the condition immediately following construction is considered to be the most critical and should include undrained shear strength values. The affect of strength gain and additional confining stress (since the organic sediments act primarily as a frictional material) will act to increase the long-term stability and are therefore not considered further here. Drained (i.e., long-term) stability will be considered in the final evaluations.

The organic sediments are divided into two main categories, those under the Causeway and those off the Causeway (i.e., in the tidal flats). The main categories are further divided into 10-foot thick layers, as follows:

Under the Causeway:

Elevation –10 to –20 msl
- Total Unit Weight = 96 pcf (Saturated)
- Average Undrained Shear Strength = 630 psf

Elevation –20 to –30 msl
- Total Unit Weight = 86 pcf (Saturated)
- Average Undrained Shear Strength = 770 psf

Elevation –30 to –40 msl
- Total Unit Weight = 80 pcf (Saturated)
- Average Undrained Shear Strength = 900 psf

Off of the Causeway:

Elevation 0 to –10 msl
- Total Unit Weight = 94 pcf (Saturated)
- Average Undrained Shear Strength = 180 psf

Elevation –10 to –20 msl
- Total Unit Weight = 88 pcf (Saturated)
- Average Undrained Shear Strength = 240 psf

Elevation –20 to –30 msl
- Total Unit Weight = 78 pcf (Saturated)
- Average Undrained Shear Strength = 310 psf

Elevation –30 to –40 msl
- Total Unit Weight = 80 pcf (Saturated)
- Average Undrained Shear Strength = 380 psf

Consolidation:

Three one-dimensional consolidation tests were performed on undisturbed samples of the organic silt deposit. Two samples were obtained from locations beneath the Causeway, and one sample was from an off Causeway location. The test data indicates the deposits beneath the Causeway are normally consolidated and the soils off the Causeway may have some slight over-consolidation (less than 100 psf). The tests provide soil parameters for the three following characteristics:

Primary Compression: This is the amount of soil compression that occurs while excess pore pressures dissipate after a new load is applied. Primary compression is evaluated using the Compression Index (C_c), and/or the Compression Ratio (C_e), parameters determined from the consolidation test, as well as the Recompression Index (C_r), and/or the Recompression Ratio (C_{re}). C_c is the slope of the virgin compression (steep) portion of the void ratio versus the log of the applied load curve, obtained from the test. C_e is the slope of the virgin compression portion of the percent strain versus the log of the applied load curve, also obtained from the test. The recompression parameters represent the flatter portion of the curve, generated when loads are being re-applied. The void ratios and strains used to develop the laboratory test curves used for this project reflect conditions near the end of primary compression, and were constructed to separate out secondary compression effects. Values obtained from the laboratory tests include the following:

- C_c, (virgin compression): 0.57 to 0.99
- C_c' (over stress range of concern): 0.37 to 0.51 (reflecting the slope of the curve over the anticipated stress range imposed by the proposed cover system)

- C_e, (virgin compression): 0.12 to 0.15
- C_e', (over stress range of concern): 0.07 to 0.11

- C_r: 0.04 to 0.11
- C_{re}: 0.011 to 0.017

Rate of Compression: The rate of primary compression is evaluated through the use of the coefficient of consolidation parameter (c_v), which can be derived from consolidation tests. This parameter reflects how fast the soil consolidates when loaded. Values determined from the testing program include the following:

- c_v (under Causeway): 0.006 to 0.0008 square inches per second (in^2/sec) (3.5 to 0.5 square feet per day [ft^2/day])
- c_v (off Causeway): 0.01 in^2 /sec (6.5 ft^2/day)

Secondary Compression: Secondary compression is the slow, continued compression that occurs after the excess pore pressures have substantially dissipated. This compression occurs over long periods of time and is often more pronounced for organic soils. The magnitude of secondary compression is expressed by the slope of the final portion of the log of time versus percent strain compression curve for each load increment applied during the consolidation test. Values of the Coefficient of Secondary Compression (C_a), determined from the tests include the following:

- C_a (all 3 tests, at highest applied load): 0.015 to 0.044
- C_a (under Causeway samples, at design applied load): 0.001 to 0.011
- C_a: (off Causeway samples, at design applied loads): 0.003.

ASTM	American Society for Testing and Materials
bgs	below ground surface
BRAC	Base Closure and Realignment
C_a	Coefficient of Secondary Compression
C_c	Compression Index
C_e	Compression Ratio
C_r	Recompression Index
C_{re}	Recompression Ratio
C_v	Coefficient of Consolidation Parameter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
^{o}	degrees
EE/CA	Engineering Evaluation/Cost Analysis
ft^2/day	square feet per day
FW	Foster Wheeler Environmental Corporation
Harding	Harding ESE, a MACTEC Company
HLA	Harding Lawson Associates
in^2/sec	square inches per second
Meridian	Meridian Engineering Corporation
msl	mean sea level
NCP	National Contingency Plan
NCRA	Non-Time-Critical Removal Action
pcf	pounds per cubic foot
PID	photoionization detector
ppm	parts per million
psf	pounds per square foot
psi	pounds per square inch
SAEP	Stratford Army Engine Plant
SOPs	Standard Operating Procedures
STL	Severn Trent Laboratories

USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

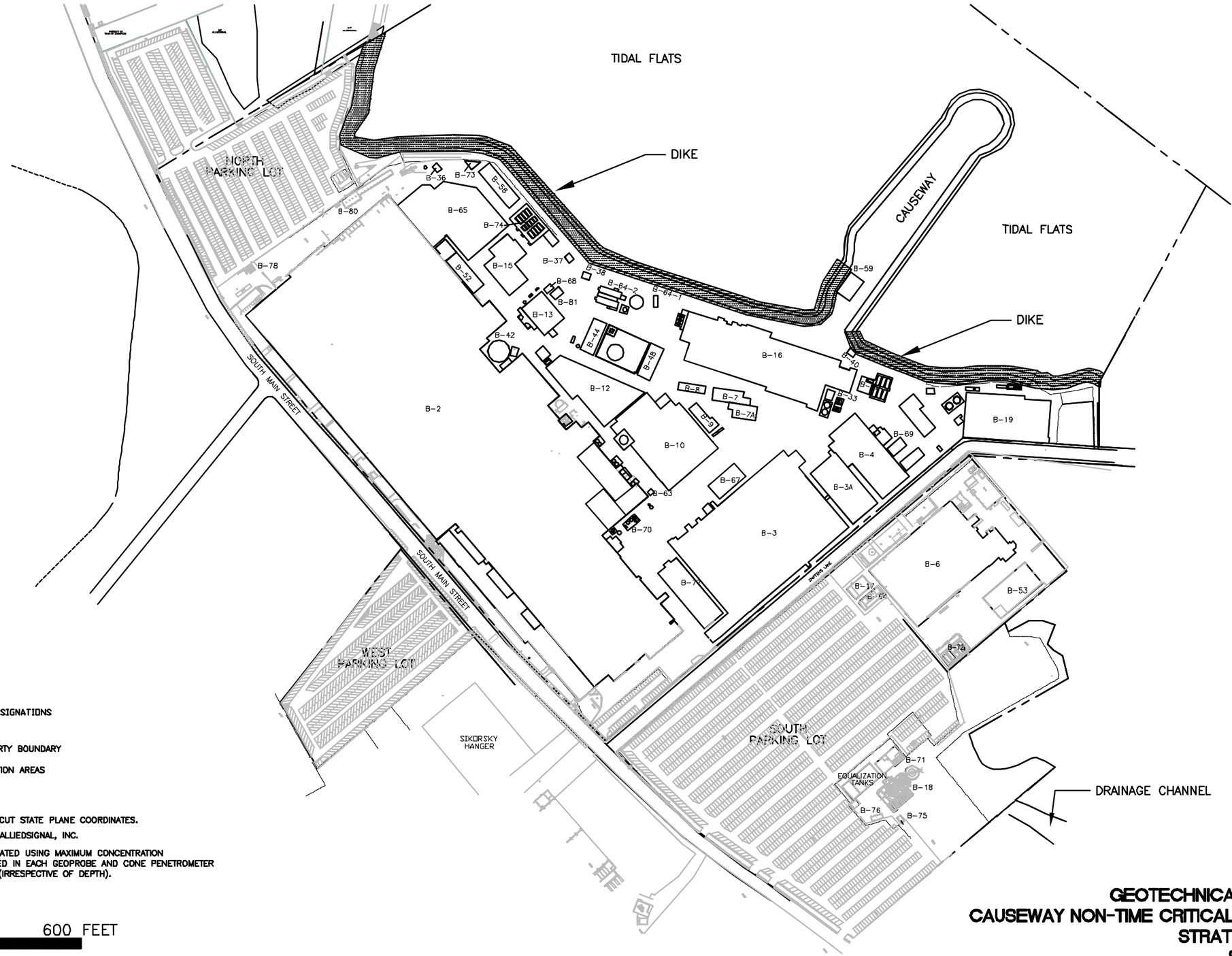
Foster Wheeler Environmental Corporation (FW)/Harding Lawson Associates, Inc. (HLA), 1999. Final Work Plan for the Non-time-Critical Removal Action for Chromium and VOC Groundwater Operable Unit (OU 2) EE/CA, Stratford Army Engine Plant. Prepared for the U.S. Army Corps of Engineers – New England District. August 27, 1999.

Foster Wheeler Environmental Corporation (FW)/Harding Lawson Associates, Inc. (HLA) 2000a. Pre-design Investigation Report Causeway and Dike NCRA, prepared for the U.S. Army Corps of Engineers – New England District, April 14, 2000.

Foster Wheeler Environmental Corporation (FW)/Harding Lawson Associates, Inc. (HLA) 2000b. Final Engineering Evaluation/Cost Analysis for the Causeway and Dike, Stratford Army Engine Plant. Prepared for the U.S. Army Corps of Engineers – New England District. September 22, 2000.

GeoTesting Express, Inc., 2000a. Geotechnical Test Results, Stratford Army Engine Plant facility, Stratford, CT., prepared for Harding Lawson Associates, Inc., Portland, ME. Boxborough, MA., November 22, 2000.

GeoTesting Express, Inc., 2000b. Geotechnical Test Results, Stratford Army Engine Plant facility, Stratford, CT., prepared for Harding Lawson Associates, Inc., Portland, ME. Boxborough, MA., December 6, 2000.



LEGEND

B-53	BUILDING DESIGNATIONS
	SEA WALL
	SAEP PROPERTY BOUNDARY
	REMOVAL ACTION AREAS

NOTES:
1. MAP IS IN CONNECTICUT STATE PLANE COORDINATES.
2. BASE MAP SOURCE: ALLIEDSIGNAL, INC.
3. EXCEEDANCES DELINEATED USING MAXIMUM CONCENTRATION OF THE VOC DETECTED IN EACH GEOPROBE AND CONE PENETROMETER SAMPLING LOCATION (IRRESPECTIVE OF DEPTH).

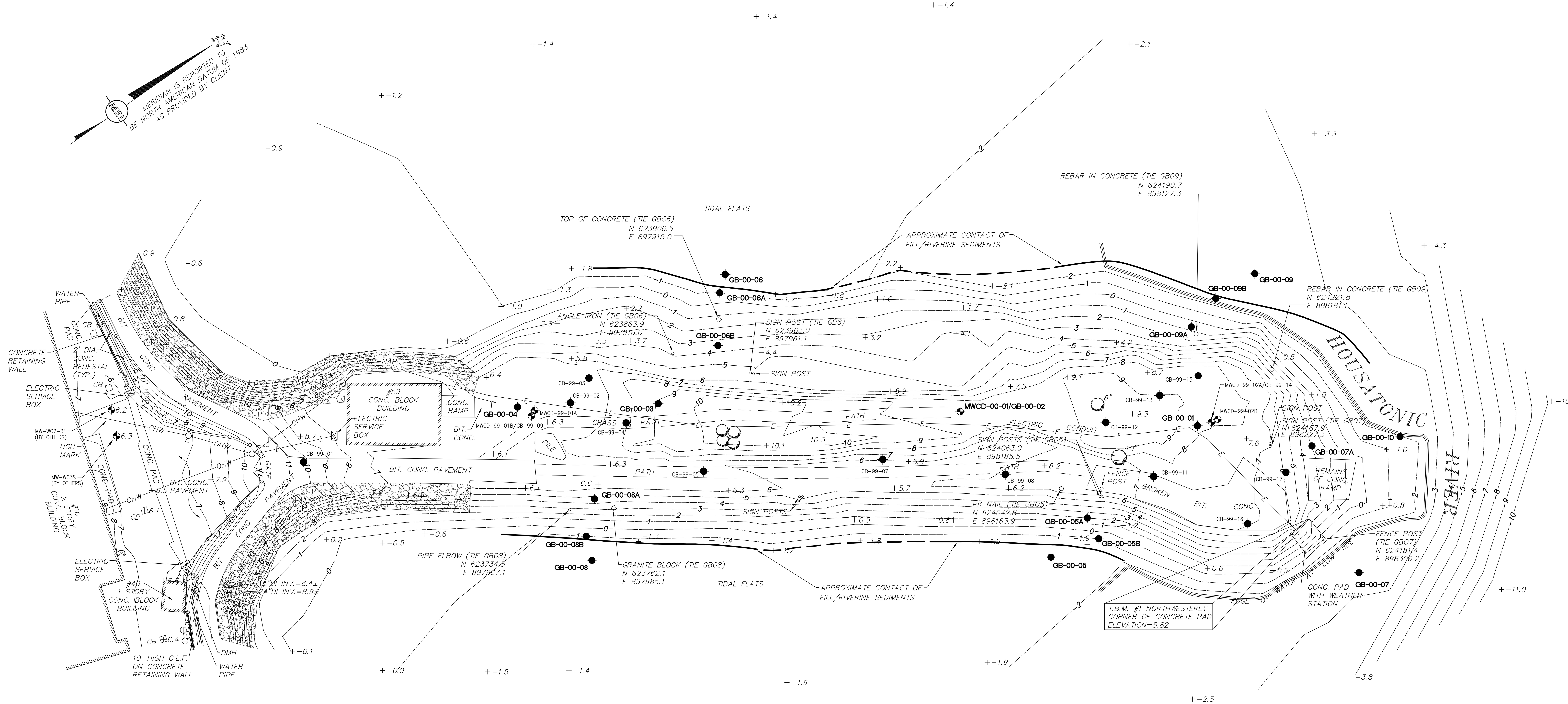
0 150 300 600 FEET

SCALE: 1"=300'

FIGURE 1-1
SITE FEATURES
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Harding ESE
A MACTEC COMPANY

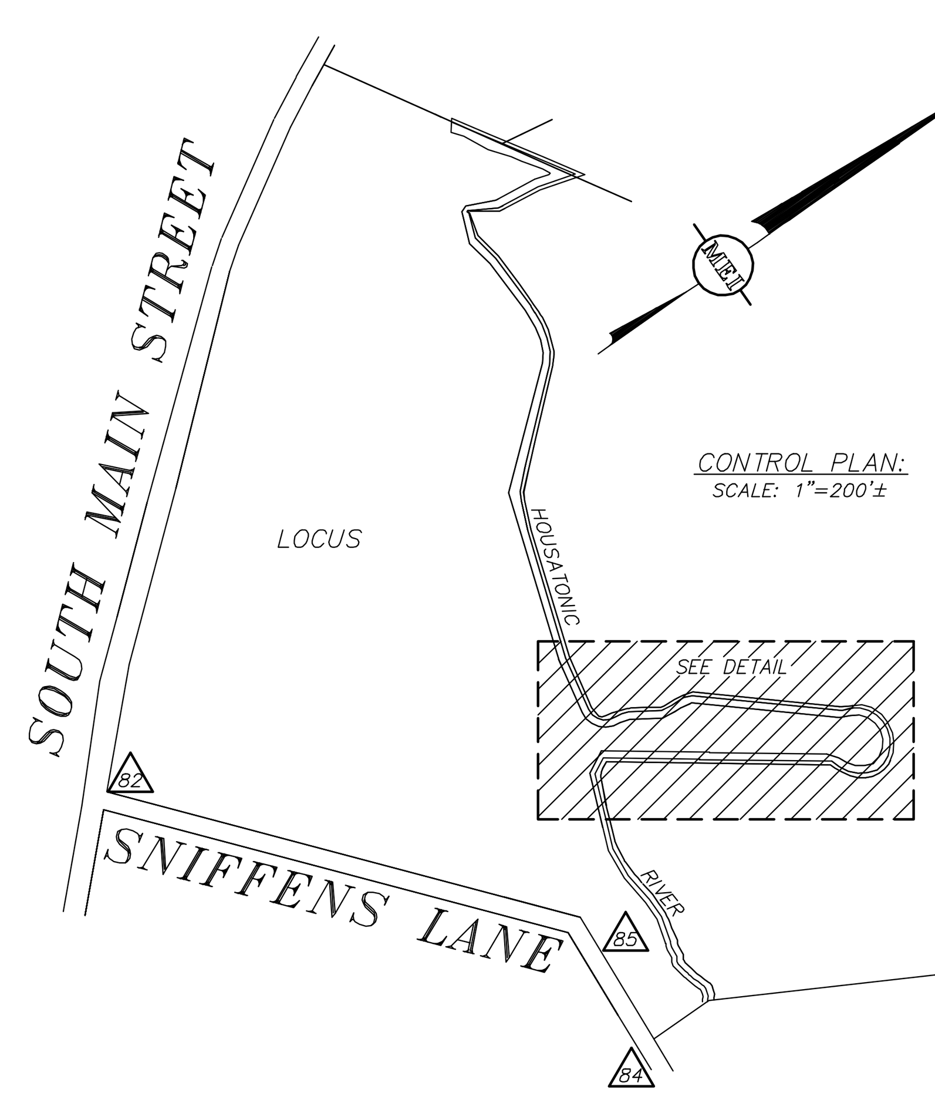
G:\PROJECTS\TERCS\PROJECTS\D020\CAUSEWAY\FIGURES\46879007.DWG 12/12/00



CONTROL POINTS:

(SEE NOTE #3)

CONTROL POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
82	622340.109131	897135.274591	7.240	F-15
84	623142.399102	898645.030716	10.550	F-23
85	623212.133802	898244.245717	7.350	F-24



LEGEND

CONC.	CONCRETE
BIT. CONC.	BITUMINOUS CONCRETE
DIA.	DIAMETER
CB	CATCH BASIN
C.L.F.	CHAIN LINK FENCE
	RETAINING WALL
4	1' CONTOUR
5	5' CONTOUR
+7.9	SPOT GRADE
	MONITORING WELL
	GROUND BORING
UGU	UNDERGROUND UTILITY MARK
	APPROXIMATE CONTACT OF FILL/RIVERINE SEDIMENTS (DASHED WHERE INFERRED)
CB-99-01	BORINGS INSTALLED FOR PRE-DESIGN INVESTIGATION
GB-00-08	BORINGS INSTALLED FOR GEOTECHNICAL INVESTIGATION
OHW	OVERHEAD WIRE
	WATER GATE
	BOLLARD
	ELECTRIC BOX
E	ELECTRIC CONDUIT
	HYDRANT
	DRAIN MANHOLE
D.I.	DUCTILE IRON
INV.	INVERT
	RIP-RAP

NOTES:

1. THE SOLE PURPOSE OF THIS PLAN IS TO DEPICT THE TOPOGRAPHY SITE DETAIL AND LOCATIONS OF WELLS, BORINGS FROM A PARTIAL FIELD SURVEY CONDUCTED BETWEEN OCTOBER 16 & 17, 2000.
2. THE LOCATIONS OF THE POINTS DEPICTED HEREON ARE FOR PICTORIAL PURPOSES ONLY. FOR POINT COORDINATE INFORMATION AND ELEVATION SEE ACCESS FILE PRODUCED BY MERIDIAN ENGINEERING, INC.
3. HORIZONTAL AND VERTICAL CONTROL POINTS WERE PROVIDED BY MICHAEL G. WILMES, L.S. OF URS GREINER WOODWARD CLYDE. THE DATUMS WERE REPORTED TO BE ON THE NORTH AMERICAN DATUM OF 1983 AND NATIONAL GEODETIC VERTICAL DATUM OF 1929.
4. NO UTILITIES ARE DEPICTED ON THIS PLAN EXCEPT THE ELECTRIC CONDUIT LOCATED WITHIN THE PENINSULA.
5. PROPERTY LINES ARE NOT DEPICTED ON THIS PLAN. MERIDIAN ENGINEERING INC. DOES NOT OFFER ANY OPINION AS TO THE LOCATION OF THE PROPERTY LINES.
6. THIS PLAN IS A TOPOGRAPHIC SURVEY IN ACCORDANCE WITH THE MOST RECENT CONNECTICUT ASSOCIATION OF LAND SURVEYORS, RECOMMENDED STANDARDS FOR SURVEY AND MAPS IN THE STATE OF CONNECTICUT. THIS MAP CONFORMS WITH A CLASS V2 VERTICAL ACCURACY AND CLASS T-1 TOPOGRAPHIC SURVEY ACCURACY.
7. BASE MAP PRODUCED BY MERIDIAN ENGINEERING, INC.. SHEET 1 OF 1 ENTITLED "RECORD CONDITIONS PLAN OF LAND LOCATED IN STRATFORD CONNECTICUT". DATED OCTOBER 25, 2000.

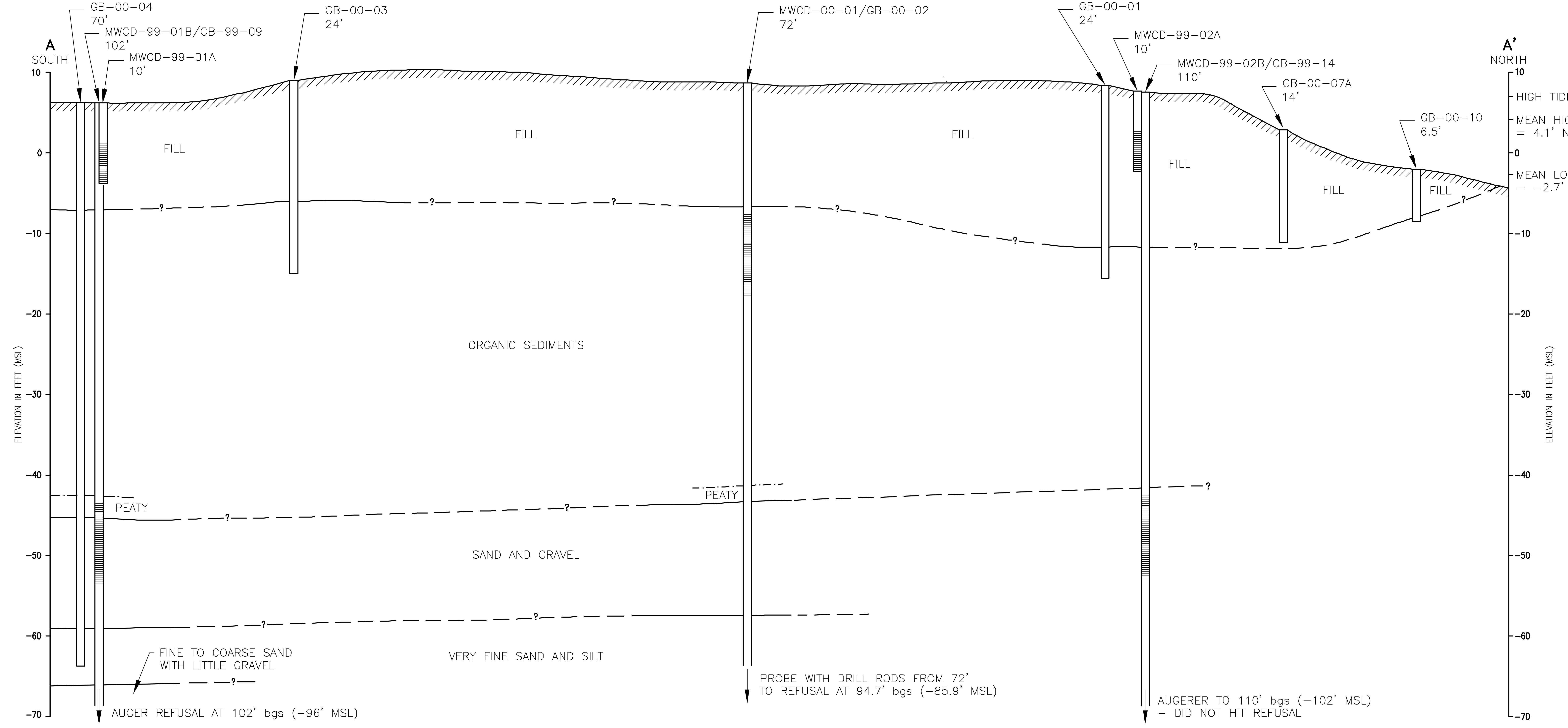
FIGURE 2-1
EXPLORATION LOCATION PLAN
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

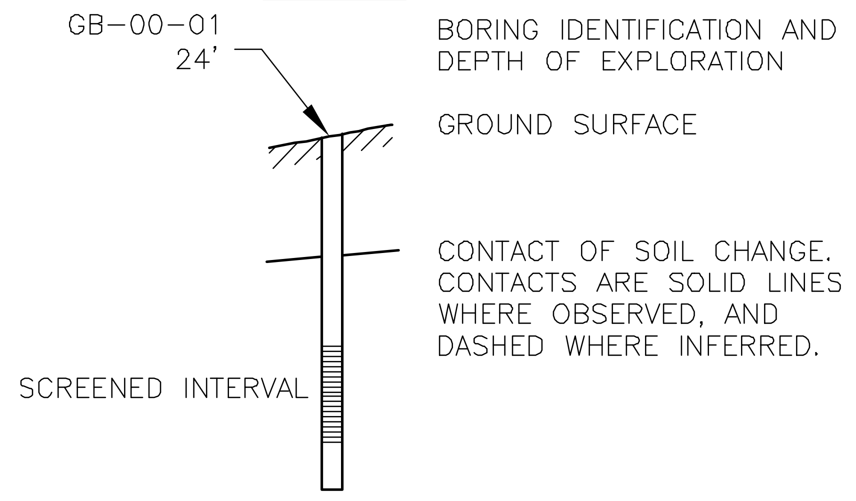
Harding ESE
A MACTEC COMPANY


MERIDIAN IS REPORTED TO BE NORTH AMERICAN DATUM OF 1983 AS PROVIDED BY CLIENT
TIDAL FLATS
HIGH TIDE = 7' NGVD
MEAN HIGH TIDE = 4.1' NGVD
MEAN LOW TIDE = -2.7' NGVD
HOUSATONIC RIVER
#59 CONC. BLOCK BUILDING
#16 2 STORY CONC. BLOCK BUILDING
#40 1 STORY CONC. BLOCK BUILDING
BIT. CONC. PAVEMENT
REMAINS OF CONC. RAMP
EDGE OF WATER AT LOW TIDE
GB-00-01
GB-00-03
GB-00-04
GB-00-05
GB-00-05A
GB-00-05B/V-1, V-2
GB-00-06/V-3, V-4, V-5
GB-00-06A
GB-00-06B
GB-00-07
GB-00-07A
GB-00-08/V-9, V-10, V-11
GB-00-08A
GB-00-08B
GB-00-09/V-6, V-7, V-8
GB-00-09A
GB-00-09B
GB-00-10
MWCD-00-01/GB-00-02
LEGEND
CONC. CONCRETE
BIT. CONC. BITUMINOUS CONCRETE
DIA. DIAMETER
CB CATCH BASIN
C.L.F. CHAIN LINK FENCE
RETAINING WALL
1' CONTOUR
5' CONTOUR
MONITORING WELL
GROUND BORING
UGU UNDERGROUND UTILITY MARK
OHW OVERHEAD WIRE
WATER GATE
BOLLARD
ELECTRIC BOX
E ELECTRIC CONDUIT
HYDRANT
DRAIN MANHOLE
D.I. DUCTILE IRON
INV. INVERT
RIP-RAP
APPROXIMATE CONTACT OF FILL/RIVERINE SEDIMENTS (DASHED WHERE INFERRED)
CB-99-01 BORINGS INSTALLED FOR PRE-DESIGN INVESTIGATION
GB-00-08 BORINGS INSTALLED FOR GEOTECHNICAL INVESTIGATION
A A' GEOLOGIC PROFILE LOCATION
L-100 R-100 V-4 GEONOR PROBE LOCATION
HIGH TIDE = 7' NGVD
MEAN HIGH TIDE = 4.1' NGVD
MEAN LOW TIDE = -2.7' NGVD
CONTROL PLAN: SCALE: 1"=200'±
SOUTH MAIN STREET
SNIFFENS LANE
LOCUS
0 20 40
Scale in feet

FIGURE 2-2
GEOLOGIC PROFILES AND GEONOR SAMPLING LOCATIONS
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Harding ESE
A MACTEC COMPANY





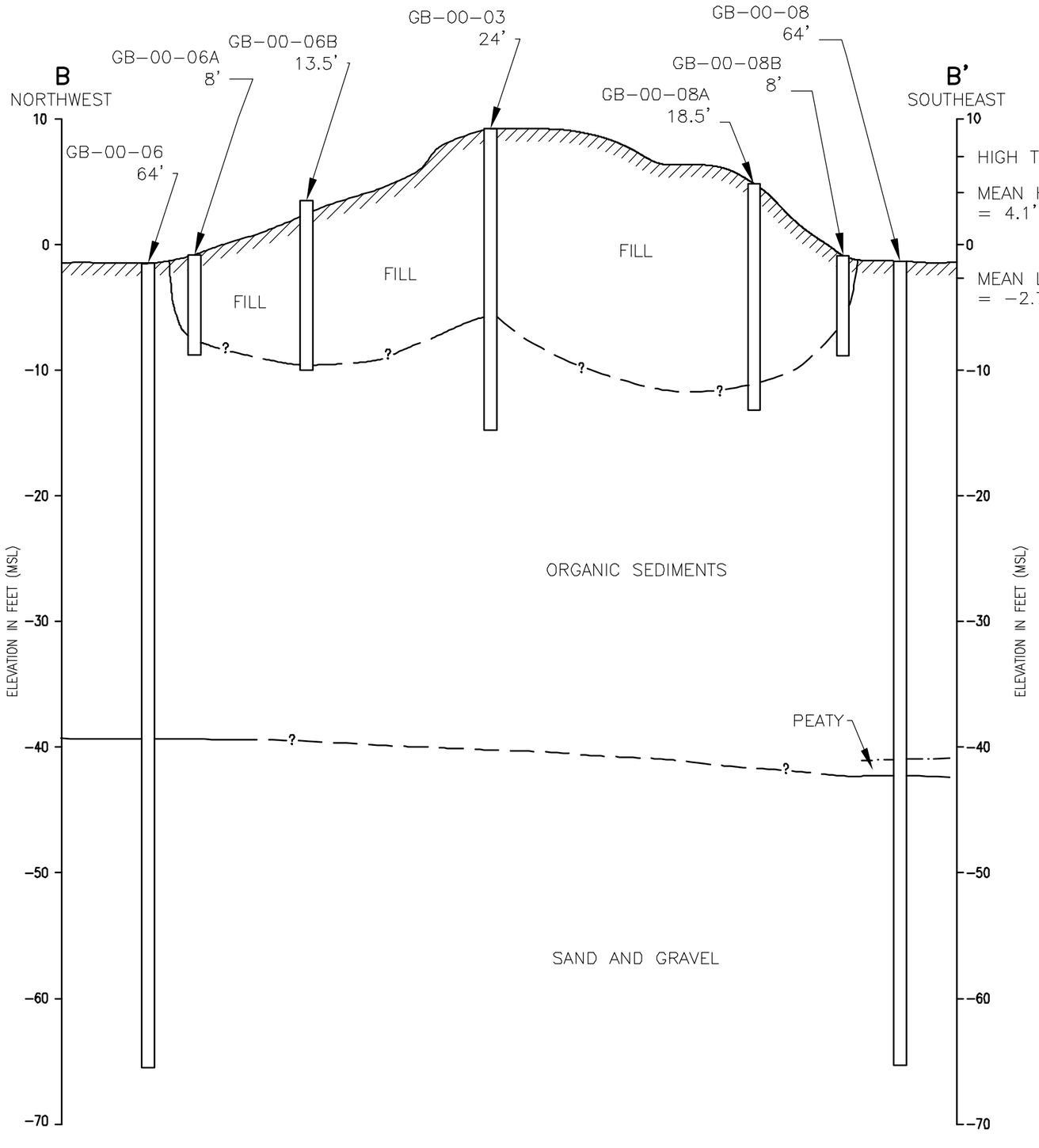
NOTES:

1. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
2. LOCATION OF PROFILE IS SHOWN ON FIGURE 2-2.

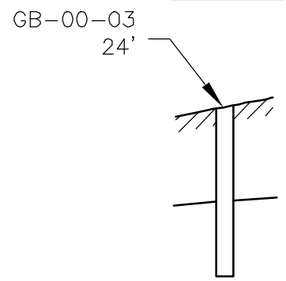
0 20 40
Scale in feet
VERTICAL EXAGGERATION 4:1

FIGURE 2-3
GEOLOGIC PROFILE A-A'
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Harding ESE
A MACTEC COMPANY



LEGEND



BORING IDENTIFICATION AND DEPTH OF EXPLORATION

GROUND SURFACE

CONTACT OF SOIL CHANGE. CONTACTS ARE SOLID LINES WHERE OBSERVED, AND DASHED WHERE INFERRED.

NOTES:

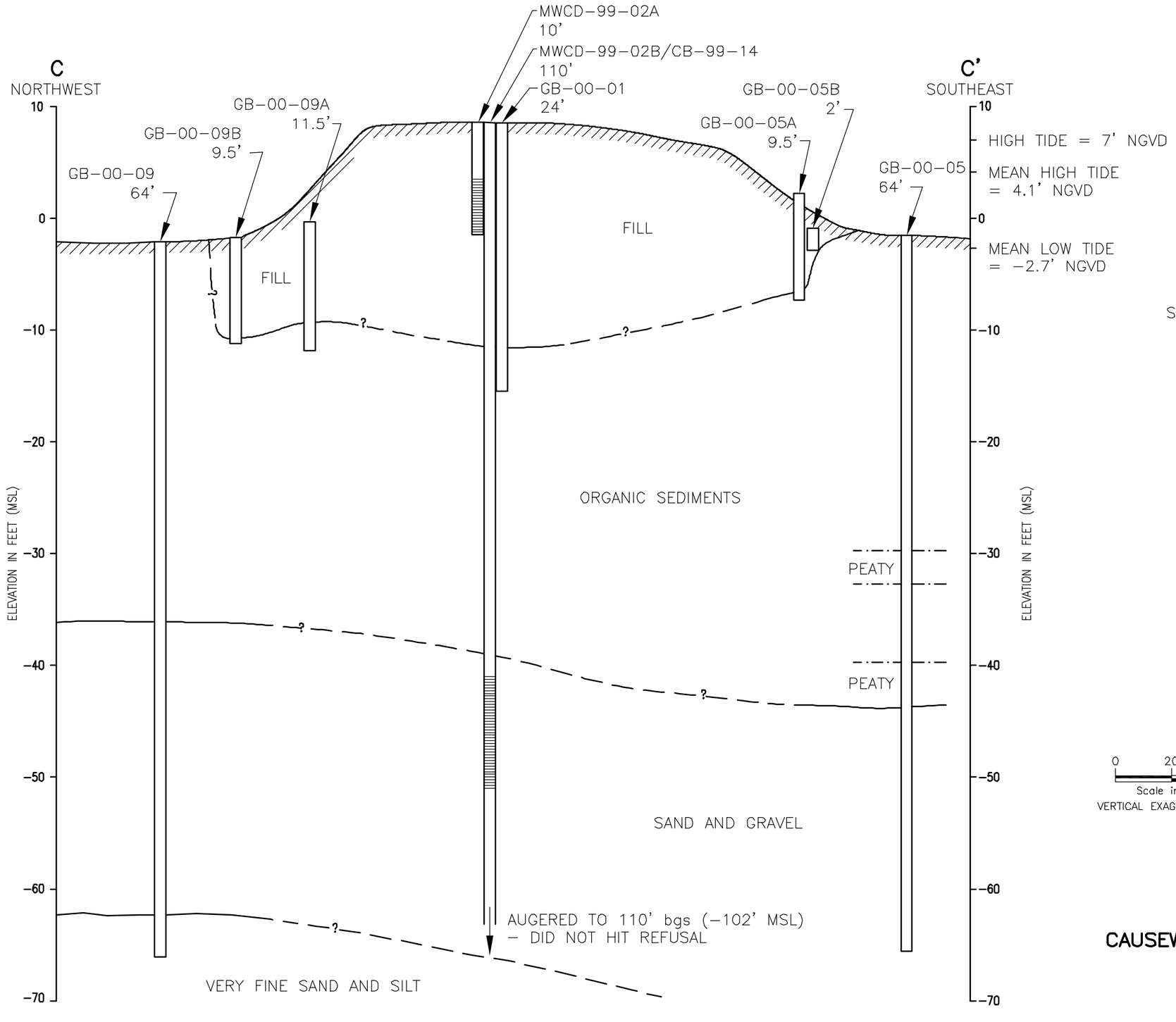
1. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
2. LOCATION OF PROFILE IS SHOWN ON FIGURE 2-2.

0 20 40
Scale in feet
VERTICAL EXAGGERATION 4:1

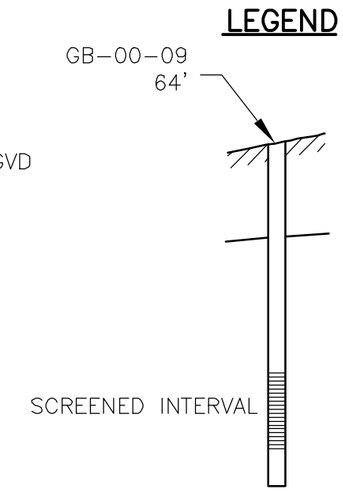
FIGURE 2-4
GEOLOGIC PROFILE B-B'
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Harding ESE
A MACTEC COMPANY

P:\CAD\Data2\50796\C50796002.dwg Tue, 10 Jul 2001 - 2:34pm jphanley



LEGEND



BORING IDENTIFICATION AND DEPTH OF EXPLORATION

GROUND SURFACE

CONTACT OF SOIL CHANGE. CONTACTS ARE SOLID LINES WHERE OBSERVED, AND DASHED WHERE INFERRED.

NOTES:

1. PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
2. LOCATION OF PROFILE IS SHOWN ON FIGURE 2-2.

0 20 40
Scale in feet
VERTICAL EXAGGERATION 4:1

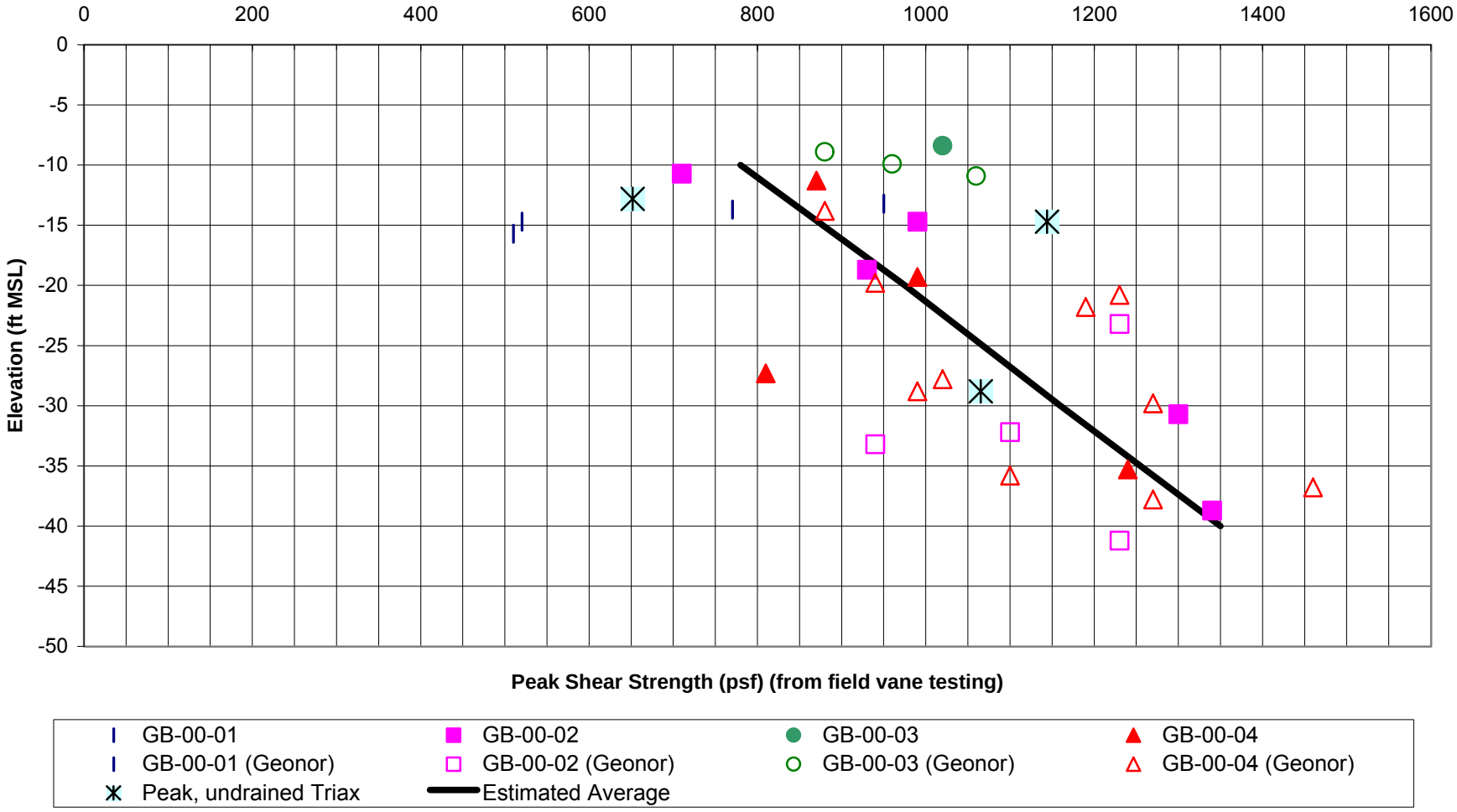
FIGURE 2-5
GEOLOGIC PROFILE C-C'
GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Harding ESE
A MACTEC COMPANY

P:\CAD\Data2\50796\C50796003.dwg Tue, 10 Jul 2001 - 2:37pm jphanley

Figure 2-6
Peak Shear Strength vs Elevation Under the Causeway

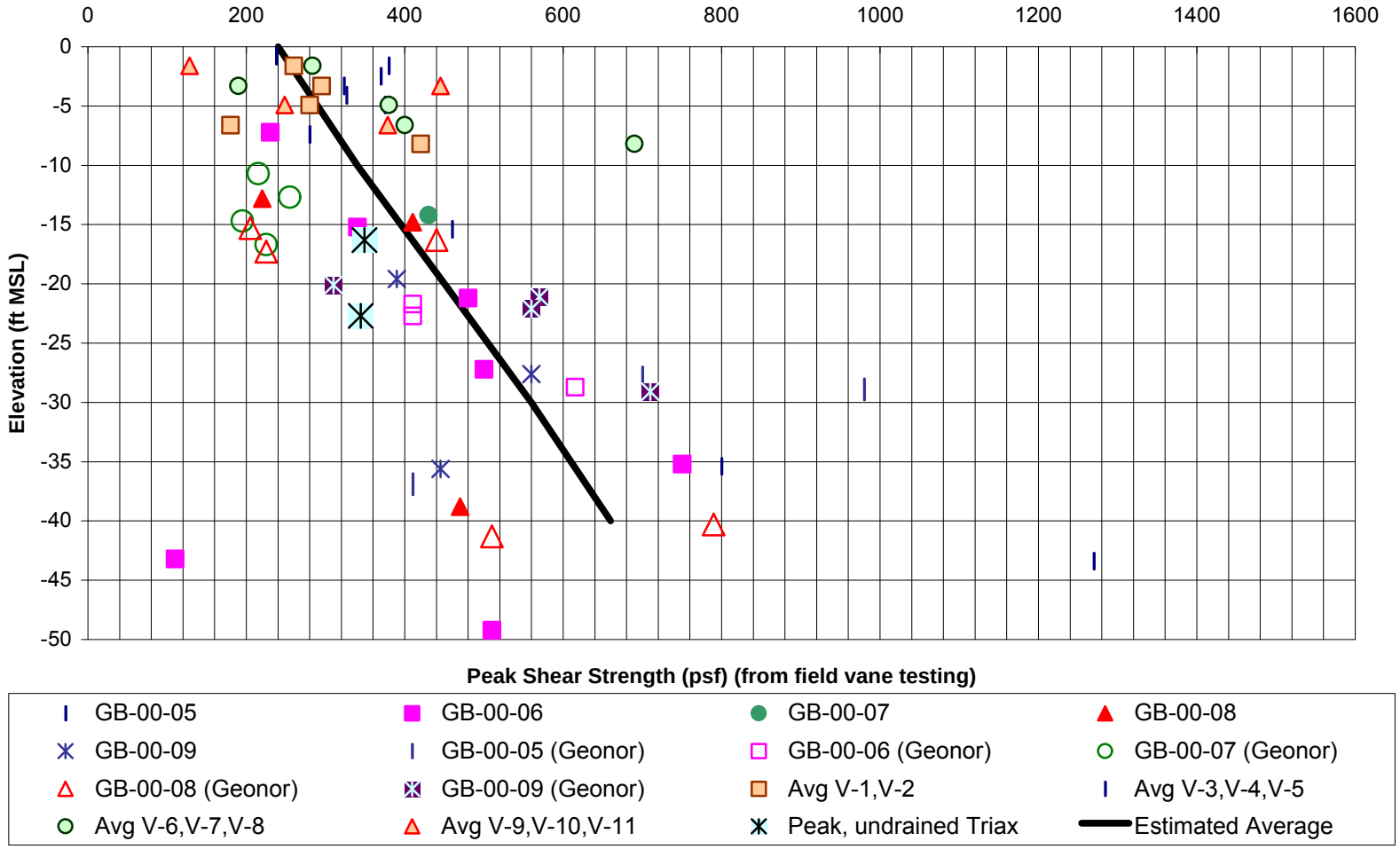
Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design



p:\projects\cbdcom\saep\causeway\geotech\field vanes\Table4-1.xls
Peak Under

Figure 2-7
Peak Shear Strength vs. Elevation Off the Causeway

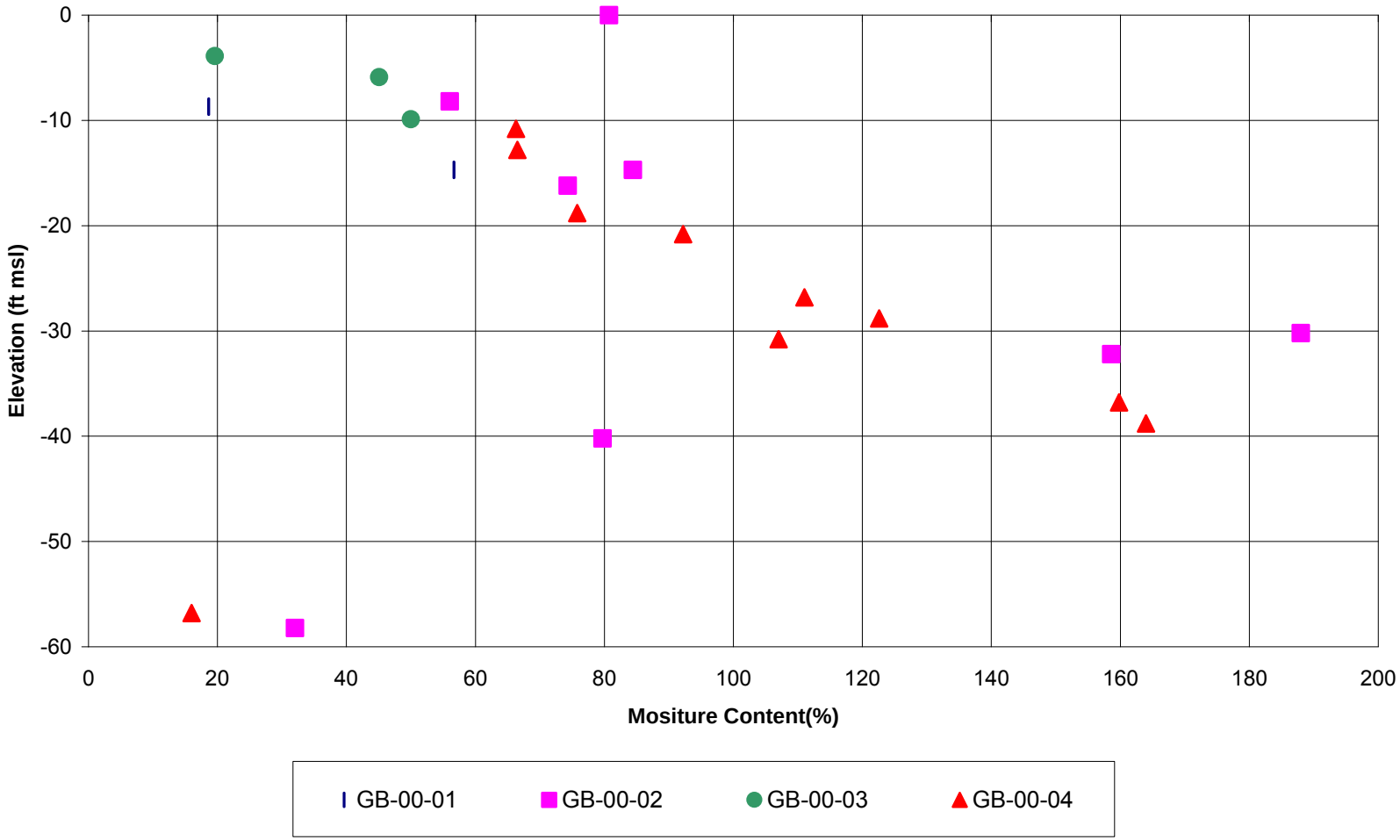
Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design



p:\projects\cbdcom\saep\causeway\geotech\field vanes\Table4-1.xls
Peak Off

Figure 3-1
Moisture Content vs. Elevation Under the Causeway

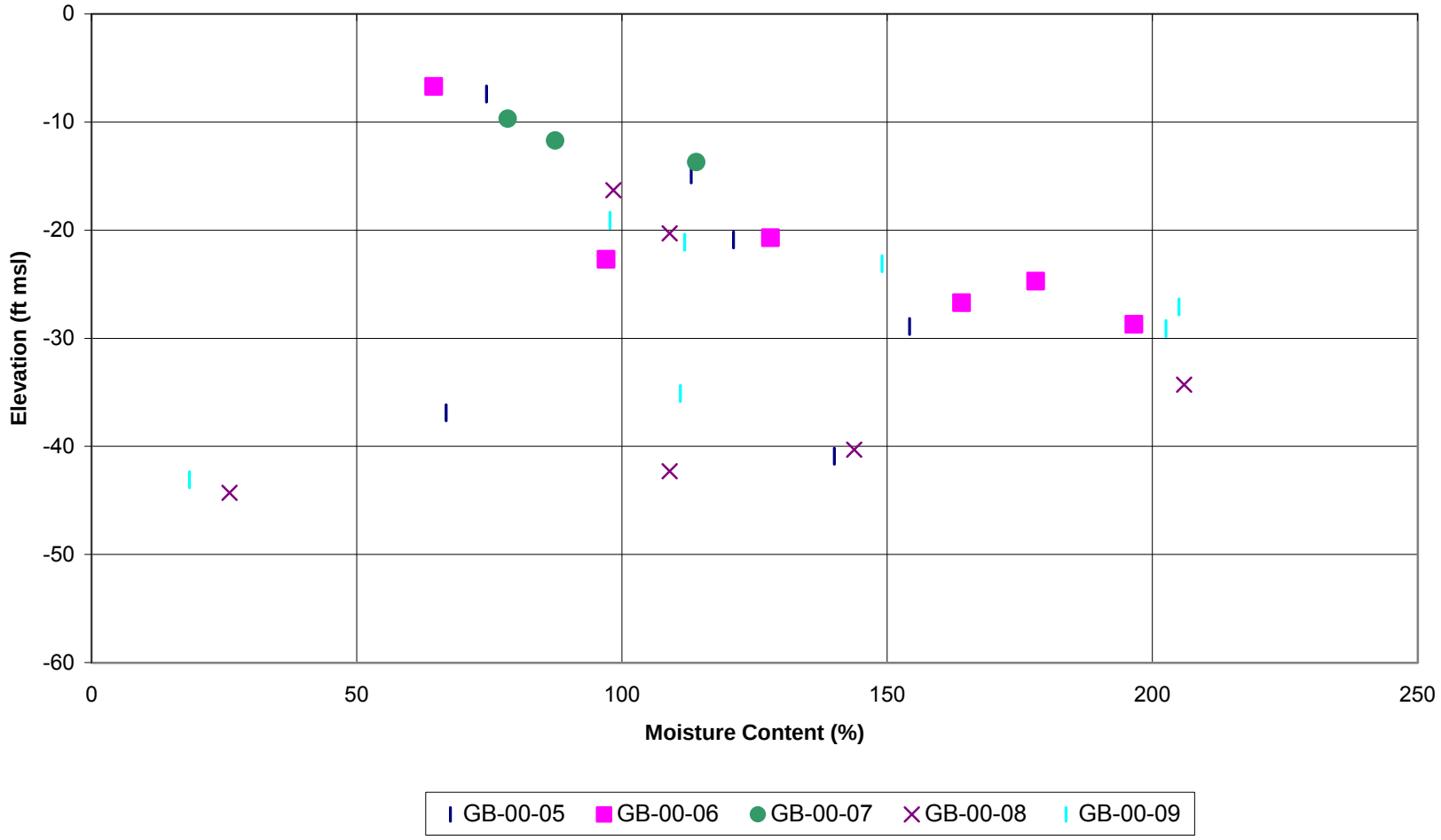
Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design



p:\projects\cbdcom\saep\causeway\geotech\lab data.xls
Moist vs Elev Under

Figure 3-2
Moisture Content vs. Elevation Off the Causeway

Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design



p:\projects\cbdcom\saep\causeway\geotech\lab data.xls
Moist vs Elev Off

Figure 4-1
Design Shear Strength Values Under the Causeway

Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design

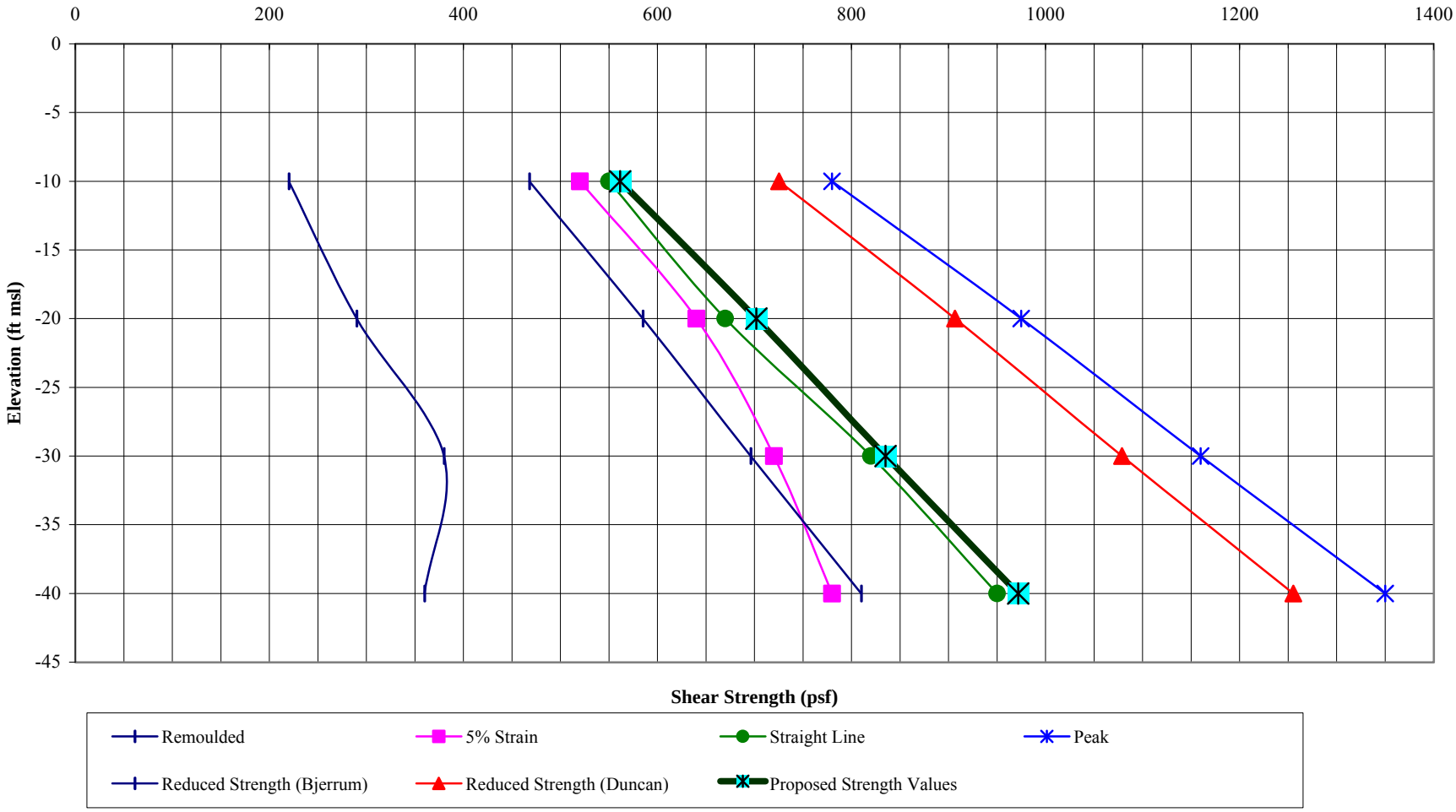
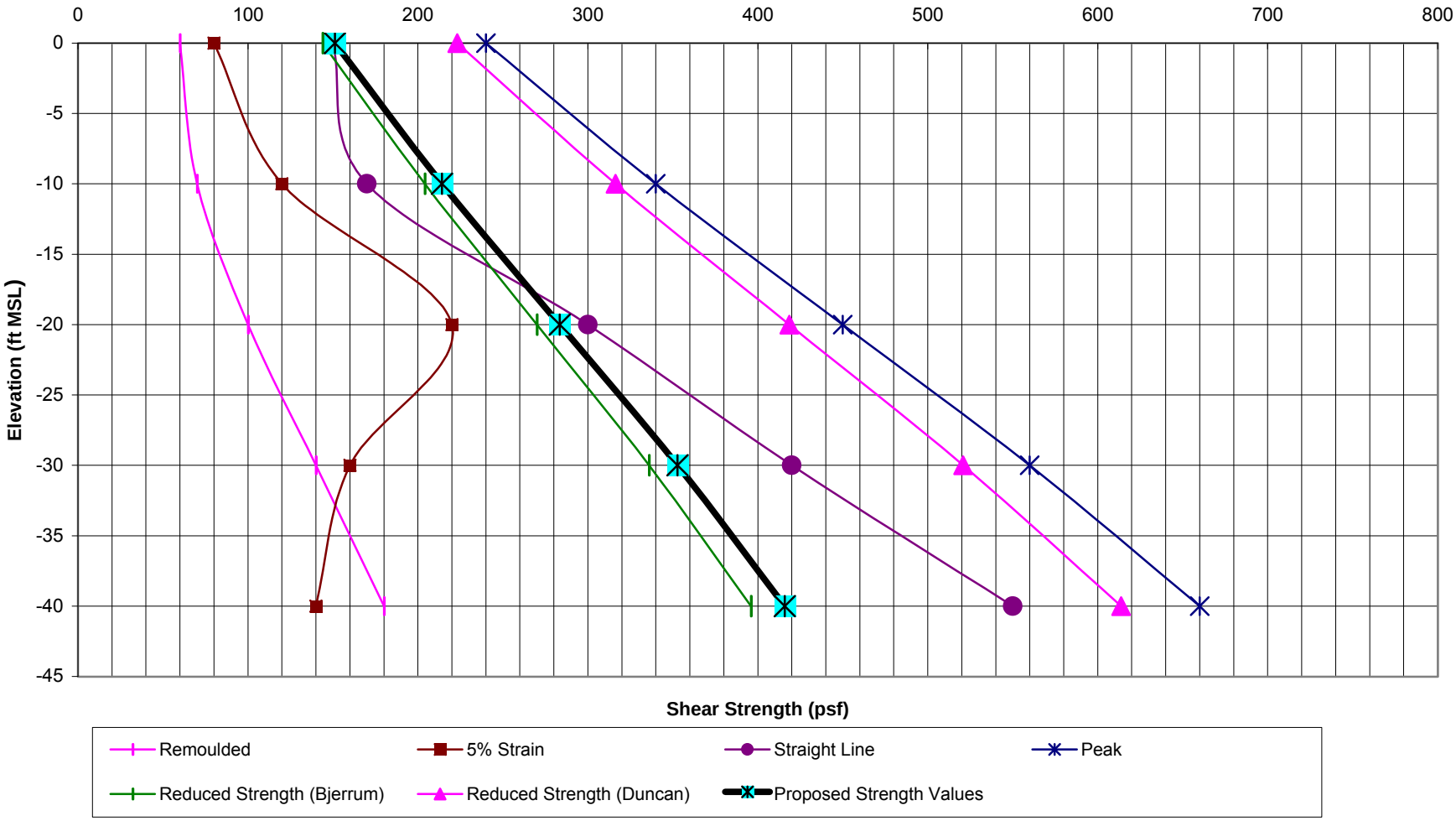


Figure 4-2
Design Shear Strength Values Off of the Causeway

Geotechnical Investigation Summary
Causeway Non-time Critical Removal Action Design



p:\project\cbdcom\saep\causeway\geotech\field vanes\Table4-1.xls
Design Off

TABLE 2-1
FIELD INVESTIGATION PROGRAM

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Soil Boring ID	Ground Surface Elevation (ft, msl)	Total Exploration Depth (ft)	Number of In-Situ Tests/Samples		
			Split Spoons[1]	Shelby Tubes[2]	Field Vane Shear[3]
GB-00-01	8.3	24	9	1	1
GB-00-02	8.8	94.7	23	4-3	6
GB-00-03	9.1	24	7	1	1
GB-00-04	6.2	70	22	4	4
GB-00-05	-1.9	64	21	5-2	4
GB-00-05A	2.0 (4)	9.5	3		
GB-00-05B	-1.0 (4)	2	1		
GB-00-06	-1.7 (4)	64	22	3-2	7
GB-00-06A	-1.0 (4)	8	4		
GB-00-06B	3.5 (4)	13.5	1		
GB-00-07	-2.7 (4)	24	8	2	2
GB-00-07A	2.9	14	5		
GB-00-08	-1.3 (4)	64	28	2	3
GB-00-08A	4.5 (4)	18.5	3		
GB-00-08B	-1.0 (4)	8	4		
GB-00-09	-2.1 (4)	64	26	2	3
GB-00-09A	0.6 (4)	11.5	3		
GB-00-09B	-2.1 (4)	9.5	3		
GB-00-10	-2.0 (4)	6.5	1		
		TOTAL	194	24-19	31

Notes:

1. Split spoon sampling was performed in accordance with American Society for Testing and Materials (ASTM) D1586 - Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.
2. Shelby Tubes were collected in accordance with ASTM D1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils. Samples were shipped to the laboratory via a dedicated courier service to reduce sample disturbance. Where 2 numbers are present, first number is total collected in the field; second number is total analyzed by laboratory.
3. Field vane shear testing was performed in accordance with ASTM D2573 - Standard Test Method for Field Vane Shear Test in Cohesive Soil and the procedure provided by the manufacturer of the vane used.
4. Estimated elevation, based on site topography, Figure2-1.

ft = feet
msl = mean sea level, NGVD

TABLE 2-2
FIELD VANE SHEAR TEST RESULTS

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Boring ID	Depth[1], ft	Vane Shear, Results Peak		Vane Shear, Results Straight Line		Vane Shear Residual (psf)	Shear @ 5% Strain (psf)	Moisture Content (%)
		Strength (psf)	Strain (Radial, %)	Strength (psf)	Strain (Radial, %)			
GB-00-01	21.5	950	19	780	6	340	650	-
GB-00-02	19.5	710	28	460	6	280	320	-
GB-00-02	23.5	990	27	900	19	220	300	84.4
GB-00-02	27.5	930	28	700	13	280	300	-
GB-00-02	37.5	Poor test- Data not used- Likely pushed an object						-
GB-00-02	39.5	1300	17	950	6	370	900	188
GB-00-02	47.5	1340	42	800	5	400	800	-
GB-00-03	17.5	1020	14	640	4	340	700	-
GB-00-04	17.5	870	22	600	7	220	450	66.3
GB-00-04	25.5	990	38	600	5	250	550	75.8
GB-00-04	33.5	810	17	500	6	500	450	111
GB-00-04	41.5	1240	33	900	9	370	650	-
GB-00-05	5.5	280	24	240	17	180	70	74.4
GB-00-05	13.5	460	22	310	7	90	220	113
GB-00-05	33.5	800	60	700	43	460	100	-
GB-00-05	41.5	1270	38	1100	25	310	210	-
GB-00-06	5.5	230	26	180	13	40	100	64.5
GB-00-06	13.5	340	21	240	10	90	200	-
GB-00-06	19.5	480	22	400	13	76	200	128
GB-00-06	25.5	500	25	400	15	90	150	164
GB-00-06	33.5	750	44	550	15	140	175	-
GB-00-06	41.5	110	22	90	12	15	60	-
GB-00-06	47.5	510	28	470	14	220	250	-
GB-00-07	5.5	Poor test- Data not used- Barge moving due to waves						-
GB-00-07	11.5	430	15	430	15	90	150	114
GB-00-08	11.5	220	17	160	8	-	100	-
GB-00-08	13.5	440	18	440	18	76	110	-
GB-00-08	37.5	470	42	380	20	220	100	-
GB-00-09	17.5	390	25	370	20	30	80	97.7
GB-00-09	25.5	560	42	470	20	100	100	205
GB-00-09	33.5	445	28	330	14	90	110	111
Median		635	25	480	13	220	200	111
Maximum		1340	60	1100	43	500	900	205
Minimum		110	14	90	4	15	60	64.5

Notes:
psf = pounds per square foot
ft = feet
% = percent rotational strain, based on 100% = 90 degrees of rotation.
- = No data.
[1] Depths are measured to the middle of the Vane, typically 0.5 from the bottom of the 2 foot sampling interval.

TABLE 3-1
LABORATORY TESTING PROGRAM

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Test Category	Test Name	Standard[1]	Number of Tests
Index Properties	Grain Size (Sieve Only)	ASTM D 422	10
	Bulk Density	ASTM D 2937	19
	Moisture content[2]	ASTM D 2216	96
	Atterberg limits	ASTM D 4318	7
	Organic matter	ASTM D 2974	15
	Specific gravity	ASTM D 854	3
	Shelby Tube Opening (density, visual description, moisture contents, 3 each)	ASTM D 2937	19
Physical Properties	1-D consolidation test series (Note 1)	ASTM D 2435	3
	Triaxial compression (3-points each)	ASTM D 4767	5
	Laboratory vane testing on Shelby tubes (3 tests per tube)	NA	15

NOTES:
[1] Tests were performed in accordance with the requirements of the standard indicated, unless otherwise noted.
[2] Mositure content tests were performed on bulk samples (47), Atterberg limit tests (7), Ash content tests (15), tube openings 919), triaxial (5), and consolidation tests (3), as summarized on Table 3-3.

ASTM = Americal Society for Testing and Materials.
NA = not applicable.
Laboratory test results are provided in Appendix A. Tables 3-2 through 3-7 summarize laboratory test results.

TABLE 3-2
GRAIN SIZE DETERMINATION[1]

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Grain Size[1] Physical Description[2]	
		Laboratory Description	**Field Description**
GB-00-02	16-18	Visual description; Moist, very dark brown silty SAND. Sieve analysis; SILT OR CLAY, trace fine sand (ML)	Olive gray SILT; trace small fibers, slightly plastic, very well sorted, moderate sulfur smell, non-draining, micaceous, has decomposed peat feel to it; (ML)
GB-00-02	66-68	Visual description; Moist, very dark brown sandy SILT; Sieve analysis; SILT OR CLAY, trace fine to coarse sand (ML)	Olive gray SILT; finely laminated with occasional repetitive red laminae of clay; has dilatency; gives up water when vibrated (ML)
GB-00-04	44-46	Visual description; Moist, very dark brown SILT with sand and organics; Sieve analysis; SILT OR CLAY with organics, trace fine and medium sand (OL)	Very dark grayish brown SILT; trace of reeds, and woody plant fibers, trace fine sand, non-plastic, sulfur odor, non-draining (ML/OL)
GB-00-04	60-64	Visual description; Moist brown sand with gravel; Sieve analysis; Poorly graded SAND WITH GRAVEL (SP)	Gray, well-sorted fine-to-med. SAND; non-plastic, alluvium (SP); over ¼" manganese layer(?); then reddish to yellowish brown gravelly SAND; trace fines, well graded (SP)
GB-00-05	38-40	Visual description; Moist, very dark brown silty sand; Sieve analysis; SILT OR CLAY, little fine sand, trace medium and coarse sand (ML) with little organics	Layered peaty SILT and PEAT; peaty zones have reeds and wood with well decomposed peat (OL/PT)
GB-00-05	60-62	Visual description; Wet, gray sandy SILT; Sieve analysis; SILT, trace fine sand (ML)	Gray very fine SAND and SILT; with very thin purple CLAY lenses (SM/ML)
GB-00-06	22-24	Visual description; Moist, very dark brown silt; Sieve analysis; SILT OR CLAY, with trace organics, trace fine and medium sand (OL)	Very dark gray to very dark brown ORGANIC SILT; very soft, slightly plastic, trace undecomposed plant fibers, non-draining, non-dialating (OL)
GB-00-07	6-8	Visual description; Moist, very dark brown clay with sand; Sieve analysis; SILT OR CLAY, trace medium and fine sand (ML)	Gray SILT; soft, slightly plastic, some shells
GB-00-08	42-44	Visual description; Moist, light gray sandy clay; Sieve analysis; SILT OR CLAY, some fine sand (ML)	Gray, SILTY FINE SAND; dense, non-plastic (SM)
GB-00-09	20-22	Visual description; Moist, very dark brown sandy silt; Sieve analysis; CLAY, some silt, with organics, trace fine sand (OL)	Black to very dark gray organic SILT; non-plastic, micaceous, trace plant fibers, strong sulfur odor (OL)

NOTES:
[1] Testing performed in accordance with ASTM D422.
[2] Descriptions and description classifications are based on the Unified Soil Classification System (USCS).
bgs = below ground surface
ft = feet

TABLE 3-3
MOISTURE CONTENT[1]

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Moisture Content, % Bulk Sample Testing	Moisture Content, % Atterberg Limit Testing	Moisture Content, % Ash Content Testing	Moisture Content, % Tube Openings[2]	Moisture Content, % Triaxial[3] and Consolidation Testing[4]
GB-00-01	16-18	18.6		19		
GB-00-01	22-24	62.0	59.9	62	56.6	56.6
GB-00-02	16-18	56				
GB-00-02	23.5	84.4				
GB-00-02	24-26	74.3		74		
GB-00-02	30-32				80.6	
GB-00-02	38-40	188				
GB-00-02	40-42	184	176.1	184	158.6	167.1
GB-00-02	48-50				79.7	
GB-00-02	66-68	32				
GB-00-03	12-14	19.6		20		
GB-00-03	14-16	45.1				
GB-00-04	16-18	66.3				
GB-00-04	18-20		112.4		66.5	65.8
GB-00-04	24-26	75.8				
GB-00-04	26-28				92.2	104.5
GB-00-04	32-34	111				
GB-00-04	36-38	107		150		
GB-00-04	34-36	112	131.5	132	122.6	122.6
GB-00-04	42-44				160	
GB-00-04	44-46	164				
GB-00-04	60-64	16				
GB-00-05	5-5.5	74.4				
GB-00-05	12-14	113		113		
GB-00-05	18-20	121				
GB-00-05	26-28	108	90.1	125	154.2	198.2
GB-00-05	34-36				66.8	
GB-00-05	38-40	140		140		
GB-00-05	60-62	136				
GB-00-05A	7.5-9.5	42.2				
GB-00-06	4-6	64.5				
GB-00-06	18-20	128				
GB-00-06	22-24	178				
GB-00-06	20-22	145	139.5	145	97.0	97.2
GB-00-06	24-26	164				
GB-00-06	26-28				196.5	
GB-00-06A	6-7	63.2				
GB-00-06B	13-13.5	56.6				
GB-00-07	6-8	78.5				
GB-00-07	8-10				87.4	
GB-00-07	10-12	114				
GB-00-07	12-14				100.2	
GB-00-07	18-20	117		117		
GB-00-08	14-16		72.8		98.4	98.4
GB-00-08	18-20	109		109		
GB-00-08	32-34	206		206		
GB-00-08	38-40				143.8	
GB-00-08	40-42	109				
GB-00-08	42-44	26				
GB-00-08B	4-6	59.1				
GB-00-09	16-18	97.7				
GB-00-09	18-20				111.8	

TABLE 3-3
MOISTURE CONTENT[1]

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Moisture Content, % Bulk Sample Testing	Moisture Content, % Atterberg Limit Testing	Moisture Content, % Ash Content Testing	Moisture Content, % Tube Openings[2]	Moisture Content, % Triaxial[3] and Consolidation Testing[4]
GB-00-09	20-22	149				
GB-00-09	24-26	205				
GB-00-09	26-28				202.5	
GB-00-09	32-34	111				
GB-00-09	40-42	18.4		18		
GB-00-09A	7.5-9.5	77.3				
GB-00-09A(5)	7.5-9.5	188				
GB-00-09B	9-9.5	75.5				

Notes:
1 Testing performed in accordance with ASTM D2216.
2 Moisture contents may be averages where numerous readings were recorded.
3 Water content for Triaxial tests are the average of all 3 moisture tests, prior to triaxial testing.
4 Consolidation test data is from the trimmings, and before consolidation.
5 This is of the fill material; other entry at this depth is of native material.
bgs = below ground surface
ft = feet
% = percent

TABLE 3-4
ATTERBERG LIMITS[1]

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Laboratory Visual Description[2]	Moisture Content, Tube Openings, %[3]	Natural Moisture Content, %	Liquid Limit %	Plastic Limit, %	Plasticity Index	Liquidity Index
GB-00-01	22-24	Moist, black clayey silt	56.6	59.9	74.3	45.5	28.8	0.50
GB-00-02	40-42	Moist, black clayey silt	158.6	176.1	NP	NP	NP	NP
GB-00-04	18-20	Moist, very dark gray clayey silt with organics	66.5	112.4	147.5	52.7	94.8	0.63
GB-00-04	34-36	Moist, black clayey silt with organics	122.6	131.5	235.0	88.6	146.3	0.29
GB-00-05	26-28	Moist, black clayey silt	154.2	90.1	NP	NP	NP	NP
GB-00-06	20-22	Moist, black clayey silt	97.0	139.5	150.4	57.6	92.8	0.88
GB-00-08	14-16	Moist, very dark gray clayey silt with organics	98.4	72.8	89.8	41.2	48.6	0.65

NOTES:
1 Atterberg limit testing was performed in accordance with ASTM D 4318.
2 Soil description and classification based on the Unified Soil Classification System (USCS).
3 Moisture content determined using ASTM D 2216. Values are the average of 1 to 4 separate sections.
bgs = below ground surface
ft = feet
% = percent
NP = Determined to be not plastic.

TABLE 3-5
ORGANIC MATTER[1]

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Laboratory Visual Description[2]	Moisture Content, %	Ash Content, %	Organic Matter, %
GB-00-01	22-24	Moist, black silt with organics	62	95.1	4.9
GB-00-01	16-18	Moist, black silt with organics	19	98.3	1.7
GB-00-02	24-26	Moist, very dark brown silty sand	74	94.2	5.8
GB-00-02	40-42	Moist, black silt with some sand	184	85.3	14.7
GB-00-03	12-14	Moist, very dark brown sandy silt	20	96.2	3.8
GB-00-04	34-36	Moist, black silt with organics	132	84.4	15.6
GB-00-04	36-38	Moist, dark silt with sand and organics	150	88.0	12.0
GB-00-05	12-14	Moist, dark brown silty sand	113	91.7	8.3
GB-00-05	26-28	Moist, black silt with organics	125	86.1	13.9
GB-00-05	38-40	Moist, very dark brown silty sand	140	86.1	13.9
GB-00-06	20-22	Moist, black silt with organics	145	89.9	10.1
GB-00-07	18-20	Moist, very dark brown sandy clay	117	90.8	9.2
GB-00-08	32-34	Moist, light gray silty clay	206	84.9	15.1
GB-00-08	18-20	Moist, dark brown silt	109	91.2	8.8
GB-00-09	40-42	Moist, very dark brown sandy silt	18	99.5	0.5

NOTES:
[1] Testing performed in accordance with ASTM D2974. Moisture content determined by Method A and reported as a percentage of oven-dried mass; dried to constant mass at temperature of 110 ° C. Ash content and organic matter determined by Method C; dried to constant mass at temperature of 440 °C.
[2] Soil description based on the Unified Soil Classification System (USCS).
ft = feet
bgs = below ground surface
% = percent

TABLE 3-6
SPECIFIC GRAVITY

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Laboratory Visual Description[1]	Specific Gravity[2], (relative to water @ 20°C)
GB-00-02	24-26	Moist, very dark brown silty sand	2.72
GB-00-04	36-38	Moist, dark brown silt with sand and organics	2.48
GB-00-05	12-14	Moist, dark brown silty sand	2.69

NOTES:
[1] Soil description based on the Unified Soil Classification System (USCS).
[2] Specific gravity performed by using method A (oven dried specimens) of ASTM D 854.
bgs = below ground surface
ft = feet
°C = degrees Celcius

TABLE 3-7
SHELBY TUBE OPENINGS

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Sample ID	Depth, ft bgs	Laboratory Visual Description	Bulk Density, lb/ft^3 (Note 1)	Moisture Content, % (Note 2)	Dry Density, lb/ft^3 (Note 3)	Laboratory Vane Shear lb/ft^2 (Note 4) Peak / Residual
GB-00-01	22-24	Moist, black silt with organics	101.3	56.6	64.8	520 / 250
GB-00-02	30-32	Moist, black silt with organics	88.8	80.6	49.3	Not tested
GB-00-02	40-42	Moist, black silt with some sand	81.1	158.6	31.4	1090 / 710
GB-00-02	48-50	Moist, black silt with some sand and organics	90.0	79.7	50.4	Not tested
GB-00-03	18-20	Moist, very dark brown sandy silt	102.9	50.0	68.8	960 / 380
GB-00-04	18-20	Moist, very dark gray clayey silt with organics	98.8	66.5	59.4	840 / 380
GB-00-04	26-28	Moist, black silt with organics	90.9	92.2	47.5	1230 / 615
GB-00-04	34-36	Moist, black silt with organics	83.4	122.6	37.5	990 / 460
GB-00-04	42-44	Moist, black silt with organics	77.5	160	30.0	1460 / 820
GB-00-05	26-28	Moist, black silt with organics	76.8	154.2	30.8	980 / 420
GB-00-05	34-36	Moist, very dark brown silt	93.3	66.8	55.9	410 / 330
GB-00-06	20-22	Moist, black silt with organics	87.0	97.0	44.2	410 / 170
GB-00-06	26-28	Moist, very dark brown silt	75.2	196.5	25.5	620 / 370
GB-00-07	8-10	Moist, black silt with organics	89.5	87.4	47.8	Not tested
GB-00-07	12-14	Moist, black silt with organics	88.1	100.2	44.1	Not tested
GB-00-08	14-16	Moist, very dark gray clayey silt with organics	88.8	98.4	44.9	440 / 160
GB-00-08	38-40	Moist, black silt with organics	78.8	143.8	34.0	790 / 440
GB-00-09	18-20	Moist, black silt with organics	85.5	111.8	40.8	570 / 360
GB-00-09	26-28	Moist, black silt with organics	76.6	202.5	25.3	710 / 380

NOTES:

1) Bulk density determined on undisturbed tube samples provided to GeoTesting Express in Shelby tubes using ASTM D 2937. Values are the average of 1 to 4 separate sections.
2) Moisture content determined using ASTM D 2216. Values are the average of 1 to 4 separate sections.
3) Dry density was determined based on average bulk density and moisture content of 1 to 4 separate sections.
4) Laboratory vane shear tests were performed using a hand held Geonore and are the average of tests performed on 2 to 3 separate sections.

TABLE 4-1
SUMMARY OF SHEAR STRENGTH VALUES VERSUS DEPTH AROUND THE CAUSEWAY

GEOTECHNICAL INVESTIGATION SUMMARY
CAUSEWAY NON-TIME CRITICAL REMOVAL ACTION DESIGN
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

	Off the Side of the Causeway			Under the Causeway		
Strength Condition	**Elevation**	**Strength**	**Rate of Change**	**Elevation**	**Strength**	**Rate of Change**
Peak	0	240				
	-10	340	10.0	-10	780	
	-20	450	11.0	-20	975	19.5
	-30	560	11.0	-30	1160	18.5
	-40	660	10.0	-40	1350	19.0
Straight Line	0	150				
	-10	170	2.0	-10	550	
	-20	300	13.0	-20	670	12.0
	-30	420	12.0	-30	820	15.0
	-40	550	13.0	-40	950	13.0
5% Strain	0	80				
	-10	120	4.0	-10	520	
	-20	220	10.0	-20	640	12.0
	-30	160	-6.0	-30	720	8.0
	-40	140	-2.0	-40	780	6.0
Remoulded	0	60				
	-10	70	1.0	-10	220	
	-20	100	3.0	-20	290	7.0
	-30	140	4.0	-30	380	9.0
	-40	180	4.0	-40	360	-2.0
Reduced Strength (Duncan)	0	223				
	-10	316	9.3	-10	725	
	-20	419	10.2	-20	907	18.1
	-30	521	10.2	-30	1079	17.2
	-40	614	9.3	-40	1256	17.7
Reduced Strength (Bjerrum)	0	144				
about 60% of peak with PI ~ 100	-10	204	6.0	-10	468	
and strength ratio ~ 0.3 - 0.4	-20	270	6.6	-20	585	11.7
	-30	336	6.6	-30	696	11.1
	-40	396	6.0	-40	810	11.4
Proposed Strength Values	0	151				
	-10	214	6.3	-10	562	
	-20	284	6.9	-20	702	14.0
reduction from Bjerrum's	-30	353	6.9	-30	835	13.3
reduced values for strain correction	-40	416	6.3	-40	972	13.7
with PI ~ 50-70						

PHOTOGRAPHIC LOG

Picture #1 Looking northerly down the length of the Causeway, with Bldg. # 59 at the left. Bituminous concrete pavement gives way to dirt just beyond Bldg. # 59. Barge rig is set up at GB-00-05. Water is near the mean high tide mark.

Picture # 2 Looking northerly down the length of the Causeway, from just north of the concrete ramp for Bldg. # 59. Monitoring wells MWCD-99-01A is in the left foreground, and MWCD-99-01B is in the right foreground. ATV rig is set up at MWCD-00-01/CB-00-02.

Picture # 3 Grassy and gently sloping western side of the Causeway. Picture is taken from just west of Picture # 2. Tide is at near mean low tide mark; note exposed mud flat to the left. When at high tide, tidal water extends through the tidal grass and to just left of the person taking the picture; note the break in grass types.

Picture # 4 At low tide conditions, looking toward the SAEP facility, with Bldg. # 59 on the left. Note the high tide mark coloring the rip-rap in the distance. Also note the contact of the filled material of the Causeway with the mud flat sediments, the contact represented by the "wetter" mud flat soils.

Picture # 5 Gently sloping west side of the Causeway, looking toward the SAEP facility. Again, mud flat/fill contact is obvious in this picture.

Picture # 6 Picture is taken from the concrete blocks that are visible in the center of picture # 3. View is looking northerly toward the Housatonic River.

Picture # 7 Example of the variation of the fill material that was deposited along the western side of the Causeway.

Picture # 8 This picture was taken at the very end of the Causeway showing the remains of the concrete ramp located in this area. The location for GB-00-10 would be near the water line on the left side of the picture.

Picture # 9 This picture was taken just south of the boring GB-00-08 location. This shows the contact between the Causeway fill material and the mud flat sediments on this side of the Causeway.

Picture # 10 The barge rig is set up at GB-00-05, with one edge of the barge just touching the Causeway fill material. The view is toward the SAEP facility, and shows full exposure of the mud flats at low tide.

Picture # 11 This is another view of the same area in Picture # 10, but from a different angle. Note the relatively steep side of the Causeway on this east side.

Picture # 12 This picture is looking north with the barge rig at GB-00-05 at near mean high tide conditions.

SOIL BORING LOGS

KEY TO SOIL DESCRIPTIONS AND EXPLORATION LOG

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (more than half of material is larger than No. 200 sieve size)	GRAVELS (more than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVELS (little or no fines)	GW	Well-drained gravels, gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (more than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SANDS (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly-graded sands, gravelly sands, little or no fines
		SANDS WITH FINES (appreciable amount of fines)	SM	Silty-sands, sand-silt mixture
			SC	Clayey-sands, sand-clay mixtures
FINE-GRAINED SOILS (more than half of material is smaller than No. 200 sieve size)	SILTS AND CLAYS (liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS (liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

TERMS DESCRIBING CONDITION, CONSISTENCY AND HARDNESS

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels; (2) silty or clayey gravels; and (3) silty, clayey or gravelly sands. Consistency is rated according to standard penetration resistance.

Descriptive Term	Standard Penetration Resistance in Blows/Ft.
Very loose	0 TO 4
Loose	5 TO 10
Medium dense	11 TO 30
Dense	31 TO 50
Very dense	OVER 50

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy or silty clays; and (3) clayey silts.

Descriptive Term	Field Guidelines/Shear Strength (ksf)
Very soft	Fist easily penetrates/less than 0.25
Soft	Thumb easily penetrates/0.25 to 0.50
Firm	Thumb penetrates with moderate effort/0.50 to 1.00
Stiff	Indented by thumb with great effort/1.00 to 2.00
Very stiff	Indented by thumbnail/2.00 to 4.00
Hard	Indented by thumbnail with difficulty/4.0 and higher

SIZE PROPORTIONS

Designation	Percent By Weight
Trace	0 TO 10
Little	10 TO 20
Some	20 TO 35
Silty, Sandy or Gravelly	35 TO 50

KEY TO SOIL SAMPLE AND TESTING DATA

Sample Type:

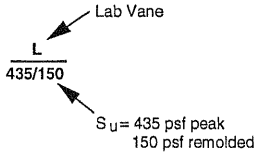
- 2" Split Spoon Sampler (S)
- Thin Wall Tube
- No Recovery
- Field Vane (F)

Thin Wall Tube Sampling Method:

- **PUSH** = Hydraulically pushed
- **H** = Pushed with statiic weight of drill rods
- **P** = Piston sampler

Shear Strength:

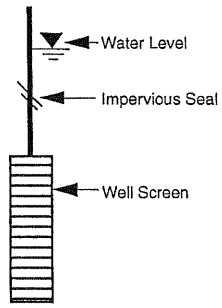
- **F** = Field vane
- **L** = Lab vane
- **G** = Geonore



Laboratory Test:

- **G** = Grain size analysis
- **H** = Hydrometer analysis
- **A** = Atterberg limit
- **T** = Triaxial compression test
- **C** = Consolidation test
- **M** = Moisture content
- **O** = Organic content
- **S** = Specific gravity
- **L** = Lab Vane Shear

Well Data:



Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-01

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-19-00	Finish Date: 9-20-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: / (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'	Depth to Groundwater/Date: 1

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1						DRILL W/OUT SAMPLING TO 2'			
2		S-1 1.5/2.0	X	18, 44, 29, 32	73	YELLOW SILTY FINE SAND OVER BLACK ASH, SLAG, CINDER, etc. - FILL - DRY, DENSE, CEMENTED NEAR BOTTOM	FILL		
3									
4	40	S-2 0.6/2.0	X	60, 35, 19, 11	54	AS ABOVE - FILL - WITH WHITE GRAVEL PIECES			
5	60								
6	50	S-3 0.7/2.0	X	17, 18, 15, 14	33	BLACK SLAG W/ BROWN SOIL			
7	60								
8	9	S-4 0.3/2.0	X	21, 34, 48, 8	82	AS ABOVE - BLACK & WHITISH SLAG, GRAVEL, TO SAND SIZE.			
9	45								
10		S-5 0.1/2.0	X	35, 17, 8, 9	25	NO-TO-VERY-LITTLE RETURN - SOME SAMPLE IN SPOON - AS ABOVE - LOSING WATER IN HOLE TO POROUS FILL			
11									
12	19	S-6 1.7/2.0	X	73, 35, 10, 9	45	GRAVELLY SAND, DARK-TO-BLACK, WELL-GRADED. TIP OF SPOON HAD CEMENT PIECE STUCK IN IT.			
13	35								
14	11	S-7 1.1/2.0	X	7, 11, 8, 9	19	DK. BRN. TO BLACK, SILTY F. SAND, W/ GRAVEL, NON-PLASTIC, WELL GRADED			
15	30								
16	8	S-8 1.1/2.0	X	6, 3, 2, 3	5	AS ABOVE			16'
17	11								M.O
18	6	S-9 0.0/2.0	X	2, 2, 2, 3	4	NO RECOVERY			8'
19	9								
20									

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-01

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-19-00
Finish Date: 9-20-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: / (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'
Depth to Groundwater/Date: /	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20									
21		F-1				MAXIMUM READING OF 30.5 W/ SMALL VANE (SEE p.15 IN FIELD BOOK) REMOLDED STRENGTH = 11	ML		
22									22'
23		P-1				BLACK SILT, LITTLE FINE SAND 0.2' 1.4' SAMPLE 0.4' G-TOP = 7.5 G-BOTTOM = 5			A, O T, L
24									24'
						B.O.B. @ 24'			

Sheet 2 of 2

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-02

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: (T.L.)/~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-21-00
Finish Date: 9-26-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 94.7'
Depth to Groundwater/Date: /	Well: ☒	Boring: ☒

MWCD-00-01

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
						DRIVE CASING W/ OUT SAMPLING TO 8'			
8		S-1 0.5/2.0		11 7 9 3	16	BLACK FINE-TO-MED SAND, LITTLE SILT, W/ SOME CONCRETE GLASS, STEEL, ETC. FILL			
10		S-2 0.9/2.0		8 10 21 34	31	CONCRETE, WOOD, GLASS; DENSE, SATURATED, 18PPM IN JAR, 0PPM on Spoon FILL			
12		S-3 1"/0.1		130/1"		AS ABOVE FILL			
14		S-4 1.0/2.0		16 7 3 3	10	2PPM IN JAR DARK GRAY TO BLACK (10YR 4/5) SILT; NON-PLASTIC, VERY WELL SORTED, MASSIVE, SULFUR SMELL, TR. ORGANICS, NO FIBERS, MICACEOUS, NON-DRAINING PID = 3.6 IN JAR	FILL	15'	
16	19	S-5 1.7/2.0		2 3 4 4	7	OLIVE GRAY (5Y 4/2) SILT; TRACE SMALL FIBERS, TR. ORGANICS, SL. PLASTIC, V. WELL SORTED, MASSIVE, MOD. SULFUR SMELL, NON-DRAINING, MICACEOUS - HAS DECOMPOSED PEAT FEEL TO IT. PID=49 ON SPOON	ML / ML/OL		16' G.M 18'
18	25								
19	35 37	F-1				MAXIMUM READING = 24 SMALL VANE USED REMOLDED = 9			
20	28	S-6 1.7/2.0		2 1 1 3	2	BLACK (5Y 2.5/2) ORGANIC SILT, TR. CLAY, TR. FIBERS, SL. PLASTIC, V. WELL SORTED, MASSIVE, MOD. SULFUR SMELL, NON-DRAINING, MICACEOUS. HAS DECOMPOSED PEAT FEEL. PID = 66 ON SPOON	OL		
22	26								22'
23		F-2				MAXIMUM READING = 91 REMOLDED STRENGTH = 20 LARGE VANE USED			M
24									
25	71	P-1 5-7		1 1		TR. SHELLS, TR. V. THIN ? SHORT FIBERS; MOD. SULFUR SMELL			24'

NATIVE SOIL

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-02

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.E.~~	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-21-00	Finish Date: 9-26-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 94.7'	Depth to Groundwater/Date: /

Well: ☒ Boring: ☒

MWCD-00-01

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" / Shelby Tube Graphic	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
25	59	P-1 S-7		3 5	4	ATTEMPTED SHELBY TUBE - NO RETURN - TOOK SPLIT SPOON INSTEAD - BLACK ORGANIC SILT - PID = 13 ON SPOON	OL		M, P, S
26						MAXIMUM READING = 30			26'
27		F-3				REMOLDED STRENGTH = 9			
28						SMALL VANE USED			
29	99 62	S-8 2.0/2.0		2 1 3 4	4	AS ABOVE W/ SL. PLASTICITY, NO FREE WATER, TR. V. SMALL FIBERS, STRONG SULFUR ODOR PID = 10 ON SPOON, 0 IN JAR	OL		
30		P-2		1.7' 0.2'		0.8' RECOVERY G = 6 AT BOTTOM W/ MEDIUM VANE			30' M TUBE LOG
31									
32									32'
33		S-9 2.0/2.0		2 1 2 4	3	BLACK (5Y 2.5/2) SILT-TO ORGANIC SILT; TR. C. SAND, TR. PLANT FIBER (V. SMALL & V. THIN), MODERATE SULFUR ODOR, SL-TO-NON-PLASTIC, NON-DRAINING, SOFT (OL TO MH)	OL		
34									
35	95 70	S-10 2.0/2.0		W.O.R. 4" 1 2 2 4	4	AS ABOVE	OL		
36						VANE TEST, BUT SUSPECT DATA: MAXIMUM READING = 6			
37		F-4				REMOLDED STRENGTH = 8.5			
38						SMALL VANE USED			38'
39		F-5				MAXIMUM READING = 42 SMALL VANE USED			M
40						REMOLDED STRENGTH = 12			40'
41	183 154	P-3		0.54'		1.96' RECOVERY G = 4.6 AT BOTTOM W/ MEDIUM VANE			A, C O.L
42						BLACK (10YR 2/1) ORGANIC SILT; TR. OF UNDECOMPOSED WOODY PLANT STEMS, 1/4" WOOD LAYER AT 43', OTHER SECTIONS W/ STEM PIECES 3/4" LONG, TR. REEDS, STRONG SULFUR ODOR, NON-PLASTIC NON-DRAINING			42
43		S-11 2.0/2.0		1 2 1 2	3		OL	PUSH CASING FROM 42'-ONWARD DUE TO HIGH FRICTION	
44						PID = 1.3 ON SPOON			
45									

Boring Log

Boring No.: GB-00-02

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-21-00	Finish Date: 9-26-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 94.7'	Depth to Groundwater/Date: /

Well: ☒ Boring: ☒

MW CD-00-01

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" / Shelby Tube Graphic	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
44		S-12 1.5/2.0	X	W.O.H. 3" - 3 4	4	AS ABOVE, ORGANIC SILT, W/ SL. INCREASE IN FIBER CONTENT, TR. REEDS, TR. FINE SAND; 1" THICK WOOD LAYER AT 45.7'	OL		
45									
46		F-6	||			MAXIMUM READING = 43 SMALL VANE USED REMOLDED STRENGTH = 13			
47									
48		P-4	▨	66		2' RECOVERY G = 6.0 AT BOTTOM W/ MEDIUM VANE			48' TUBE log M
49									
50		S-13 2.0/2.0	X	W.O.R 2" 3 5 5	10	BLACK ORGANIC PEAT LAYERED W/ WHITISH GRAY FINE SAND; SAND LENSES (0.1') ARE CLEAN W/ ORGANICS, NON-PLASTIC; 0.3' PEAT ZONE W/ SILTY F. SAND, LITTLE WOODY FIBERS, REEDS; NON-DRAINING; BOTTOM IS SILTY F. SAND, TR. CLAY for 0.8', SL. PLASTIC	OL/SM PT OL		50'
51									
52		S-14 1.9/2.0	X	12 75 97 27	172	GRAY (10YR5/1) SILTY V.F. SAND; LAYERED, NON-PLASTIC, W/ PEATY, SILTY V.F. SAND ZONE, TR. CLAY, ALLUVIUM; BOTTOM 0.9' = GRAVELLY, SILTY F. SAND (GM) TR. CLAY, NON-PLASTIC, SL. DRAINING; BOTTOM OF SPOON HAS YELLOW BRN, GRAVELLY F. SAND (GM), NON-PLASTIC, TR. CLAY	SM GM		
53									
54		S-15 0.7/2.0	X	22 44 12 13	26	LT. GRAY GRAVEL AND SAND; TR. SILT/CLAY, (TILL-LIKE) W/ ROUNDED TO ANGULAR GRAVEL, WELL GRADED, DENSE, NON-PLASTIC; POSSIBLE ABLATION TILL(?)	GM		
55									
56		S-16 0.6/2.0	X	14 16 20 15	36	FINE-TO-COARSE SAND & GRAVEL; DENSE, MASSIVE, WELL GRADED, TR. SILT, NON-PLASTIC (ABLATION TILL?); APPEARS TO BE WASHED W/OUT FINES AS IN A BASAL TILL	GP		
57									
58		S-17 1.1/2.0	X	24 17 26 48	43	AS ABOVE - GRAVELLY SAND FOR 0.3', THEN 0.2' OF WELL SORTED MED. TO F. SAND, THEN 0.6' OLIVE GRAY (5Y 5/2) V.F. SAND & SILT; NON-PLASTIC; STRATIFIED ALLUVIUM	GP/ML		
59									
60		S-18 1.0/2.0	X	20 21 24 23	45	OLIVE GRAY (5Y 4/2) SILT; NON-PLASTIC, V. WELL SORTED, DILATES AS W/ BEACH SAND UNDER PRESSURE; 1-THIN (1/8") F. SAND LENSE, TR. GRAVEL; FEW LARGE ROUNDED GRAVEL PIECES IN SPOON TIP.	ML		
61									
62									

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-02

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-21-00
Finish Date: 9-26-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 94.7'
Depth to Groundwater/Date: /	Well: ☒	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
62		S-19 1.3/2.0	X	11, 11, 9, 10	20	AS ABOVE - SILT W/ THIN (<1/16") F.-TO-MED. SAND LENSE @ 62.5'	ML		
63									
64		S-20 0.0/2.0	X	13, 15, 24, 25	39	NO RECOVERY			
65									
66		S-21 1.3/2.0	X	15, 13, 13, 17	26	OLIVE GRAY (5Y 4/2) SILT; FINELY LAMINATED W/ OCCASIONAL REPETITIVE REDDISH LAMINAE OF CLAY; HAS DILATENCY, GIVES UP WATER WHEN VIBRATED IN HAND PALM,	ML		66' G, M 68'
67									
68		S-22 0.0/2.0	X	7, 9, 12, 22	21	NO RECOVERY			
69									
70		S-23 1.6/2.0	X	4, 7, 9, 14	16	AS IN 66'-68' SILT IN THIN LAMINAE, TR. CLAY	ML		
71									
72						PROBE W/ AW RODS FROM 72 TO REFUSAL AT 94.7'			

MW CD-00-01

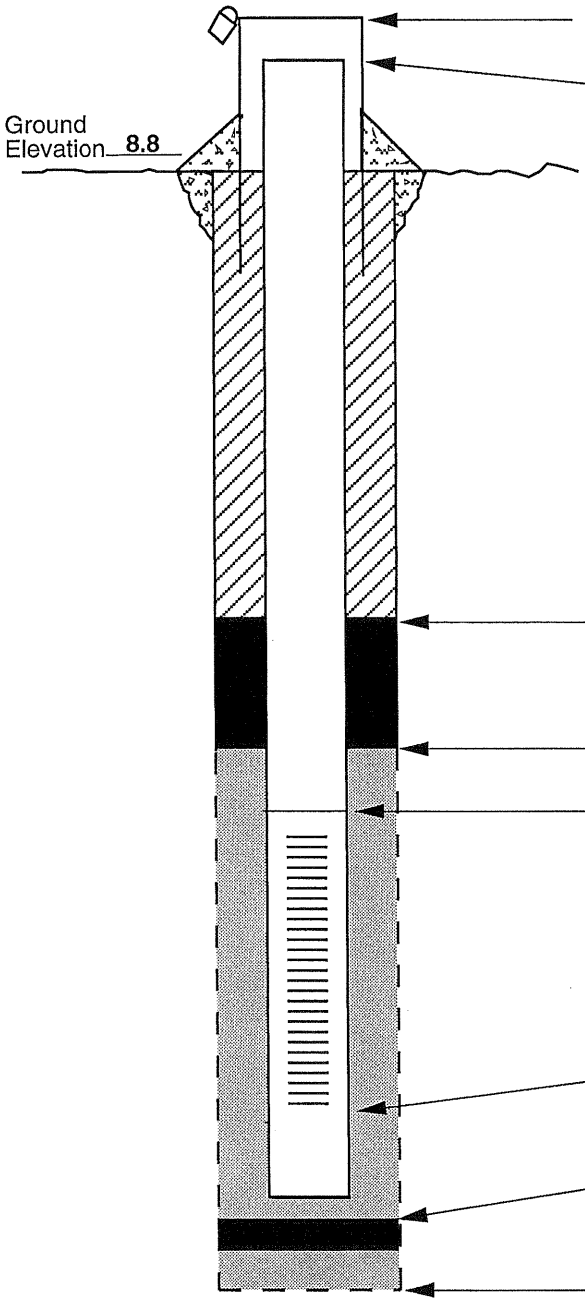
Sheet 4 of 4

W2000080(a)

Harding ESE
A MACTEC COMPANY

MONITORING WELL CONSTRUCTION DIAGRAM

Project: SAEP | Study Area: Causeway | Driller: Earth Exploration, Inc.
Project No.: 50796/1032 | Boring No.: MWCD-00-01 | Drilling Method: Drive & Wash
Date Installed: 9-26-00 | Development Method: Pump & Surge
Field Geologist: T. Longley



Elevation of Top of Surface Casing: _____
Stick-up of Casing Above Ground Surface: _____
Elevation of Top of Riser Pipe: _____
Type of Surface Seal: Concrete
Type of Surface Casing: Steel

ID of Surface Casing: 4"

Diameter of Borehole: 4"

Riser Pipe ID: 2"
Type of Riser Pipe: Sch 40 PVC

Type of Backfill: Bentonite/Cement

Elevation of Top of Seal: -3.2'
Depth of Top of Seal: 12'
Type of Seal: Benonite Pellets

Elevation of Top of Sand: -5.2'
Depth of Top of Sand: 14'

Elevation of Top of Screen: -7.2'
Depth of Top of Screen: 16'

Type of Screen: Sch 40 PVC
Slot Size x Length: 0.010" x 10'
ID of Screen: 2"

Type of Sandpack: Silica Well Sand

Elevation of Bottom of Screen: -17.2'
Depth of Bottom of Screen: 26'
Depth of Sediment Sump with Plug: 26'

Elevation of Top of Seal: -18.2'
Depth of Top of Seal: 27'
Type of Seal: Bentonite Pellets (3' thick)

Elevation of Bottom of Borehole: -61.2'
Depth of Bottom of Borehole: 70'

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-03

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: (T.L.)/~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-27-00
Finish Date: 9-27-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" / SHELBY TUBE GRAPHIC	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
						DRIVE CASING W/OUT SAMPLING TO 6'			
6	24	S-1 1.3/1.9	X	18 24 52 120/4"	76	RUSTY RED ZONE IN MOSTLY A FINE-GRAINED, GRAVELLY GRIT; VERY FIRM, HIGH FUEL ODOR (DEGRADE).	FILL		
8	96								
9	18 47	S-2 0.7/2.0	X	24 17 17 30	34	AS ABOVE, THEN LAST 0.3' OF SPOON OLIVE BROWN GRAVELLY SAND			
10	23 30	S-3 0.1/2.0	X	12 4 5 4	9	V. LITTLE RECOVERY - TIP OF SPOON HAS ASPHALT, GRAVEL CONCRETE			12'
12		S-4 0.8/2.0	X	16 4 15 21	19	BLACK GRAVELLY SAND W/ BRICK, ASH, ETC.			O
14		S-5 1.1/2.0	X	17 7 5 5	12	BLACK OILY LOOKING GRAVELLY SAND; FILL AS ABOVE, W/ BRICK; ABRUPT CHANGE TO VARVED NATIVE SILT; DARK GRAY (N4/) NON-PLASTIC, TR. SHELLS, TR. PLANT FIBERS, MICACEOUS, DILATES W/ PRESSURE; ALLUVIUM BOTTOM 0.6'	ML		14' M
15									
16		F-1				MAXIMUM READING = 33 USED SMALL VANE REMOLDED STRENGTH = 11			16'
17									
18	38	P-1		0.56'		1.94' SAMPLE RECOVERY G = 4.3 TOP W/MED. VANE G = 5.2 BOTTOM			18' L
19	36								
20									20'

Sheet 1 of 2

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-03

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: (T.L.) ~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-27-00
Finish Date: 9-27-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'
Depth to Groundwater/Date: /	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20		S-6 2.0/2.0	X	2 2 4 5	6	BLACK ORGANIC SILT; MICACEOUS, HIGH SULFUR ODOR, SL. PLASTIC TO NON-PLASTIC, NON-DRAINING, TR. V. THIN & SHORT FIBERS	OL		
21									
22		S-7 2.0/2.0	X	1 1 4 3	5	SAME AS ABOVE BUT W/ TR. SHELLS - 1 GRAVEL PIECE AT TOP OF SAMPLE	OL		
23									
24						B.O.B. @ 24'			

Sheet 2 of 2

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-04

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: (T.L.) ~~M.E.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-28-00
Finish Date: 10-2-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 70'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (SHELBY TUBE / CORE RATE)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
						DRIVE CASING W/ OUT SAMPLING TO 6'			
6		S-1 1.0/1.0		33 66 120/1"	>186	BLACK ASH, CINDER, BRICK, WOOD, etc. FILL	FILL		
8		S-2		50/0"		BOUNCING ON FILL - NO RECOVERY REFUSAL			
10						ADVANCE W/OUT SAMPLING TO 14'			
14		S-3 1.6/2.0		1 2 3 5	5	DARK GRAY (N4/) SILT. TR. SHELLS, TR. REEDS, SL.-TO-NON-PLASTIC, high SULFUR ODOR, NON-DRAINING PID = 21 ON SPOON	ML/a	GOT SOFT AT 13'	
16		F-1				MAXIMUM READING = 28 REMOLDED STRENGTH = 7 USING SMALL VANE			16' M
18		P-1		0.53		1.97' RECOVERY G = 4.3 BOTTOM/MEDIUM VANE			18' .MA
20									20' TL

Boring Log

Boring No.: GB-00-04

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.L.~~	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-28-00	Finish Date: 10-2-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 70'	Depth to Groundwater/Date: 1
Well: ☐	Boring: ☒		

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (Shelby Tube Graphic)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20		S-4 1.8/2.0	X	1 4 4 7	8	DARK GRAY (N4/) SILT. SLIGHTLY PLASTIC, MICACEOUS, TR. WHITE SHELLS, TR. PLANT FIBER, STRONG SULFUR ODOR PID = 4 ON SPOON	ML		
22		S-5 1.8/2.0	X	W.O.R. 3" 1 2 3 6	5	DARK GRAY (N4/) SILT. SL.-TO-NON-PLASTIC, MASSIVE, TR. SHELLS, TR. FIBER, TR. C. SAND, V. STRONG SULFUR ODOR PID = 5 ON SPOON	ML		
24		F-2				MAXIMUM READING = 32 USING SMALL VANE REMOLDED STRENGTH = 8			M
26		P-2		0.5'		2.0' RECOVERY G = 4.6 TOP G = 5.8 BOTTOM USING MEDIUM VANE			M, C, L
28		S-6 1.2/2.0	X	4 6 7 8	13	AS IN S-5	ML		
30		S-7 1.1/2.0	X	4 4 3 3	7	BLACK SILT. MICACEOUS, STRONG SULFUR ODOR, TR. WEEDS	ML		
32		F-3				MAXIMUM READING = 26 USING SMALL VANE REMOLDED STRENGTH = 16			M
34		P-3		0.51'		1.99' RECOVERY G = 5 TOP G = 6.2 BOTTOM USING MEDIUM VANE			A, T, S O, L
36		S-8 1.9/2.0	X	2 3 5 7	8	BLACK (7.5YR 2.5/1) TO V. DARK BRN. SILT. TR. SAND, TR. REEDS, FIBERS, TO LITTLE REEDS & FIBERS, WELL PRESERVED, SL. PLASTIC, MASSIVE, MED. STIFF, NON-DRAINING, SULFUR ODOR	OL/(ML)		M, O
38		S-9 2.0/2.0	X	4 4 5 6	9	AS ABOVE; NOTICEABLY MORE FIRM BELOW 39'	OL/(ML)		
40									

Boring Log

Boring No.: GB-00-04

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.** Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-28-00 / Finish Date: 10-2-00
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 70' / Depth to Groundwater/Date: 1 / Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" SHELBY TUBE GRAPHIC	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
40						MAXIMUM READING = 40 USING SMALL VANE			
41		F-4				REMOLDED STRENGTH = 12			
42				0.5					42'
43		P-4				2.0' RECOVERY G = 5.4 TOP G = 6.2 BOTTOM USING MEDIUM VANE			M, L
44									44'
45		S-10 2.0/2.0		1 2 3 5	5	VERY DARK GRAYISH BRN (2.5Y4/2) SILT, TR. REEDS & WOODY PLANT FIBERS, NON-PLASTIC, TR. F. SAND, SULFUR ODOR, NON-DRAINING	ML (OL)		G,M
46									46'
47		S-11 2.0/2.0		1 4 4 7	8	AS ABOVE	ML (OL)		
48		S-12 2.0/2.0		3 5 8 9	13	V. DARK BRN. (10YR 2/2) SILT & PEAT. SILT BECOMES STRATIFIED BELOW 49' W/ PEATY LAYERS. PEAT IS COMPACT, SILTY W/ UNDECOMPOSED WOOD LAYERS, NON-DRAINING. CORE BREAKS AT SILT LAYERS - BECOMING MORE GRAY	OL (ML)		
49									
50		S-13 1.0/2.0		3 5 11 20	16	AS ABOVE, THEN LAST 0.3' GRAY (N 5/) V.F. SAND & SILT, "SUGARY" TEXTURED, STRATIFIED, DILATES W/ PRESSURE OL-SM/ML	OL/SM		
51									
52		S-14 1.0/2.0		10 11 17 21	28	GRAY V.F. SAND, TR SILT, TR C. SAND, STRATIFIED, DILATES W/ PRESSURE, GIVES UP WATER WHEN VIBRATED IN HAND PALM. ALLUVIUM	SM		
53									
54		S-15 1.1/2.0		3 6 9 11	15	AS ABOVE. GRAY, FINE SAND, V. WELL SORTED, NON-PLASTIC, FREE DRAINING, TR. SILT, TR. F. GRAVEL & COARSE SAND	SP/SM		
55									
56		S-16 1.6/2.0		3 13 15 33	28	GRAY SAND. AS ABOVE W/ GRAVELLY ZONES & DARK GRAY SILT LENSES	SP/SM		
57									
58		S-17 0.7/2.0		21 18 19 18	37	GRAY GRAVEL AND SAND, WELL GRADED, DENSE. LOOKS LIKE TILL	GM/SP		
59									
60									

Boring Log

Boring No.: GB-00-04

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-28-00	Finish Date: 10-2-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 70'	Depth to Groundwater/Date: /

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
60		S-18 0.4/2.0	X	17, 9, 8, 11	17	VERY LITTLE RETURN			60'
61									
62		S-19 0.8/2.0	X	7, 7, 11, 12	18	GRAY, WELL SORTED FINE-TO-MED. SAND. NON-PLASTIC, ALLUVIUM (SP) Then BLACK ¼" LAYER (MANGANESE?), THEN REDDISH TO YELLOWISH BRN (OXIDIZED REMNANT SURFACE SOIL?) GRAVELLY SAND, TR FINES, WELL GRADED	SP		G, M
63									
64		S-20 1.3/2.0	X	8, 8, 8, 7	16	REDDISH TO YELLOWISH BRN. GRAVELLY SAND (SP). ABRUPT CHANGE TO GRAY V.F. SAND & SILT, SL. PLASTIC, DIALATES W/ PRESSURE, V. WELL SORTED, TR. CLAY, VARVED	ML		64'
65									
66		S-21 1.5/2.0	X	3, 3, 5, 8	8	GRAY VARVED SILT. STRATIFIED, MASSIVE, NON-PLASTIC, WITH V.F. SAND, FREE DRAINING, DIALATES. CONTAINS THIN, CLAY LENSES, PURPLE.	ML/SM		
67									
68		S-22 1.0/2.0	X	9, 17, 29, 33	46	AS ABOVE. V. THIN PURPLE CLAY LENSES. BECOMING MORE OF A V. F. SAND THAN SILT	SM (ML)		
69									
70						B.O.B. @ 70'			

Sheet 4 of 4

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-05

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 9-20-00
Finish Date: 10-3-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
0–2		S-1 0.6/2.0	X	W. O. R.	<1	BLACK MUD FLAT MUCK, GRITTY W/ TRACE SAND, TR SILT, TR. FIBER W/ DISTINCT HYDROCARBON ODORS, NON-PLASTIC, VERY STICKY, NON DRAINING PID=3	MH		
2–4		S-2 1.1/2.0	X	W. O. R.	<1	BLACK, ORGANIC SILT, TR. FIBERS, TR. SHELLS. SULFUR ODOR W/ SL. ORGANIC ODOR, NON-PLASTIC, NON-DILATING, NON-DRAINING. PID=2.6			
4–6		F-1	|||			MAXIMUM READING = 25 USING LARGE VANE REMOLDED STRENGTH = 17			M
6–8		P-1 S-3	▨			NO RECOVERY TO SHELBY TUBE SAMPLE. Collected split spoon INSTEAD. DARK GRAY SILT. TR. ORGANICS, MICACEOUS, SL. PLASTIC, VERY SOFT, SULFUR ODOR, NO FIBERS	MH		
8–10		S-4 1.3/3.0	X	W.O.R. W.O.R. W.O.H. W.O.H.	<1	DARK GRAY SILT. TR. ORGANICS, MICACEOUS, SL. PLASTIC, VERY "SLIPPERY", STRONG SULFUR ODOR, TRACE FIBERS	MH/OL		
10–12		S-5 2.0/3.0	X	W.O.H. W.O.H. 1 1	2	DARK GRAY SILT. TR. TO LITTLE ORGANICS, MICACEOUS, SL. PLASTIC, VERY STICKY, STRONG SULFUR ODOR, TR. FIBERS	OL		
12–14		F-2	|||			MAXIMUM READING = 42 USING LARGE VANE REMOLDED STRENGTH = 8 DK. BRN. SILT, LITTLE-TO-SOME ORGANICS, TR. MICA, V. STICKY SL. PLASTIC	OL		M, O, S
14–16		P-2 S-6 1.5/3.0	▨			NO RECOVERY W/ PISTON SAMPLER - PUSH Spoon by HAND. DARK BRN. ORGANIC SILT. TR. MICA., VERY SLIPPERY, SL. PLASTIC, SULFUR ODOR.			
16–18		S-7 1.7/2.0	X	W.O.R. W.O.H. W.O.H. 1	1	DARK BRN. ORGANIC SILT. TR. MICA, VERY SLIPPERY, SL. PLASTIC, SULFUR ODOR.	OL		M
18–20									

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-05

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 9-20-00	Finish Date: 10-3-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'	Depth to Groundwater/Date: /

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (SHELBY TUBE GRAPHIC)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20									
21									
22									
23									
24									
25									
26		P		0.6'		1.9 RECOVERY G ON BOTTOM = 3.4 W/ MEDIUM VANE			A, C O, L
27									
28						BLACK SILTY PEAT TO PEATY SILT, V. SOFT, HIGH SULFUR ODOR, NON-DRAINING - MID SECTION PEATY, V. DECOMPOSED, W/ FEW V. THIN & SHORT FIBERS	OL/PT		
29		S 2.0/2.0		W. O. R.	<1				
30						PEATY SILT THEN, MICACEOUS SILT. BLACK TO V. DARK GRAY.	OL		
31		S 1.0/2.0		W. O. R.	<1				
32						MAXIMUM READING = 74 USING LARGE VANE			
33		F				REMOLDED STRENGTH = 42			
34									
35		P		0.35' 1.1		0.55' RECOVERY NO GEONOR DATA ON TUBE SAMPLE			L, M
36									
37		S 1.5/2.0		W. O. R. 1' PUSHED 1'	<1	BLACK ORGANIC SILT, SLIGHT SULFUR ODOR, TR. FIBERS, EASILY SEEN OF FRACTURE FACES, V. SMALL & V. THIN, WELL DECOMPOSED, NON-PLASTIC, NON-DILATING, NON-DRAINING	OL		
38									
39		S 2.0/2.0		W. O. DRIVEN	<1	LAYERED PEATY SILT & PEAT. PEATY ZONES HAVE REEDS, WOOD W/ WELL DECOMPOSED PEAT. MORE DENSE THAN ABOVE	PT/OL		G, O
40									

Sheet 2 of 4

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-05

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 9-20-00
Finish Date: 10-3-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
40									
41		F				MAXIMUM READING = 41 USING SMALL VANE - REMOLDED STRENGTH = 1 VANE WINGS BENT AT THIS ZONE.			
42									
43		P				NO RECOVERY - DRILLER THINKS IN GRAVEL.			
44									
45		S 1.4/2.0		7 18 17 20	35	GRAY (10YR 6/1) GRAVELLY SAND, TR. SILT, V. WELL SORTED, NON-PLASTIC, DRAINING, STRATIFIED, MICACEOUS; GRAVEL IS ROUNDED/COARSE, TO FINE, BOTTOM OF SHOE IS OLIVE YELLOW PID=20 GRAVELLY SAND	SP		
46									
47		S 0.8/2.0		22 16 20 17	36	GRAVELLY SAND. AS ABOVE	SP		
48									
49		S 0.5/2.0		16 14 10 10	24	GRAY SAND, WITH GRAVEL - SAND AND GRAVEL ARE WELL GRADED; GRAVEL IS ROUNDED NON-PLASTIC, MED. DENSE, LOOKS LIKE ABLATION TILL OR ALLUVIUM.	SW		
50									
51		S		13 7 10 10	17	WELL GRADED GRAVELLY SAND.	SW		
52									
53		S 0.5/2.0		28 38 27 22	65	VERY TOP OF SPOON HAS ABRUPT CONTACT W/ GRAY, V.F. SAND & SILT. VARVED. V. WELL SORTED, NON-PLASTIC, DRAINING W/ PRESSURE.	SM/ML		
54									
55		S 1.0/2.0		3 9 15 90	14	AS ABOVE	SM/ML		
56									
57		S 1.5/2.0		5 9 13 14	22	AS ABOVE TO 57', THEN OLIVE BRN, V.F. SAND & SILT, AS ABOVE BUT COLOR CHANGE. VARVED W/ V. THIN PURPLE CLAY LENSES.	SM/ML		
58									
59		S 1.2/2.0		7 9 12 16	21	CHANGE BACK TO GRAY V.F. SAND & SILT. W/ V. THIN PURPLE CLAY LENSES AS ABOVE	↓		
60									

Boring Log

Boring No.: GB-00-05

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 9-20-00	Finish Date: 10-3-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'	Depth to Groundwater/Date: 1

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
60									60'
61		S 1.7/2.0	X	5 5 8 10	13	AS ABOVE W/ THIN PURPLE CLAY LENSES	SM/ML		G,M
62									62'
63		S 1.2/2.0	X	2 8 13 19	21	AS ABOVE, BUT BROWNISH GRAY	SM/ML		
64						B.O.B. @ 64'			

Sheet 4 of 4

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-05A

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-8-00
Finish Date: 11-8-00		
Drilling Method: ~~**Drive and Wash**~~ AIR ROTARY W/ SPOONS	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 9.5'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (*)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1									
2									
3									
4		S-1	X	W.O.H. 6 6 6	12	FILL OF gravel, SAND, SILT, CONCRETE, ASH, etc.	FILL		
5									
6		S-2	X	8 7 6 5	13	FILL AS ABOVE EXCEPT for very TIP OF SPOON which HAS black, mucky SILT. TR. SAND, TR, GRAVEL; very "soupy" w/ high SULFUR ODOR			
7									7.5'
8		S-3	X			BLACK gravelly SANDY FILL TO ~9', THEN GRAY V.F. SAND & SILT (VERY black AT CONTACT) MICACEOUS, NON PLASTIC, TR. Shells, TR. C. SAND, high SULFUR ODOR.	MIXED ML	~9'	M
9									9.5'
10						B.O.B. @ 9.5'			

(*) BLOWS ARE FOR 3" SPOON USING 300lb. HAMMER

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-05B

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.** Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type:	Start Date: 11-9-00 / Finish Date: 11-9-00
Drilling Method: ~~**Drive and Wash**~~ Push spoons		Casing Size: **4.0** (Inches) / Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 2' / Depth to Groundwater/Date: 1 / Well: ☐ / Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1	X			GRAY SILT, MICACEOUS, SL. PLASTIC, high sulfur ODOR, tr. shells. FILL TO ~1', then mixed fill & MUCK to 1.5' then NATIVE	FILL MIX / ML		
2						B.O.B. @ 2'			
						Pushed 3" spoon			
						AT 5.8', W/ MEDIUM GEONOR VANE, GOT READING OF 6.6, & W/out VANE, RECORDED 4.0 READING.			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-06

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-4-00
Finish Date: 10-6-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1 1.0/2.0	X	W. O. R.	<1	BLACK ORGANIC SILT. HIGH SULFUR ODOR, VERY SOFT, SOME FIBERS - MUCK PID=7	OL		
2									
3		S-2 2.0/2.0	X	W. O. R.	<1	BLACKISH BROWN ORGANIC SILT. MUCK, HIGH SULFUR ODOR, VERY SOFT, MICACEOUS, W/ SOME PLANT FIBERS PID=31	OL		
4						MAXIMUM READING = 21 USING LARGE VANE			4'
5		F-1	|||			REMOLDED STRENGTH = 4			M
6									6'
7		S-3 1.5/2.0	X	W. O. R.	<1	VERY DARK GRAY TO BLACK MUCK. VERY SOFT, NON-DRAINING, NON-PLASTIC, HIGH SULFUR ODOR, TR. FIBERS, LOOKS LIKE PEAT - DOES NOT STAIN HANDS WHEN SQUEEZED. MICACEOUS PID=71	OL/PT		
8									
9		S-4 0.0/2.0	X	W. O. R.	<1	NO RECOVERY - TOO SOFT TO GO INTO SPOON			
10									
11		S-5 1.5/2.0	X	PUSH BY HAND	<1	SAME AS IN 6'-8', TR. SHELLS, SL. PLASTIC PID=29	OL/PT		
12									
13		F-2	|||			MAXIMUM READING = 31 USING LARGE VANE			
14						REMOLDED STRENGTH = 8			
15		S-6 2.0/2.0	X	PUSH BY HAND	<1	SAME AS 10'-12'. DARK GRAY, ORGANIC SILT, SL-PLASTIC, NON-DRAINING, TR. V. SMALL FIBERS, STRONG SULFUR ODOR, NON-DILATING PID=29	OL		
16									
17		S-7 2.0/2.0	X	PUSH BY HAND	<1	SAME AS ABOVE PID=33	OL		
18									18'
19		F-3	|||			MAXIMUM READING = 44 REMOLDED STRENGTH = 7			M
20									20'

Boring Log

Boring No.: GB-00-06

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-4-00
Finish Date: 10-6-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (Shelby Tube / Graphic)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20									
21		P-1				2" RECOVERED IN SHELBY TUBE G = 4 ON TOP, REMOLDED AT 0.2 (NO BOTTOM G VALUES) USING LARGE VANE			A, T O, L
22									22'
23		S-8 1.0/2.0		W.O.R. & PUSH BY HAND	<1	VERY DARK GRAY TO V. DARK BRN. (10YR 2/2) ORGANIC SILT, VERY SOFT, SL. PLASTIC, TR. UNDECOMPOSED PLANT FIBERS, NON-DRAINING, NON-DILATING PID = 3	OL		G, M
24									
25		F-4				MAXIMUM READING = 46.5 USING LARGE VANE REMOLDED STRENGTH = 8			M
26									26'
27		P-2		0.42' / 0.06'		0.52 RECOVERY TOP OF TUBE IS SOLID WOOD, NO GEONOR READINGS ON SAMPLE			L, M
28									28'
29		S-9 2.0/2.0		PUSH 1' 2 3	2	DRK. GRAYISH BRN. (10YR 4/2) ORGANIC SILT, BREAKS ON HORIZONTAL FACES, NON-DRAINING, TR. SAND, TR. C. SAND, COMMON PLANT FIBERS, STRONG SULFUR ODOR PID = 3	OL		
30									
31		S-10 1.7/2.0		W.O.H. 1 3 2	3	SAME AS ABOVE	OL		
32									
33		F-5				MAXIMUM READING = 24 USING SMALL VANE REMOLDED STRENGTH = 4.5 (G. PUSTAD LOG FROM 32' ONWARD)			
34									
35		P-3				NO RECOVERY WORTH KEEPING, SOIL DENSITY MAY HAVE PREVENTED SAMPLE COLLECTION			
36									
37		S-11		W.O.R. W.O.R. 9 15	9	DK GRAYISH BRN. ORGANIC SILT, TR. TO LITTLE F. SAND. BREAKS ON HORIZONTAL. TR. REEDS, LOW SULFUR ODOR	OL		
38									
39		S-12 1.4/2.0		6 6 5 5	11	GRAY, F.-TO-MED. SAND, TR. TO NO SILT OR ORGANIC MATTER, SLOW DRAINING, MOD. DENSE	SM		
40									

Boring Log

Boring No.: GB-00-06

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.** Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-4-00 / Finish Date: 10-6-00
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64' / Depth to Groundwater/Date: 1 / Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
40									
41		F-6				MAXIMUM READING = 3.5 USING SMALL VANE REMOLDED STRENGTH = 0.5			
42									
43		S-13 1.0/2.0	X	37 20 8 8	28	GRAY MEDIUM TO COARSE SAND, NO ORGANICS, MOD. DENSE, WELL-DRAINED, NO ODOR, SUBANGULAR	SP		
44									
45		S-14 1.4/2.0	X	2 3 3 8	6	TOP 1.0' SAME AS ABOVE, THEN GRAY, MED-TO-COARSE SAND, LITTLE F. GRAVEL, SUBANGULAR, MOD. WELL DRAINED, NO ODOR	SW		
46									
47		F-7				MAXIMUM READING = 16 USING SMALL VANE? REMOLDED STRENGTH = 7			
48									
49		S-15 1.1/2.0	X	18 21 31 25	52	BROWNISH GRAY SAND, MEDIUM-TO-COARSE, LITTLE F. GRAVEL (SUB-ANGULAR), NO ORGANICS, MOD. WELL DRAINED	SW		
50									
51		S-16 0/2.0	X	25 34 24 22	58	NO RECOVERY. A LITTLE BIT OF C. SAND & F.-TO-MED. GRAVEL IN TIP - GRAY			
52									
53		S-17 0.1/2.0	X	24 13 18 19	31	V. LITTLE RECOVERY. COARSE SAND, SOME COARSE-MEDIUM-FINE GRAVEL, ANGULAR TO SUBANGULAR, CLEAN	SP		
54									
55		S-18 0.9/2.0	X	8 9 10 10	19	GRAY, V.F. SAND AND SILT, VARVED, MODERATELY DRAINED, POORLY GRADED	SM		
56									
57		S-19 0.0/2.0	X	8 8 8 11	16	NO RECOVERY			
58							ML		
59		S-20 1.2/2.0	X	6 6 7 10	13	GRAY SILT W/ SOME V. FINE SAND. INTERBEDDED LAYERS OF REDDISH BAN. SILT. POORLY DRAINED, GRADING TO V.F. SAND W/ SOME SILT AT BOTTOM OF SPOON			
60									

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-06

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-4-00
Finish Date: 10-6-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
60		S-21 1.4/2.0	X	9 5 6 9	11	GRAY V.F. SAND & SILT. INTERBEDDED LAYERS OF REDDISH BRN. SILT, POORLY-TO-MOD. DRAINED	ML		
62		S-22 2.0/2.0	X	10 10 13 15	23	GRAY FINE SAND & SILT. W/ INTERBEDDED LAYERS OF REDDISH BRN. SILT. AS ABOVE	ML		
64						B.O.B. @ 64'			

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-06A

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-8-00
Finish Date: 11-8-00		
Drilling Method: ~~Drive and Wash~~ AIR ROTARY W/ SPOONS	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 8'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1	X			ALL FILL - PUSHED 3" SPOON FOR SAMPLE - BLACK muck over well-graded SAND W/ high fuel odor - DEGRADED FUEL SMELL	FILL		
2									
3		S-2	X			PUSHED 3" SPOON. BLACK WELL-graded SAND W/ TR. GRAVEL - high degraded fuel odor			
4									
5		S-3	X			V. POOR RECOVERY - SAME AS ABOVE			
6									6'
7		S-4	X			PUSHED 3" SPOON. VERY TOP IS GRAVELLY SAND OVER NATIVE SOILS. Dark gray very fine SAND & SILT, Tr. PLANT fibers, micaceous, strong sulfur odors, NON-plastic, NON-DRAINING, MAY be varved.	ML		M
8									7'
						B.O.B. @ 8'			
						WITH GEONOR & MEDIUM VANE, GOT READING OF 7 @ 9.8' bgs. & 1.9 W/OUT VANE.			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-06B

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.** Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-9-00 / Finish Date: 11-9-00
Drilling Method: ~~Drive-and-Wash~~ Air Rotary w/ Spoons	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 13.5' / Depth to Groundwater/Date: / Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (*)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1–4						DRILLERS ADVANCE CASING TO 11.5' W/ out Sampling Hit WOOD, FIBERGLASS, copperwire, steel, etc. AS SOON AS got through a section of fiberglass, drilling became real SOFT.			
5–10						11.5'-13.5' - NO RECOVERY 1ST time, then ATTEMPT AGAIN (SPUN CASING PRIOR TO RETRIEVAL) GOT RECOVERY THIS TIME - Likely U. TOP of NATIVE SOIL & bottom of FILL (*) DRIVE 3" SPOON W/ 300 Lb. hammer	FILL & MIXTURE		
11–12		S-1	X	2	2	DARK GRAY to black SILT, very soft, shiney, little shells, high SULFUR ODOR, NON-DRAINING, SL. PLASTIC, TR. FIBERGLASS mixed in TOP OF SPOON, MICACEOUS, TR. PLANT FIBERS.	ML		M
13				1					13' 13.5
13–14				2					
14–15						B.O.B. @ 13.5'			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-07

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-19-00
Finish Date: 10-19-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1		W. O. H.	<1	BLACK SILT. SOFT, NON-PLASTIC			
2									
3		S-2		W. O. H.	<1	BLACK SILT, LOOSE FINE SAND. NON PLASTIC, SOFT			
4									
5		F-1				MAXIMUM READING = 5 REMOLDED STRENGTH = 1			
6									6'
7		S-3				GRAY SILT. SOFT, SL. PLASTIC, SOME SHELLS.			G, M
8									8'
9		P-1				2' RECOVERY G. on Top = 2.1 REMOLDED = 1.2 G on Bottom = 2.2 REMOLDED = 1.0			M, TUBE LOG
10									10'
11		F-2				MAXIMUM READING = 39.5 REMOLDED STRENGTH = 8.5			M
12									12'
13		P-2				2' RECOVERY G TOP = 1.9 REMOLDED = 0.4 G BOTTOM = 2.2 REMOLDED = 1.4			M, TUBE LOG
14									14'
15		S-4		W. O. H.	<1	BROWN SILT. SOFT, SLIGHTLY PLASTIC, MICACEOUS, TRACE SHELLS.			
16									
17		S-5				SAME AS ABOVE			
18									18'
19		S-6		W. O. H.	<1	BROWN SILT. SOFT, PLASTIC, DENSER W/ DEPTH.			M, O
20									20'

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-07

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~/M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-19-00
Finish Date: 10-19-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 24'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20		S-7	X			AS ABOVE			
21									
22		S-8	X			AS ABOVE			
23									
24						B.O.B. @ 24'			

Sheet 2 of 2

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-7A

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L.** ~~M.L.~~	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 9-27-00
Finish Date: 9-27-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth: 14'	Total Depth: 14'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1	X			POUNDED 3" SPOON - NO RECOVERY			
2									
3		S-2 0.3/2.0	X	10 12 18 22	30	BLACK gravelly SAND. FILL, LOOSE			
4									
5		S-3 0.3/2.0	X	42 26 36 84	62	BROWN gravelly SAND. FILL			
6									
7		S-4 0.3/2.0	X	26 59 59 24	118	BLACK gravelly SAND. with brick pieces. Bottom of shoe had LARGE gravel preventing good RECOVERY	FILL		
8									
9		S-5 0.1/2.0	X	11 16 27 16	43	GRAVEL & SAND. FILL			
10									
11						Hit steel @ ~10.5' for 4", then again @13'. Casing hits refusal @ 13'. Drilled to 14' w/ Roller bit, steel shavings coming to surface. Lost water return just below 13'.			
12									
13									
14						No ADVANCEMENT to drill STRING W/ out water RETURN @ 14'. Decide to ABANDON BORING HERE.			
15						B.O.B. @ 14'			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-08

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~ (M.L.)	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-17-00
Finish Date: 10-18-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
0		S-1 1.2/2.0	X	W. O. H.	<1	BLACK MUCK, SILT, VERY SOFT	ML		
2		S-2 1.5/2.0	X	W. O. H.	<1	BLACK TO V. DARK GRAY SILT, FINE SAND, MUCK, V. SOFT	ML		
4		S-3	X	W. O. H.	<1	FINE SANDY SILT, WOOD, SOFT, TRACE PEAT, MICACEOUS. BROWN TO GRAY.	ML/OL		
6		S-4	X	W. O. H.	<1	FINE SANDY SILT. OLIVE GRAY, MICACEOUS, PLASTIC, SOFT.	ML		
8		S-5	X	W. O. H.	<1	FINE SANDY SILT. OLIVE GRAY, MICACEOUS, PLASTIC, SOFT, TRACE SHELLS.	ML		
10		F-1 & S-6	X			MAXIMUM READING = 20 USING LARGE VANE COLLECT SPOON AT THIS DEPTH REMOLDED STRENGTH = ? POOR TEST? ALSO - SAME AS SEEN IN S-5	ML		
12		F-2	X			MAXIMUM READING = 40 USING LARGE VANE REMOLDED STRENGTH = 7			
14		P-1	X			2' RECOVERY IN TUBE G TOP = 2.0 REMOLDED = 0.2 G BOTTOM = 2.2 REMOLDED = 0.9			M, A, T, L
16		S-7	X	W. O. H.	<1	OLIVE GRAY SILTY SAND, SOFT, PLASTIC, SOME WOOD, ORGANICS			
18		S-8	X	W. O. H.	<1	OLIVE GRAY SANDY SILT, PLASTIC, SOFT, TR. ORGANICS, WOOD.			M, O
20									

14' 16' 8' 20'

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-08

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~ M.L.	Checked By:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-17-00
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Finish Date: 10-18-00
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20		S-9	X	W. O. H.	<1	OLIVE GRAY SANDY SILT, PLASTIC, SOFT, TRACE ORGANICS, WOOD			
21									
22		S-10	X	W. O. H.	<1	SAME AS ABOVE			
23									
24		S-11	X	W. O. H.	<1	SAME AS ABOVE			
25									
26		S-12	X			SILT. CLAY LENSE (3") AT 27.5'. SOFT, PLASTIC.			
27									
28		S-13	X	W. O. H.	<1	OLIVE BROWN SILT. SOFT, PLASTIC, TRACE COARSE SAND, SOME PEAT/ORGANICS.	OL		
29									
30		S-14	X	W. O. H.	<1	SAME AS ABOVE, BUT W/ MORE PEAT	OL		
31									
32		S-15	X	W. O. H.	<1	BROWN SILT, PEAT. SOFT, PLASTIC.	OL		32' M, O
33									
34		S-16	X	W. O. H.	<1	SAME AS ABOVE. F. SAND NOTED IN TIP OF SPOON	OL		34'
35									
36		F-3				MAXIMUM READING = 15 USING SMALL VANE			
37						REMOLDED STRENGTH = 7			
38		P-2				2' RECOVERY G TOP = 0.3 REMOLDED = 0.2			TUBE LOG, 38' M,
39						G BOTTOM = 5.0 REMOLDED = 1.1			
40									40'

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-08

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~ M.L.	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-17-00	Finish Date: 10-18-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'	Depth to Groundwater/Date: 1

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
40		S-17	X	W.O.H. W.O.H. 9 10	9	40'-41' PEAT 41'-41.5' BLACK SILTY CLAY, PLASTIC, SOFT 41.5'-42' GRAY FINE SAND. DENSE, SOME SILT, MICACEOUS			40'
41									M
42		S-18	X	10 9 12 8	21	GRAY FINE SILTY SAND. DENSE, NON-PLASTIC	SM		42'
43									G, M
44		S-19	X	NA	NA	GRAY FINE SILTY SAND. DENSE, non-plastic	SM		44'
45									
46		S-20	X	4 4 4 4	8	SAME AS ABOVE W/ TR. MED-TO-C. SAND.			
47									
48		S-21	X	W.O.H. W.O.H. 5 1	5	GRAY SAND. FINE-TO-COARSE. POORLY GRADED, W/ SOME F. GRAVEL, SILTY, NON-PLASTIC			
49									
50		S-22	X			SAME AS ABOVE, TO 51.5. THEN BROWN SANDY GRAVEL. ~~POORLY GRADED~~, V. DENSE. GRAVEL IS FINE-TO-COARSE.			
51									
52		S-23	X	15 22 54 55	76	BROWN GRAVELLY SAND. POORLY GRADED, SOME SILT,	SP		
53									
54		S-24	X	17 25 35 40	60	BROWN GRAVELLY SAND, DENSE, POORLY GRADED, SOME SILT,	SP		
55									
56		S-25	X	NA	NA	BROWN GRAVELLY SAND. DENSE, POORLY GRADED.	SP		
57									
58		S-26	X	NA	NA	GRAVELLY SAND, DENSE, POORLY GRADED, SOME SILT.	SP		
59									
60									

Boring Log

Boring No.: GB-00-08

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~ **M.L.**	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-17-00	Finish Date: 10-18-00
Drilling Method: **Drive and Wash**		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'	Depth to Groundwater/Date: 1

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
60		S-27	X	23 32 69 46	101	SAME AS ABOVE	SP		
61									
62		S-28	X	40 41 51 76	92	SAME AS ABOVE			
63									
64						B.O.B. @ 64'			

Sheet 4 of 4

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-08A

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-9-00
Finish Date: 11-9-00		
Drilling Method: ~~Drive and Wash~~ AIR ROTARY w/ SPOONS	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 18.5'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" ⊕	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1–9						ADVANCE W/ CASING TO 10' W/OUT SAMPLING. ⊕ DRIVE 3" SPOON USING 300 Lb. HAMMER	FILL		
10–11		S-1	X	7 24 14 17	38	ALL FILL - Bricks, concrete, gravel, etc.			
12–13		S-2 2" Spoon	X	5 5 7 6	12	ALL FILL - SLAG, Ash, concrete, etc.			
14–16						NO SAMPLING to 16.5'			
17–18		S-3	X	5 2 3 2	5	NO RETURN - TIP OF SPOON HAS SILT ON SHOE, DRILLER THINKS SILT/FILL CONTACT AT 16.5'. CASING STUCK AT 14'. CAN'T GET SAMPLES below this depth due to CAVE.	ML		
19–20						B.O.B. @ 18.5'			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-08B

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. / ~~M.L.~~	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-7-00	Finish Date: 11-7-00
Drilling Method: ~~Drive and Wash~~ AIR ROTARY W/ SPOONS		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 8	Depth to Groundwater/Date: /

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1	X			GRAY TO DK. GRAY F. & MED. SAND, TR. C. SAND W/ BLACK ORGANIC SAND @ BOTTOM OF SPOON. FUEL ODOR TO THE ORGANIC SAND. FILL	FILL		
2									
3		S-2	X			NO RECOVERY			
4									4'
5		S-3	X			FILL TO ~ 5.5', THEN NATIVE DK. GRAY MICACEOUS SILT, TR. FIBERS, TR. SHELLS, SL. PLASTIC.			M
6									6'
7		S-4	X			SILT (AS ABOVE) MICACEOUS, NON-PLASTIC, NON-DRAINING TR. C. SAND	ML		
8									
						B.O.B. @ 8'			
						COLLECTED GEONOR DATA AFTER HOLE COMPLETED AT DEPTH OF ~ 5.8', USING MEDIUM VANE, GOT READING OF 8.0, & 6.7 W/OUT VANE.			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-09

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-12-00
Finish Date: 10-17-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
0		S-1 0.6/2.0	X	W. O. R.	<1	NO RECOVERY			
1									
2		S-2 0.6/2.0	X	W. O. DRILLER	<1	BLACK MUCK AND SILT. VERY HIGH SULFUR ODOR, VERY SOFT & STICKY PID=2	OL		
3									
4		S-3 0.6/2.0	X	W. O. DRILLER	<1	BLACK TO V. DARK GRAY ORGANIC SILT. MICACEOUS - DOES NOT STICK TO FINGERS WHEN SQUEEZED, STRONG SULFUR ODOR. PID=7	OL		
5									
6		S-4 2.0/2.0	X	W. O. DRILLER	<1	AS ABOVE. SL. TO MOD. PLASTIC PID=5	OL		
7									
8		S-5 2.0/2.0	X	W. O. DRILLER	<1	AS ABOVE. ORGANIC SILT. SL./MOD. PLASTIC, TR. REEDS & V. THIN & V. SHORT PLANT FIBERS, MICACEOUS, SULFUR ODOR PID=5	OL		
9									
10		S-6 2.0/2.0	X	W. O. DRILLER	<1	AS ABOVE W/ SL. MORE PLANT FIBERS. TR. SILT. TR. SHELLS, SL./MOD. PLASTIC, STRONG SULFUR ODOR PID=2	OL		
11									
12		S-7 1.5/2.0	X	W. O. DRILLER	<1	AS ABOVE - SLIGHTLY MORE DENSE LOOKING	OL		
13									
14		S-8 2.0/2.0	X	W. O. DRILLER	<1	V. DARK GRAY ORGANIC SILT. SL/MOD. PLASTIC, MICACEOUS, TR. PLANT FIBERS, STRONG SULFUR ODOR. PID=2	OL		
15									
16		F-1				MAXIMUM READING = 36 USING LARGE VANE			16' M
17						REMOLDED STRENGTH = 3			
18									
19		P-1				2' RECOVERY G. TOP = 3 REMOLDED = 0.7			M
20						USING LARGE VANE G. BOTTOM = 5.5 REMOLDED = 1.2			

Sheet 1 of 4

Harding ESE
A MACTEC COMPANY

20' TUBE LOG

W2000080(a)

Boring Log

Boring No.: GB-00-09

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L./M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-12-00
Finish Date: 10-17-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" / Shelby Tube / Graphic	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
20		S-9 2.0/2.0	X	W.O.D. DRILLER	<1	BLACK-TO-V. DK. GRAY ORGANIC SILT. NON-PLASTIC, MICACEOUS, TR. PLANT FIBERS, STRONG SULFUR ODOR PID = 1.9	OL		G,M
21									
22		S-10 1.5/2.0	X	W.O.D. DRILLER	<1	AS ABOVE, POSSIBLY FIRMER W/ TR. UNDECOMPOSED WOODY STEMS & TR. PLANT FIBER PID=4	OL		
23									
24									M
25		F2				MAXIMUM READING = 51.5 USING LARGE VANE REMOLDED STRENGTH = 9			
26									M, TUBE OPENING
27		P-2			0.7' 0.2'	1.6 RECOVERY WOOD CORE AT BOTTOM NO GEONOR DATA			
28									
29		S-11 2.0/2.0	X	W.O.D. DRILLER	<1	V. DARK BRN. ORGANIC SILT. TR. ORGANIC FIBER, SL. PLASTIC, DENSE, STRONG SULFUR ODOR	OL		
30									
31		S-12 1.0/2.0	X	W.O.D. DRILLER	<1	AS ABOVE BUT MORE SANDIER AT BOTTOM W/ V. THIN LAMINAE OF V.F. SAND, TR. TO LITTLE ORGANIC FIBER, 1- WOOD PIECE - BECOMING STIFFER	OL		
32									
33		F-3				MAXIMUM READING = 42 USING LARGE VANE REMOLDED STRENGTH = 8			M
34									
35		S-13 2.0/2.0	X	W.O.D. 2" 2 3 4 5	9	ATTEMPTED SHELBY TUBE - NO RECOVERY - DID NOT OPEN TOOK SPOON INSTEAD - OLIVE GRAY F. SAND, V. WELL SORTED LOOSE, TR. FINES; C. SAND/GRAVEL LENSE @ ~35.5', thk 2", NO ODOR, CLEAN,	SP	RUNNING SANDS START @ 34'-35'	
36									
37		S-14 1.1/2.0	X	1 3 6 5	9	OLIVE TO LIGHT GRAY SAND, FINE W/ 2 ZONES (1" & 1.5") OF C. SAND W/ TR. GRAVEL, V. WELL SORTED, NON-PLASTIC ALLUVIUM	SP		
38									
39		S-15 1.1/2.0	X	4 7 7 9	14	AS ABOVE W/ 1-LAYER OF C. SAND.	SP		
40									

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-09

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. / M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-12-00
Finish Date: 10-17-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
40		S-16	X	8 5 8 14	13	NO RECOVERY - TRIED AGAIN - GOT 0.5' RETURN - F. TO M. SAND, OVER GRAVELLY F. SAND, W TR. SILT. - NON-PLASTIC, DILATES	SP		M, O
41									
42		S-17	X	18 19 23 23	42	NO RECOVERY (M. LOUNSBURY LOGS FROM 42' ONWARD)			
43									
44		S-18 1.2/2.0	X	24 23 22 27	45	SAND - FINE TO COARSE - White GRAVEL IN TIP W/ SILT.	SP		
45									
46									
47		S-19 0.4/2.0	X	33 38 26 NA	64	PIECE OF GRAVEL PREVENTED GOOD RECOVERY - OLIVE GRAY F. TO C. SAND; SOME GRAVEL	GP		
48									
49		S-20 1.0/2.0	X	36 44 53 79	97	FINE SAND, SOME MED. C. SAND, SILT, OLIVE GRAY, SL. PLASTIC.	SP		
50									
51		S-21	X	120 84 107 144	191	NO RECOVERY			
52									
53						COULD NOT COLLECT SAMPLE DUE TO GRAVEL/ COBBLE OBSTRUCTION			
54									
55		S-22	X	87 78 61 55	139	NO RECOVERY			
56									
57		S-23 0.2	X	74 133		PUSHING ROCK AHEAD OF SPOON - GRAY SILT COMES BACK IN SPOON.			
58									
59		S-24 1.4/2.0	X	9 16 19 25	35	GRAY SILTY F. SAND, SLIGHTLY PLASTIC, TR. MED. SAND, TR. C. SAND, Dense	SM		
60									

40'

42'

Boring Log

Boring No.: GB-00-09

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: ~~T.L.~~ M.L.	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: BARGE	Start Date: 10-17-00
Finish Date: 10-17-00		
Drilling Method: **Drive and Wash**	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 64'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
60		S-25 1.1/2.0	X	27 24 36 40	60	GRAY SILT, TR. F. SAND, SLIGHTLY PLASTIC, DENSE, HOLDS WATER - REDDISH LENSES AT BOTTOM	ML		
62		S-26	X	31 47 46 58	93	GRAY SILT, TR. F. TO C. SAND, DENSE, SL. PLASTIC	ML		
64						B.O.B. @ 64'			

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-09A

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-8-00	Finish Date: 11-8-00
Drilling Method: ~~Drive and Wash~~ AIR ROTARY W/ SPOONS		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 11.5'	Depth to Groundwater/Date: /

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (*)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1–5						PUSHED CASING TO 5.5' W/ OUT SAMPLING	FILL TO MIXED ZONE		
6–7		S-1	X			NO RECOVERY - TOO LOOSE TO STAY IN SPOON			7.5'
8–9		S-2	X	1 1 1 1	2	BLACK MUCKY SAND & SILT. TR. C. SAND, TR. GRAVEL LITTLE SHELLS, REEDS (FILL) W/ ABRUPT CHANGE TO OLIVE GRAY V.F. SAND & SILT (@ 9') NON-PLASTIC, TR. SHELLS, TR. FIBERS.	ML	~9'	M / M 9.5'
10–11		S-3	X			NO RECOVERY			
12						B.O.B. @ 11.5'			

(*) BLOWS FOR 3" SPOON USING 300 LB. HAMMER

FILL IS MIXED W/ NATIVE DEPOSITS TO APPROX. 9', THEN CLEAN NATIVE SOILS BELOW THIS DEPTH

GEONOR DATA AT ~10.3' BGS - W/ LARGE VANE GOT 4.6

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-09B

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**		Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: T.L. ~~M.L.~~	Checked By:	Ground Elevation:
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV.	Start Date: 11-8-00	Finish Date: 11-8-00
Drilling Method: ~~Drive and Wash~~ AIR ROTARY W/ SPOONS		Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 9.5'	Depth to Groundwater/Date: /

Well: ☐ Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6" (*)	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1						PUSH CASING TO 3.5' W/ OUT SAMPLING			
2									
3									
4		S-1	X	W.O.H. / 1 / 1	2	BLACK TO V. DARK GRAY SILTY SAND, COMMON SHELLS, TR. PLANT FIBERS/STEMS, HIGH SULFUR ODOR. LOOKS LIKE MIXED SANDY FILL & RIVER SEDIMENTS	FILL TO MIXED ZONE		
5									
6		S-2	X			BLACK f. SAND & SILT, STICKY, TR. TO LITTLE PLANT FIBERS, HIGH SULFUR ODOR, TR SHELLS. LOOKS LIKE TOP OF NATIVE & BOTTOM OF FILL MIXED ZONE.			
7									
8		S-3	X			MIXED AS ABOVE TO 9', THEN ALL NATIVE. DARK TO OLIVE GRAY V.F. SAND & SILT, MICACEOUS, STRONG SULFUR ODOR.	ML		M
9									9' 9.5
10						B.O.B. @ 9.5'			
11						(*) BLOWS FOR 3" SPOON USING 300LB. HAMMER W/ GEONOR LARGE VANE, GOT READING OF 6.2 @ 9.8' bgs.			

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

Boring Log

Boring No.: GB-00-10

Project Name: **Stratford Army Engine Plant**	Site: **Causeway**	Project No.: **50796-1032**
Client Name: **CBDCOM**	Logged By: **T.L./M.L.**	Checked By:
Ground Elevation:		
Drilling Contractor: **Earth Exploration, Inc.**	Rig Type: ATV	Start Date: 11-9-00
Finish Date: 11-9-00		
Drilling Method: ~~**Drive and Wash**~~ AIR ROTARY -NO SPOONS	Casing Size: **4.0** (Inches)	Core Size: (Inches)
Overburden Depth:	Rock/Refusal Depth:	Total Depth: 6.5'
Depth to Groundwater/Date: 1	Well: ☐	Boring: ☒

Depth (feet) Below Ground Surface	Casing Blows/Foot	Sampling No. & Penetration/Recovery (Feet)	Sample Type	SPT Blows/6"	SPT-N (Blows/Foot)	Visual Classification Description and Remarks	USCS Group Symbol	Notes On Drilling	Lab Tests
1		S-1	X			PUSHED 3" SPOON - ALL FILL			
2									
3						DRILLED W/ TRI-CONE ROLLER BIT BELOW 2'- Hit SOLID RESISTANCE AT 3' - CONCRETE? - Then OUT of it @ ~ 3.2'. Hit black muck @ 5.8' bgs. AT 6.5', hit gray SILTS. CALL SOILS AT 6.5' bgs	FILL OR MIXED		
4									
5									
6									
7						B.O.B. @ 6.5'	ML		

Sheet 1 of 1

W2000080(a)

Harding ESE
A MACTEC COMPANY

FIELD SHEAR TEST RESULTS

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-01 Elevation = 8.3 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 22 21.5

Elevation:

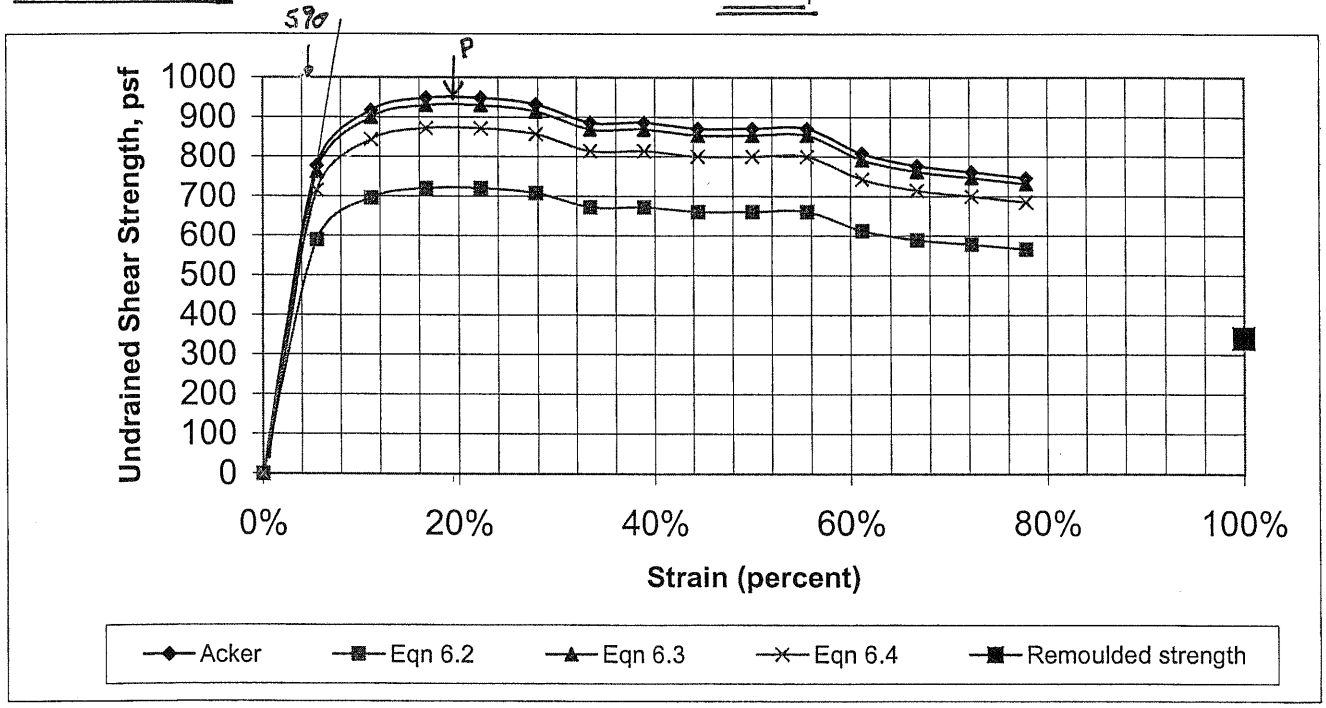
Estimated Overburden pressure = psf

Vane size			
	rod diam	0.75	in
	Length	6.625	in
	Width	2.5	in
	Flat/Tapered	Tapered	
	k =	2.59	Acker
	moment arm	12	inches

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	25	777.00	589.99	761.90	714.12
10	0.1745	11.12%	29.5	916.86	696.18	899.05	842.66
15	0.2618	16.68%	30.5	947.94	719.78	929.52	871.23
20	0.3491	22.23%	30.5	947.94	719.78	929.52	871.23
25	0.4363	27.79%	30	932.40	707.98	914.29	856.95
30	0.5236	33.35%	28.5	885.78	672.58	868.57	814.10
35	0.6109	38.91%	28.5	885.78	672.58	868.57	814.10
40	0.6981	44.47%	28	870.24	660.78	853.33	799.82
45	0.7854	50.03%	28	870.24	660.78	853.33	799.82
50	0.8727	55.58%	28	870.24	660.78	853.33	799.82
55	0.9599	61.14%	26	808.08	613.58	792.38	742.69
60	1.0472	66.70%	25	777.00	589.99	761.90	714.12
65	1.1345	72.26%	24.5	761.46	578.19	746.67	699.84
70	1.2217	77.82%	24	745.92	566.39	731.43	685.56

Remoulded strength 11.00 341.88 psf 1.00



Peak = 950 psf @ 19%
Remoulded = 340 psf
5% = 650 psf
End Straight Line = 780 psf

OK
GR

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 Elevation = 8.8 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 19.5

Elevation = - ft MSL

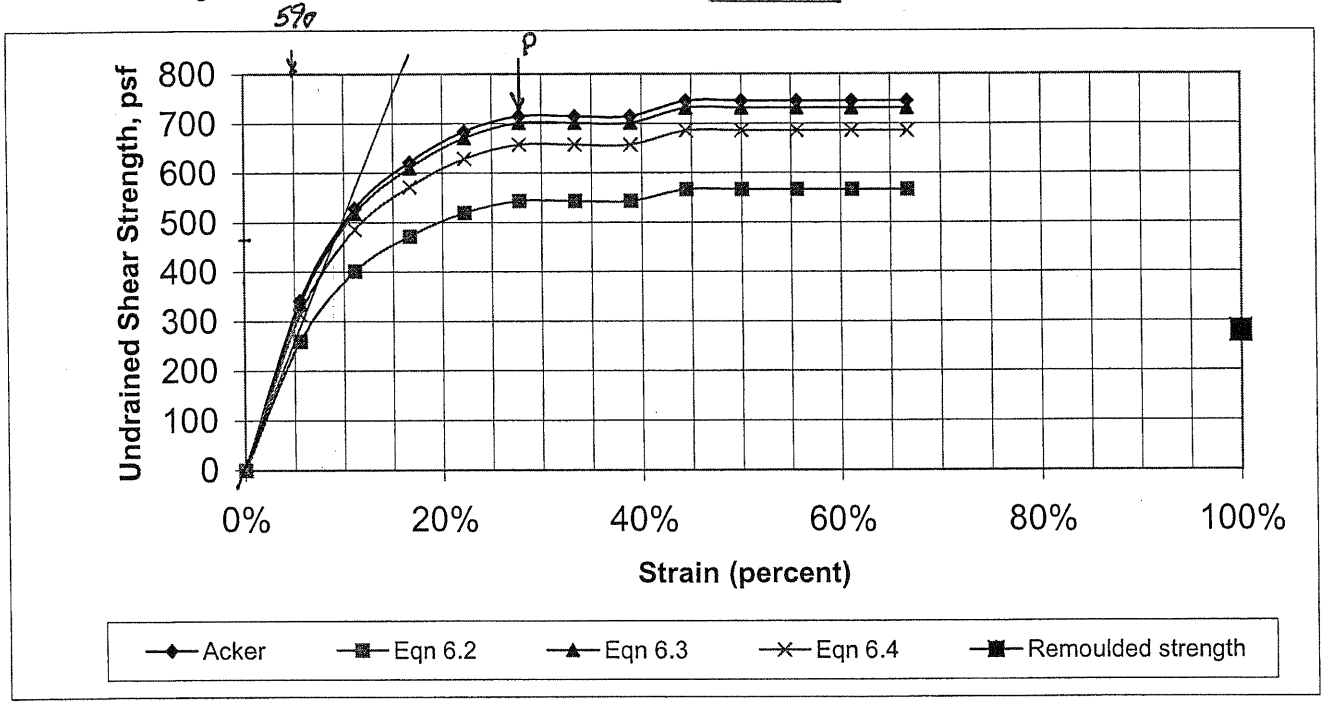
Estimated Overburden pressure = psf

Vane size		
	rod diam	0.75 in
	Length	6.625 in
	Width	2.5 in
	Flat/Tapered	Tapered
	k =	2.59 Acker
	moment arm	12 inches

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	11	341.88	259.59	335.24	314.21
10	0.1745	11.12%	17	528.36	401.19	518.10	485.60
15	0.2618	16.68%	20	621.60	471.99	609.52	571.30
20	0.3491	22.23%	22	683.76	519.19	670.48	628.43
25	0.4363	27.79%	23	714.84	542.79	700.95	656.99
30	0.5236	33.35%	23	714.84	542.79	700.95	656.99
35	0.6109	38.91%	23	714.84	542.79	700.95	656.99
40	0.6981	44.47%	24	745.92	566.39	731.43	685.56
45	0.7854	50.03%	24	745.92	566.39	731.43	685.56
50	0.8727	55.58%	24	745.92	566.39	731.43	685.56
55	0.9599	61.14%	24	745.92	566.39	731.43	685.56
60	1.0472	66.70%	24	745.92	566.39	731.43	685.56

Remoulded strength 9:00 279.72 psf 1.00



Peak = 710 psf @ 28%
Remoulded = 280 psf
5% = 320 psf
End Straight Line = 460 psf

ok GP

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 23.5

Elevation: - ft msl

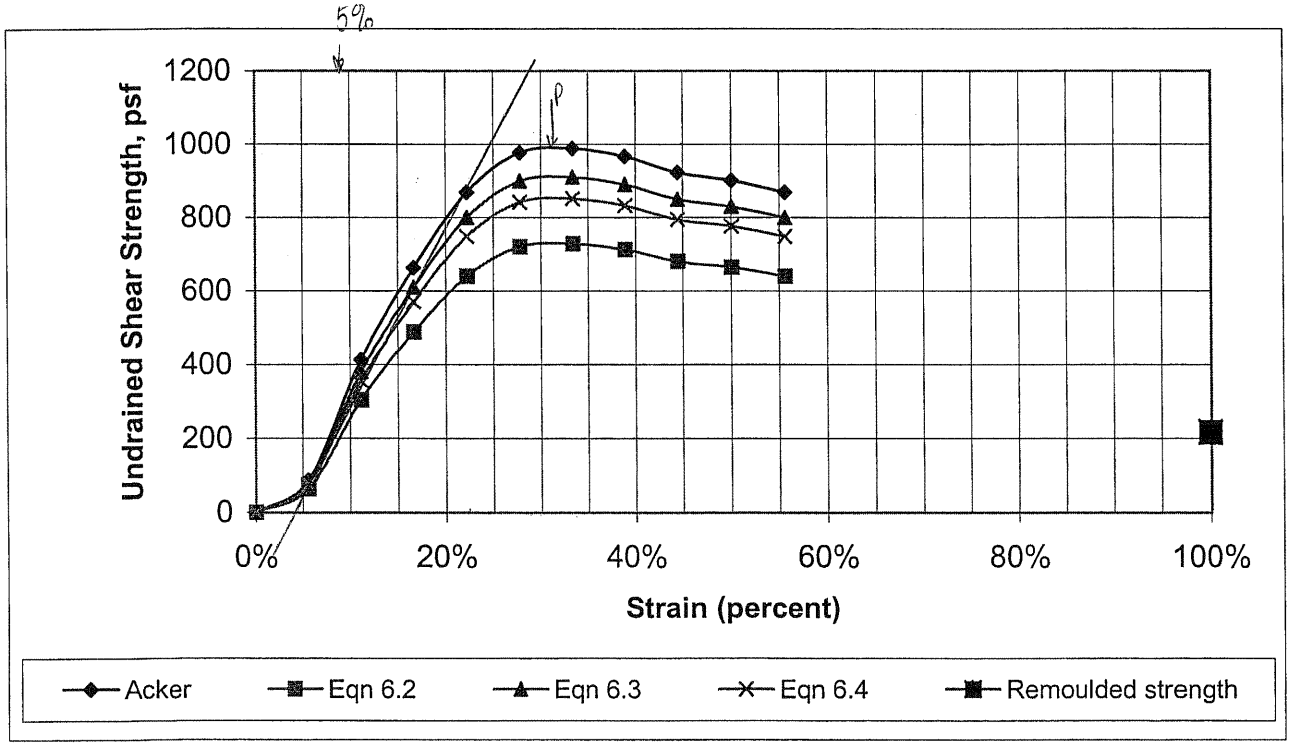
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Taper Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	8	86.88	64.04	79.97	74.83
10	0.1745	11.12%	38	412.68	304.18	379.87	355.43
15	0.2618	16.68%	61	662.46	488.29	609.80	570.57
20	0.3491	22.23%	80	868.80	640.37	799.74	748.28
25	0.4363	27.79%	90	977.40	720.42	899.70	841.82
30	0.5236	33.35%	91	988.26	728.43	909.70	851.17
35	0.6109	38.91%	89	966.54	712.42	889.71	832.46
40	0.6981	44.47%	85	923.10	680.40	849.72	795.05
45	0.7854	50.03%	83	901.38	664.39	829.73	776.34
50	0.8727	55.58%	80	868.80	640.37	799.74	748.28

Remoulded strength 20.00 217.20 psf 1.00



PEAK = 990 psf @ 20%

REMOULDED = 220 psf

5% = 300 psf

END STRAIGHT LINE = 900 psf

OK GP

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 27.5

Elevation = ft msl

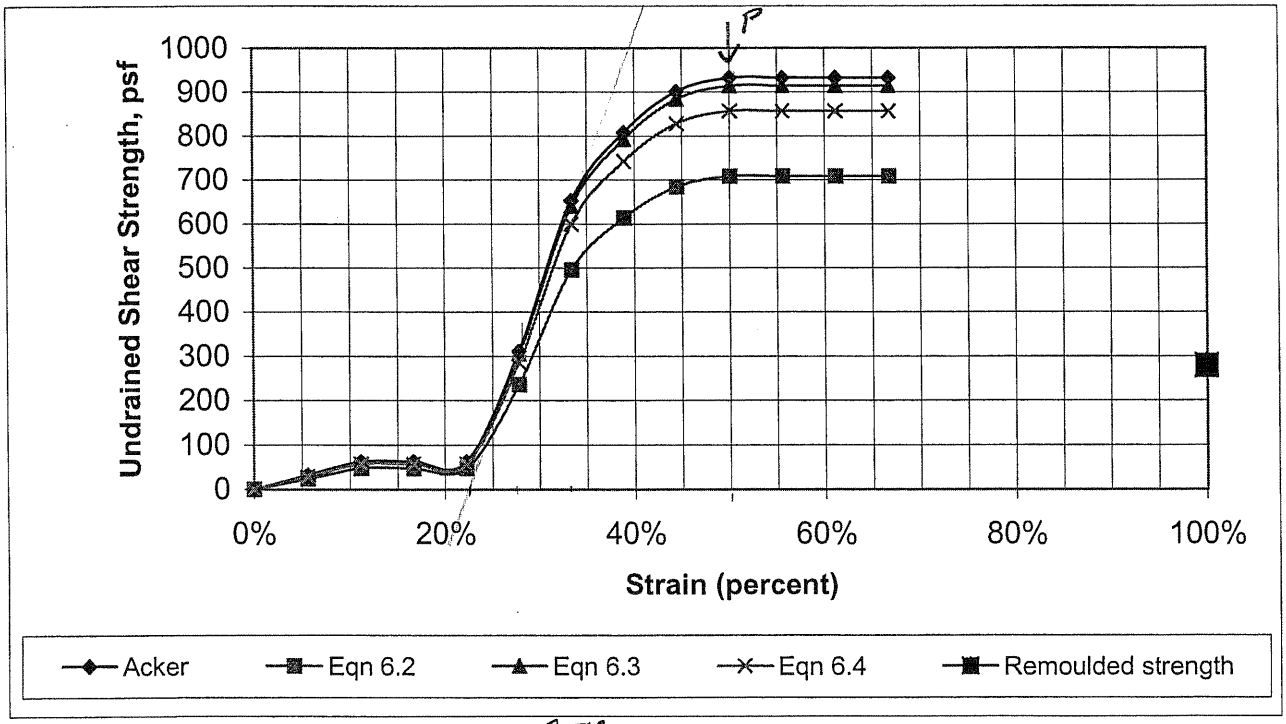
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Tapere Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	1	31.08	23.60	30.48	28.56
10	0.1745	11.12%	2	62.16	47.20	60.95	57.13
15	0.2618	16.68%	2	62.16	47.20	60.95	57.13
20	0.3491	22.23%	2	62.16	47.20	60.95	57.13
25	0.4363	27.79%	10	310.80	235.99	304.76	285.65
30	0.5236	33.35%	21	652.68	495.59	640.00	599.86
35	0.6109	38.91%	26	808.08	613.58	792.38	742.69
40	0.6981	44.47%	29	901.32	684.38	883.81	828.38
45	0.7854	50.03%	30	932.40	707.98	914.29	856.95
50	0.8727	55.58%	30	932.40	707.98	914.29	856.95
55	0.9599	61.14%	30	932.40	707.98	914.29	856.95
60	1.0472	66.70%	30	932.40	707.98	914.29	856.95

Remoulded strength 9.00 279.72 psf 1.00



Peak = 930 @ 28% ε
Residual = 280
5% = 300
Straight Line = 700

ok GP

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 Elevation: 0.8 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 37.5

Elevation: - ft MSL

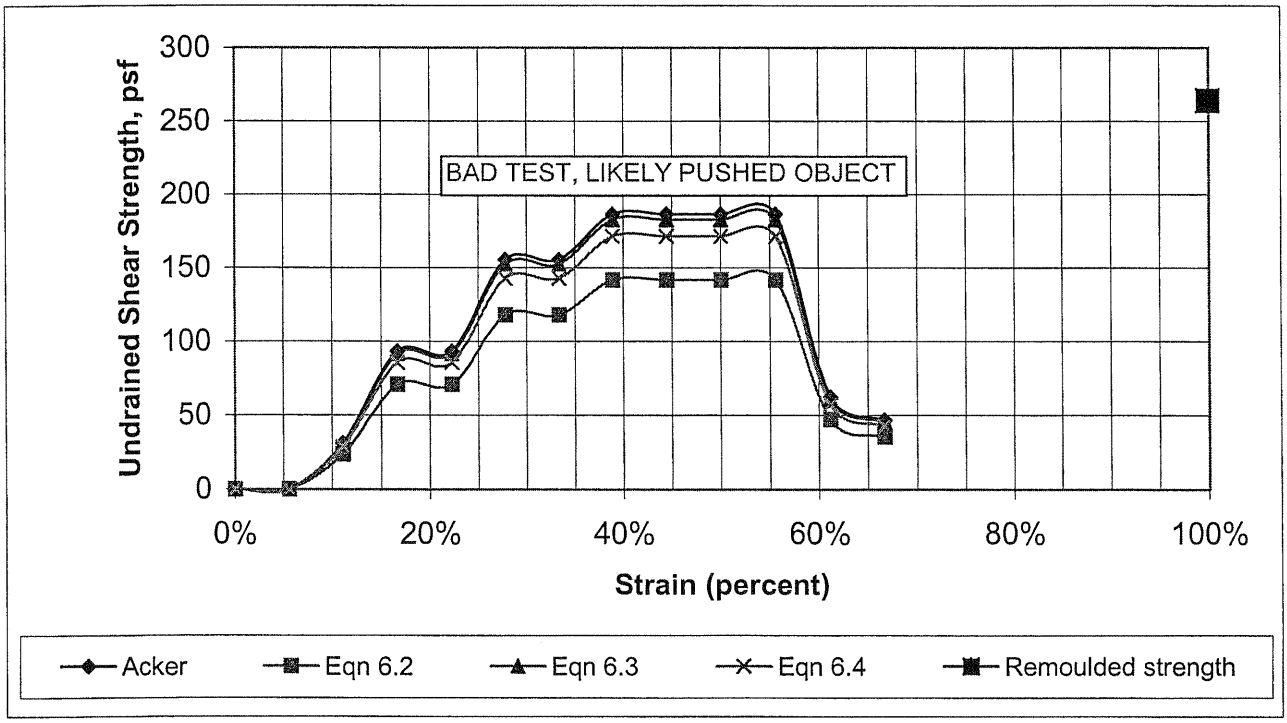
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Tapere Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	0	0.00	0.00	0.00	0.00
10	0.1745	11.12%	1	31.08	23.60	30.48	28.56
15	0.2618	16.68%	3	93.24	70.80	91.43	85.69
20	0.3491	22.23%	3	93.24	70.80	91.43	85.69
25	0.4363	27.79%	5	155.40	118.00	152.38	142.82
30	0.5236	33.35%	5	155.40	118.00	152.38	142.82
35	0.6109	38.91%	6	186.48	141.60	182.86	171.39
40	0.6981	44.47%	6	186.48	141.60	182.86	171.39
45	0.7854	50.03%	6	186.48	141.60	182.86	171.39
50	0.8727	55.58%	6	186.48	141.60	182.86	171.39
55	0.9599	61.14%	2	62.16	47.20	60.95	57.13
60	1.0472	66.70%	1.5	46.62	35.40	45.71	42.85

Remoulded strength 8.50 264.18 psf 1.00



PEAK = 190psf
REMOULDED = 260psf

OK GR

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 Elevation: 8.8 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 39.5

Elevation= ft MSL

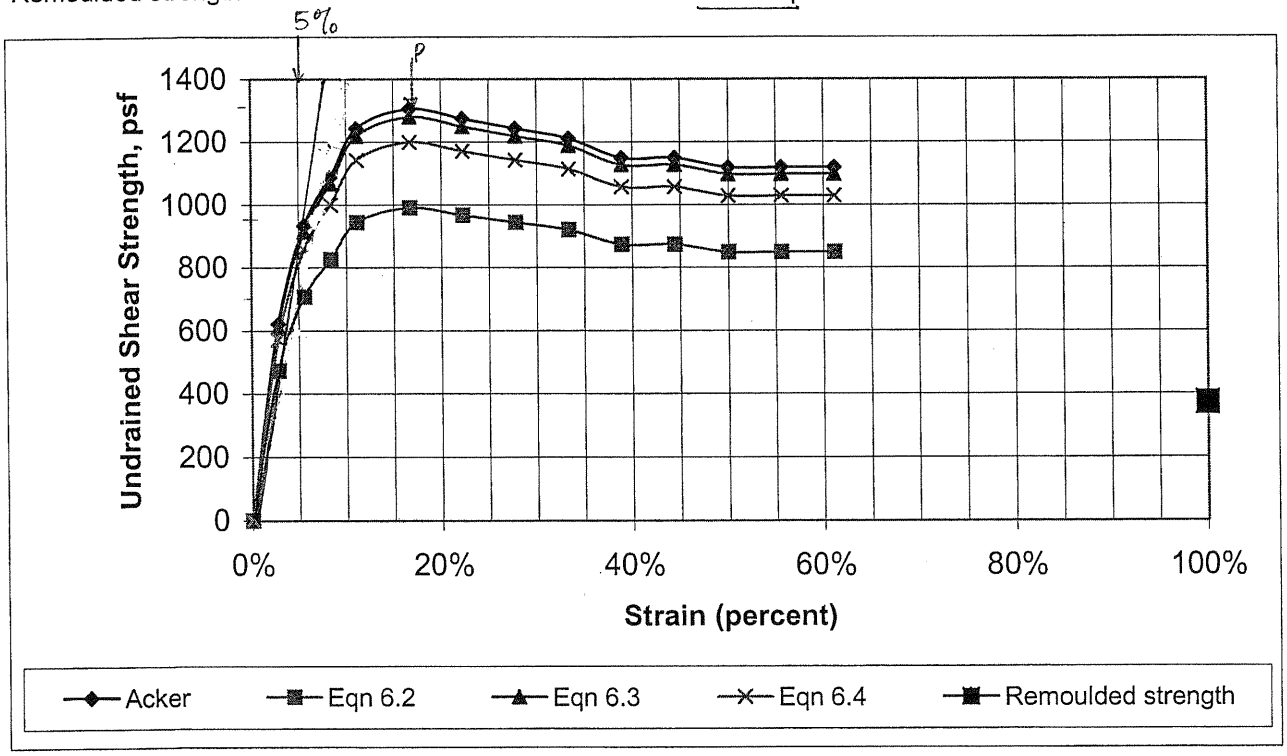
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapere Tapered
- k = 2.59 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	20	621.60	471.99	609.52	571.30
5	0.0873	5.56%	30	932.40	707.98	914.29	856.95
7.5	0.1309	8.34%	35	1087.80	825.98	1066.67	999.77
10	0.1745	11.12%	40	1243.20	943.98	1219.05	1142.59
15	0.2618	16.68%	42	1305.36	991.17	1280.00	1199.72
20	0.3491	22.23%	41	1274.28	967.58	1249.52	1171.16
25	0.4363	27.79%	40	1243.20	943.98	1219.05	1142.59
30	0.5236	33.35%	39	1212.12	920.38	1188.57	1114.03
35	0.6109	38.91%	37	1149.96	873.18	1127.62	1056.90
40	0.6981	44.47%	37	1149.96	873.18	1127.62	1056.90
45	0.7854	50.03%	36	1118.88	849.58	1097.14	1028.33
50	0.8727	55.58%	36	1118.88	849.58	1097.14	1028.33
55	0.9599	61.14%	36	1118.88	849.58	1097.14	1028.33

Remoulded strength 12.00 372.96 psf 1.00



PEAK = 1300 psf @ 17 %
REMOULDED = 370 psf
5% = 800 psf
END STRAIGHT LINE = 950 psf

OK

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-02 8.8ft MSL Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~48~~ 47.5

Elevation -37.5

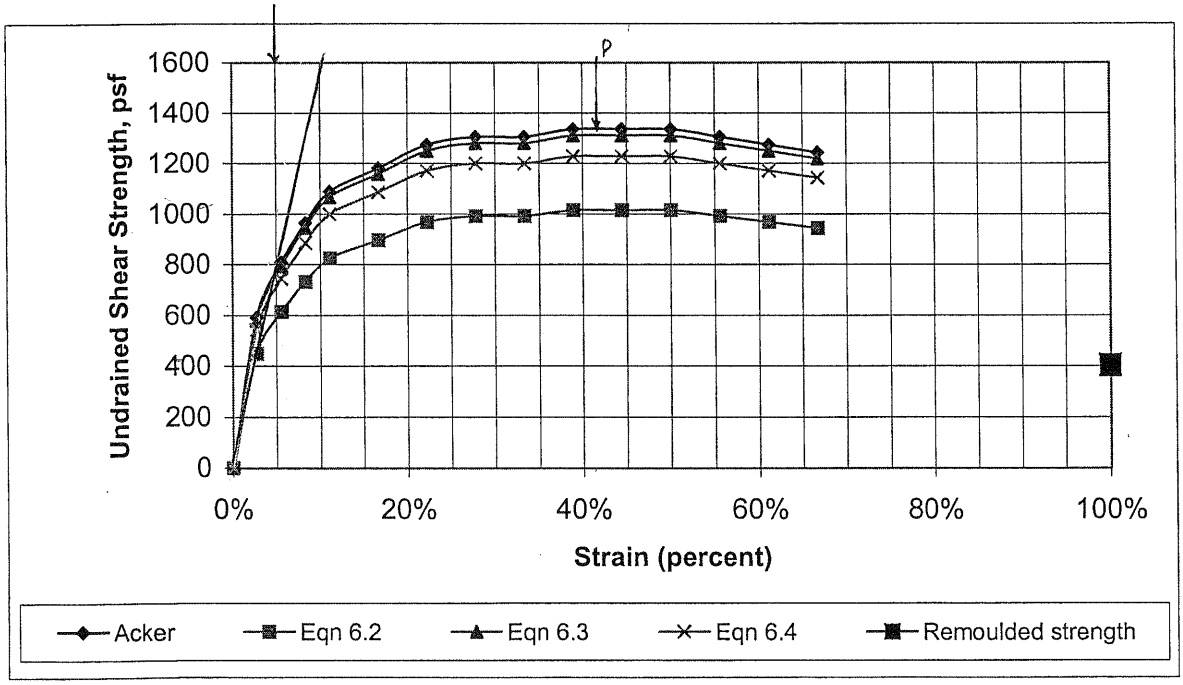
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Taper Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	19	590.52	448.39	579.05	542.73
5	0.0873	5.56%	26	808.08	613.58	792.38	742.69
7.5	0.1309	8.34%	31	963.48	731.58	944.76	885.51
10	0.1745	11.12%	35	1087.80	825.98	1066.67	999.77
15	0.2618	16.68%	38	1181.04	896.78	1158.10	1085.46
20	0.3491	22.23%	41	1274.28	967.58	1249.52	1171.16
25	0.4363	27.79%	42	1305.36	991.17	1280.00	1199.72
30	0.5236	33.35%	42	1305.36	991.17	1280.00	1199.72
35	0.6109	38.91%	43	1336.44	1014.77	1310.48	1228.29
40	0.6981	44.47%	43	1336.44	1014.77	1310.48	1228.29
45	0.7854	50.03%	43	1336.44	1014.77	1310.48	1228.29
50	0.8727	55.58%	42	1305.36	991.17	1280.00	1199.72
55	0.9599	61.14%	41	1274.28	967.58	1249.52	1171.16
60	1.0472	66.70%	40	1243.20	943.98	1219.05	1142.59
65	1.1345	72.26%	39	1212.12	920.38	1188.57	1114.03
70	1.2217	77.82%	38	1181.04	896.78	1158.10	1085.46
75	1.3090	83.38%	36	1118.88	849.58	1097.14	1028.33
80	1.3963	88.93%	36	1118.88	849.58	1097.14	1028.33

Remoulded strength 5% 13.00 404.04 psf 1.00



PEAK = 1340 psf @ 42%
REMOULDED = 400 psf
5% = 800 psf
END STRAIGHT = 800 psf

OK GP

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-03 Elevation = 9.1 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 17.5

Elevation = -8 ft MSL

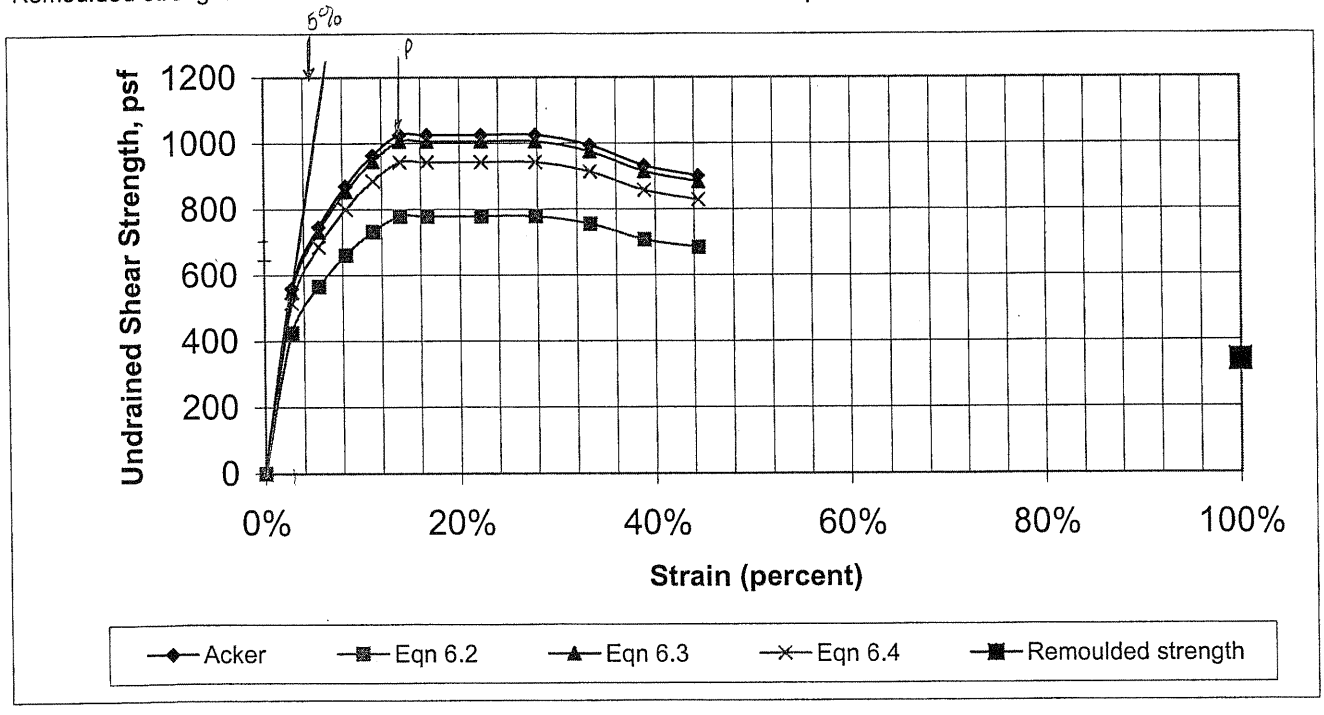
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapered Tapered
- k = 2.59 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	18	559.44	424.79	548.57	514.17
5	0.0873	5.56%	24	745.92	566.39	731.43	685.56
7.5	0.1309	8.34%	28	870.24	660.78	853.33	799.82
10	0.1745	11.12%	31	963.48	731.58	944.76	885.51
12.5	0.2182	13.90%	33	1025.64	778.78	1005.71	942.64
15	0.2618	16.68%	33	1025.64	778.78	1005.71	942.64
20	0.3491	22.23%	33	1025.64	778.78	1005.71	942.64
25	0.4363	27.79%	33	1025.64	778.78	1005.71	942.64
30	0.5236	33.35%	32	994.56	755.18	975.24	914.08
35	0.6109	38.91%	30	932.40	707.98	914.29	856.95
40	0.6981	44.47%	29	901.32	684.38	883.81	828.38

Remoulded strength 11.00 341.88 psf 1.00



PEAK = * 1020 psf @ 14%

REMOULDED = 340 psf

5% = * 700 psf

END STRAIGHT = * 640 psf

OK (GR)

* revised from original estimate

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-04 Elevation = 6.2 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~18~~ 17.5

Elevation = -11 MSL

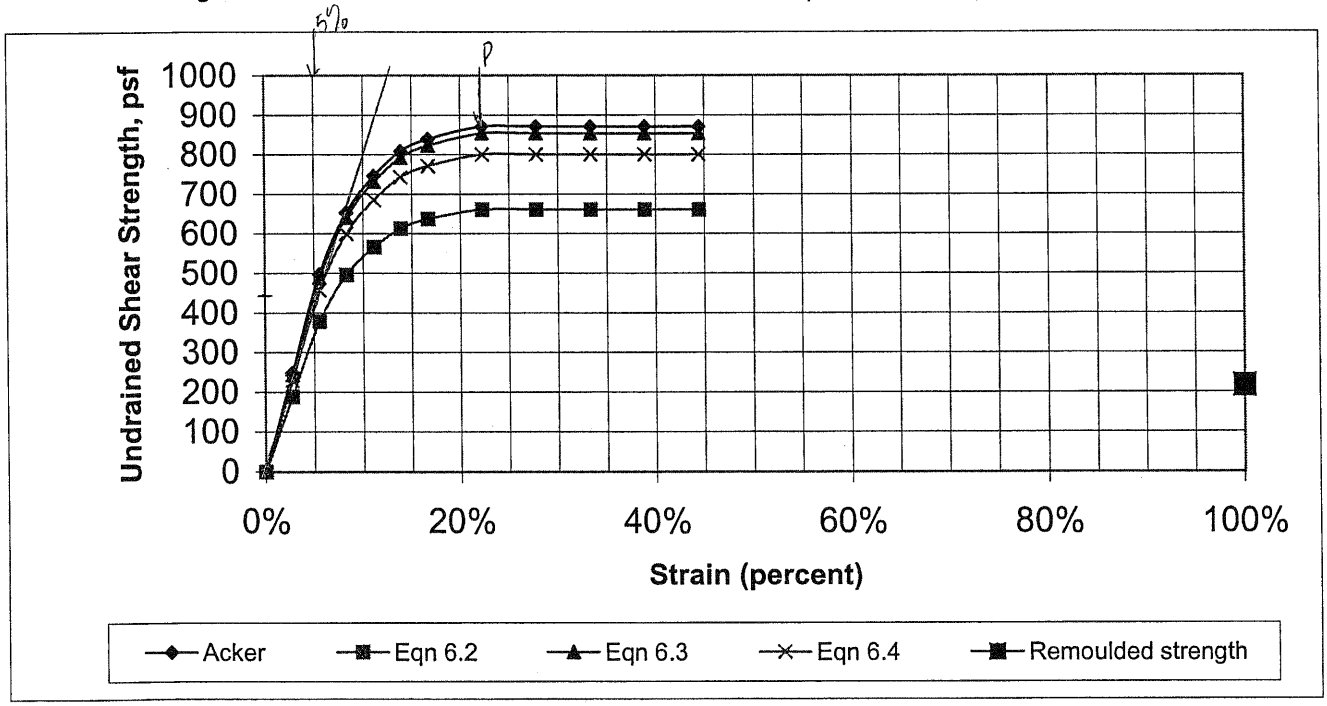
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapered Tapered
- k = 2.59 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	8	248.64	188.80	243.81	228.52
5	0.0873	5.56%	16	497.28	377.59	487.62	457.04
7.5	0.1309	8.34%	21	652.68	495.59	640.00	599.86
10	0.1745	11.12%	24	745.92	566.39	731.43	685.56
12.5	0.2182	13.90%	26	808.08	613.58	792.38	742.69
15	0.2618	16.68%	27	839.16	637.18	822.86	771.25
20	0.3491	22.23%	28	870.24	660.78	853.33	799.82
25	0.4363	27.79%	28	870.24	660.78	853.33	799.82
30	0.5236	33.35%	28	870.24	660.78	853.33	799.82
35	0.6109	38.91%	28	870.24	660.78	853.33	799.82
40	0.6981	44.47%	28	870.24	660.78	853.33	799.82

Remoulded strength 7.00 217.56 psf 1.00



PEAK : 870psf @ 22%

REMOULDED = 220psf

5% = 450psf

STRAIGHT LINE = 600psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-04 6.2ft MSL Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 26 25.5

= ?ft MSL

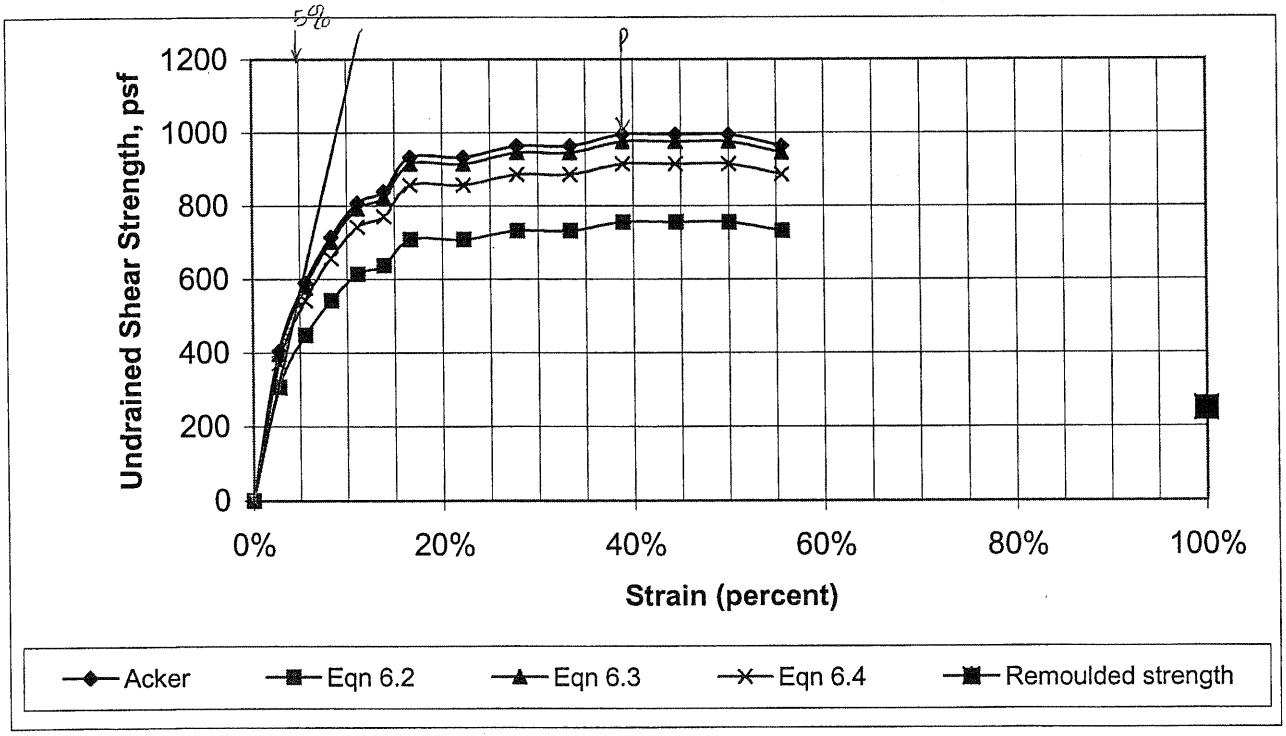
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapere Tapered
- k = 2.59 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	13	404.04	306.79	396.19	371.34
5	0.0873	5.56%	19	590.52	448.39	579.05	542.73
7.5	0.1309	8.34%	23	714.84	542.79	700.95	656.99
10	0.1745	11.12%	26	808.08	613.58	792.38	742.69
12.5	0.2182	13.90%	27	839.16	637.18	822.86	771.25
15	0.2618	16.68%	30	932.40	707.98	914.29	856.95
20	0.3491	22.23%	30	932.40	707.98	914.29	856.95
25	0.4363	27.79%	31	963.48	731.58	944.76	885.51
30	0.5236	33.35%	31	963.48	731.58	944.76	885.51
35	0.6109	38.91%	32	994.56	755.18	975.24	914.08
40	0.6981	44.47%	32	994.56	755.18	975.24	914.08
45	0.7854	50.03%	32	994.56	755.18	975.24	914.08
50	0.8727	55.58%	31	963.48	731.58	944.76	885.51

Remoulded strength 8.00 248.64 psf 1.00



PEAK = 990 psf @ 38%

REMOULDED = 250 psf

5% = 550 psf

END STRAIGHT = 600 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-04 6.2 ft MSL Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~34~~ 33.5

= - . ft MSL

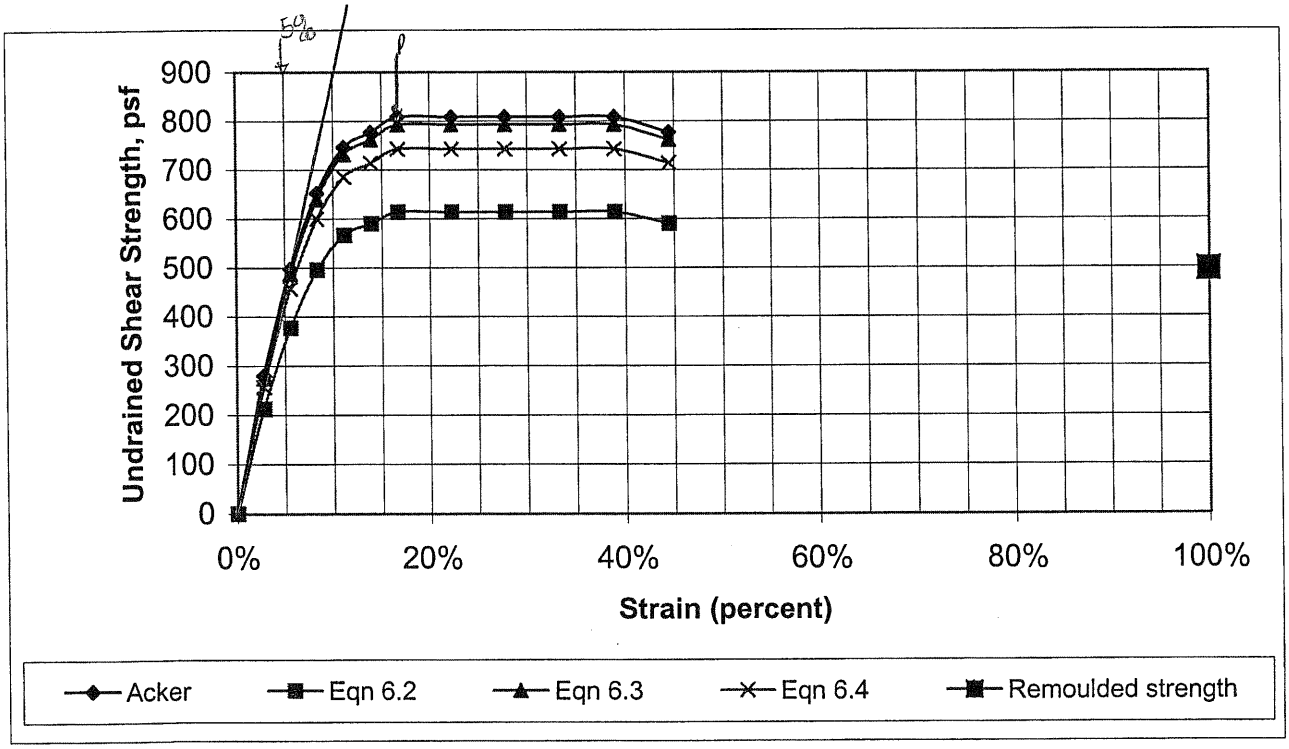
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapere Tapered
- k = 2.59 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	9	279.72	212.39	274.29	257.08
5	0.0873	5.56%	16	497.28	377.59	487.62	457.04
7.5	0.1309	8.34%	21	652.68	495.59	640.00	599.86
10	0.1745	11.12%	24	745.92	566.39	731.43	685.56
12.5	0.2182	13.90%	25	777.00	589.99	761.90	714.12
15	0.2618	16.68%	26	808.08	613.58	792.38	742.69
20	0.3491	22.23%	26	808.08	613.58	792.38	742.69
25	0.4363	27.79%	26	808.08	613.58	792.38	742.69
30	0.5236	33.35%	26	808.08	613.58	792.38	742.69
35	0.6109	38.91%	26	808.08	613.58	792.38	742.69
40	0.6981	44.47%	25	777.00	589.99	761.90	714.12

Remoulded strength 16.00 497.28 psf 1.00



PEAK : 810psf @ 17%

REMOULDED : 500psf

5% : 450 psf

END STRAIGHT = 500psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-04 6.2ft MSL Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~42~~ 41.5

= ft MSL

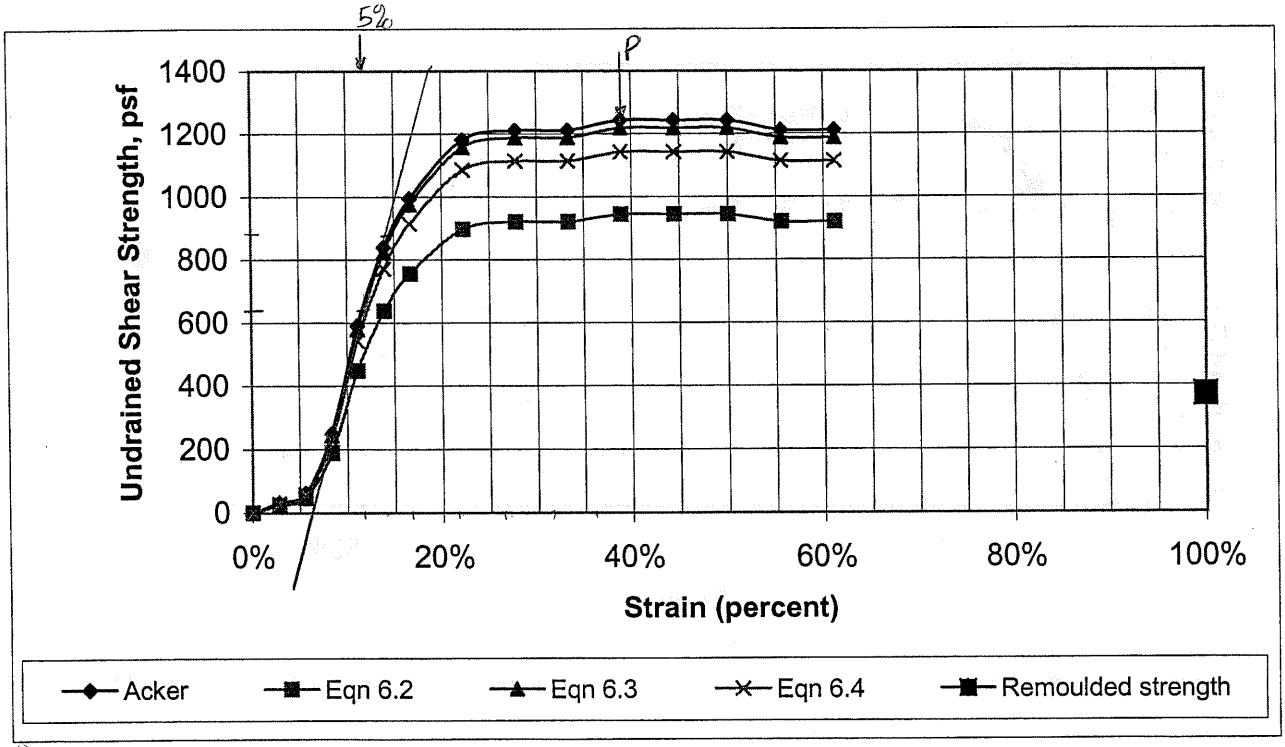
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Taper Tapered
- k = 2.59 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	1	31.08	23.60	30.48	28.56
5	0.0873	5.56%	2	62.16	47.20	60.95	57.13
7.5	0.1309	8.34%	8	248.64	188.80	243.81	228.52
10	0.1745	11.12%	19	590.52	448.39	579.05	542.73
12.5	0.2182	13.90%	27	839.16	637.18	822.86	771.25
15	0.2618	16.68%	32	994.56	755.18	975.24	914.08
20	0.3491	22.23%	38	1181.04	896.78	1158.10	1085.46
25	0.4363	27.79%	39	1212.12	920.38	1188.57	1114.03
30	0.5236	33.35%	39	1212.12	920.38	1188.57	1114.03
35	0.6109	38.91%	40	1243.20	943.98	1219.05	1142.59
40	0.6981	44.47%	40	1243.20	943.98	1219.05	1142.59
45	0.7854	50.03%	40	1243.20	943.98	1219.05	1142.59
50	0.8727	55.58%	39	1212.12	920.38	1188.57	1114.03
55	0.9599	61.14%	39	1212.12	920.38	1188.57	1114.03

Remoulded strength 12.00 372.96 psf 1.00



PEAK = 1240@ 33%

REMOULDED = 370 psf

5% = 650 psf

END STRAIGHT = 900 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-05 Elevation ≈ -1.9 ft MSL Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 5.5

Elevation = -7.4 ft MSL

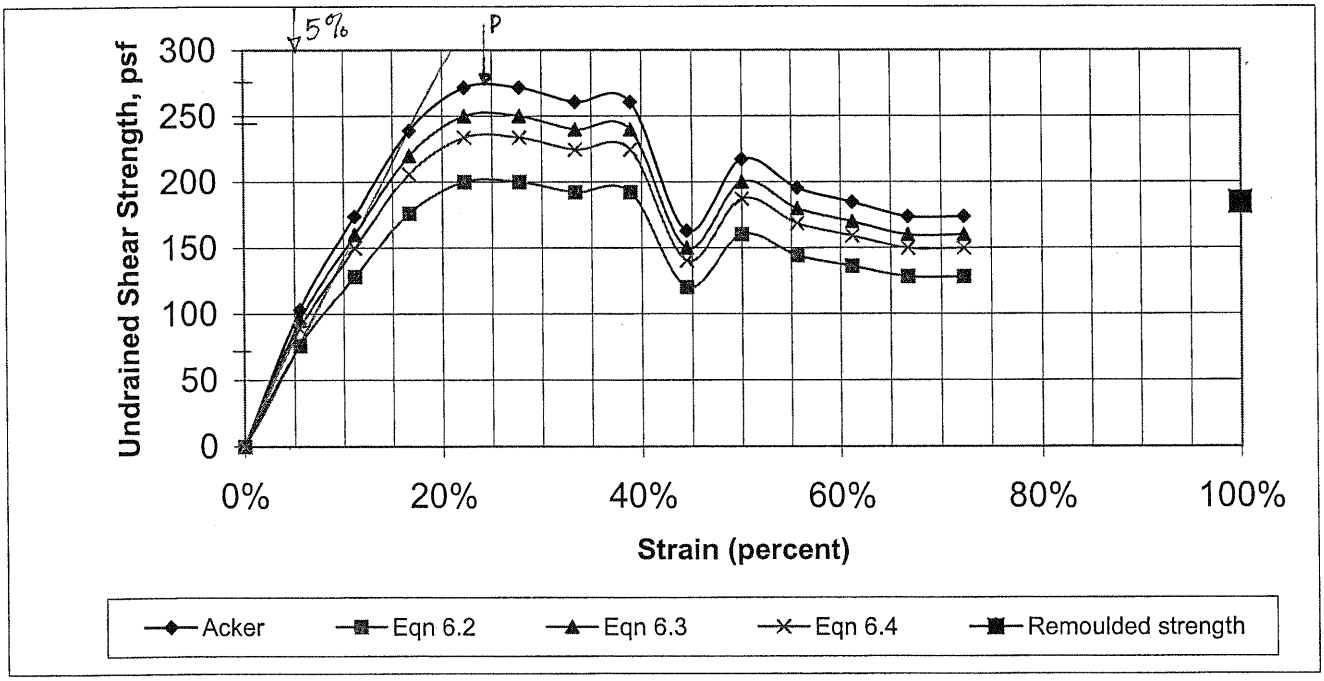
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Tapered Tapered
- k = 0.905 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	9.5	103.17	76.04	94.97	88.86
10	0.1745	11.12%	16	173.76	128.07	159.95	149.66
15	0.2618	16.68%	22	238.92	176.10	219.93	205.78
20	0.3491	22.23%	25	271.50	200.12	249.92	233.84
25	0.4363	27.79%	25	271.50	200.12	249.92	233.84
30	0.5236	33.35%	24	260.64	192.11	239.92	224.48
35	0.6109	38.91%	24	260.64	192.11	239.92	224.48
40	0.6981	44.47%	15	162.90	120.07	149.95	140.30
45	0.7854	50.03%	20	217.20	160.09	199.93	187.07
50	0.8727	55.58%	18	195.48	144.08	179.94	168.36
55	0.9599	61.14%	17	184.62	136.08	169.94	159.01
60	1.0472	66.70%	16	173.76	128.07	159.95	149.66
65	1.1345	72.26%	16	173.76	128.07	159.95	149.66

Remoulded strength 17.00 184.62 psf 1.00



PEAK = 280 psf @ 24%

REMOULDED = 190 psf

5% = 70 psf

END STRAIGHT LINE = 240 psf

OK GP

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-05 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~14~~ 13.5

Elevation = -15.4 ft MSL

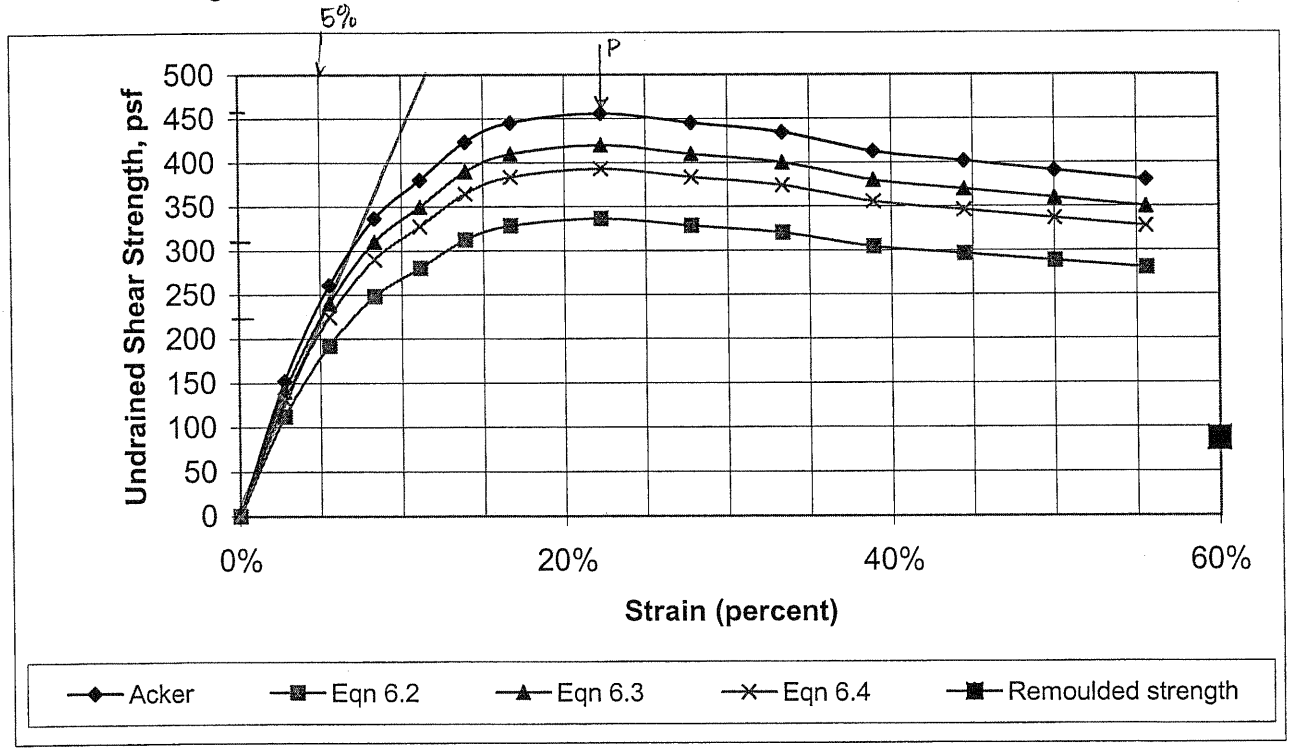
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Tapere Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	14	152.04	112.07	139.95	130.95
5	0.0873	5.56%	24	260.64	192.11	239.92	224.48
7.5	0.1309	8.34%	31	336.66	248.15	309.90	289.96
10	0.1745	11.12%	35	380.10	280.16	349.88	327.37
12.5	0.2182	13.90%	39	423.54	312.18	389.87	364.79
15	0.2618	16.68%	41	445.26	328.19	409.86	383.49
20	0.3491	22.23%	42	456.12	336.20	419.86	392.85
25	0.4363	27.79%	41	445.26	328.19	409.86	383.49
30	0.5236	33.35%	40	434.40	320.19	399.87	374.14
35	0.6109	38.91%	38	412.68	304.18	379.87	355.43
40	0.6981	44.47%	37	401.82	296.17	369.88	346.08
45	0.7854	50.03%	36	390.96	288.17	359.88	336.73
50	0.8727	55.58%	35	380.10	280.16	349.88	327.37

Remoulded strength 8.00 86.88 psf 0.60



PEAK = 460 psf @ 22%

REMOULDED = 90 psf

5% = 220 psf

END STRAIGHT LINE = 310 psf

OK GL

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-05 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~34~~ 33.5

Elevation = -35.4ft MSL

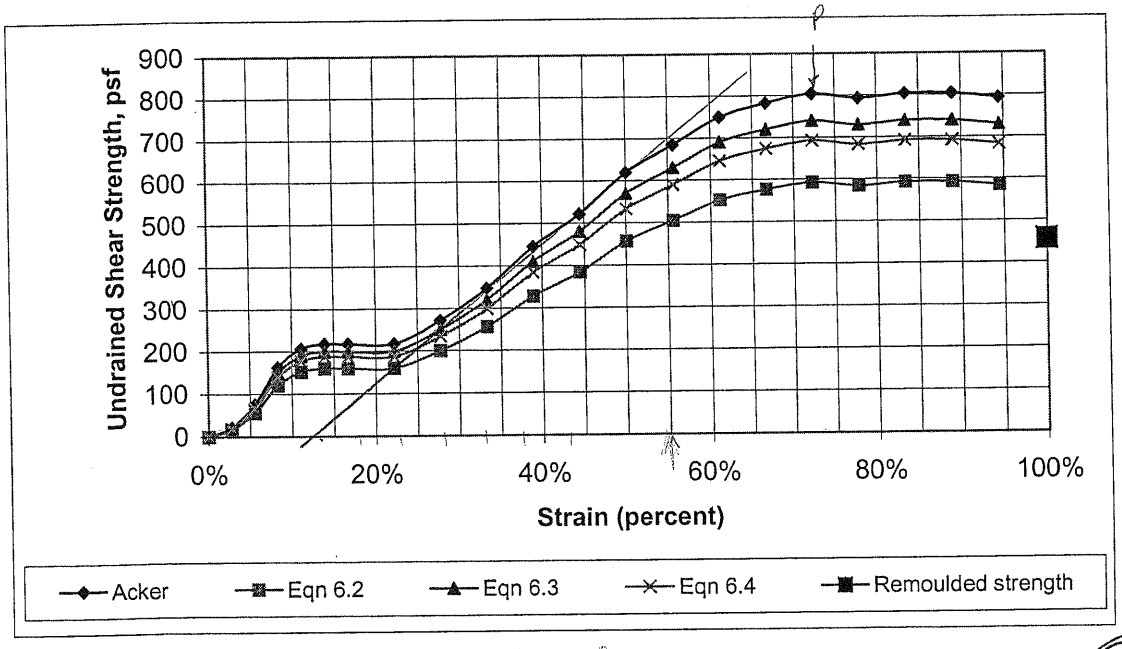
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size rod diam 0.75 in
Length 9.25 in
Width 3.625 in
Flat/Taper Tapered
k = 0.905 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	2	21.72	16.01	19.99	18.71
5	0.0873	5.56%	7	76.02	56.03	69.98	65.47
7.5	0.1309	8.34%	15	162.90	120.07	149.95	140.30
10	0.1745	11.12%	19	206.34	152.09	189.94	177.72
12.5	0.2182	13.90%	20	217.20	160.09	199.93	187.07
15	0.2618	16.68%	20	217.20	160.09	199.93	187.07
20	0.3491	22.23%	20	217.20	160.09	199.93	187.07
25	0.4363	27.79%	25	271.50	200.12	249.92	233.84
30	0.5236	33.35%	32	347.52	256.15	319.89	299.31
35	0.6109	38.91%	41	445.26	328.19	409.86	383.49
40	0.6981	44.47%	48	521.28	384.22	479.84	448.97
45	0.7854	50.03%	57	619.02	456.27	569.81	533.15
50	0.8727	55.58%	63	684.18	504.30	629.79	589.27
55	0.9599	61.14%	69	749.34	552.32	689.77	645.39
60	1.0472	66.70%	72	781.92	576.34	719.76	673.45
65	1.1345	72.26%	74	803.64	592.35	739.76	692.16
70	1.2217	77.82%	73	792.78	584.34	729.76	682.81
75	1.3090	83.38%	74	803.64	592.35	739.76	692.16
80	1.3963	88.93%	74	803.64	592.35	739.76	692.16
85	1.4835	94.49%	73	792.78	584.34	729.76	682.81

Remoulded strength 42.00 456.12 psf 1.00



PEAK = 800 psf @ 60%
REMOULDED = 400 psf
5% = 100 psf
END STRAIGHT LINE = 700 psf

OK GL

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-05 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 41.5

Elevation = -43.4ft MSL

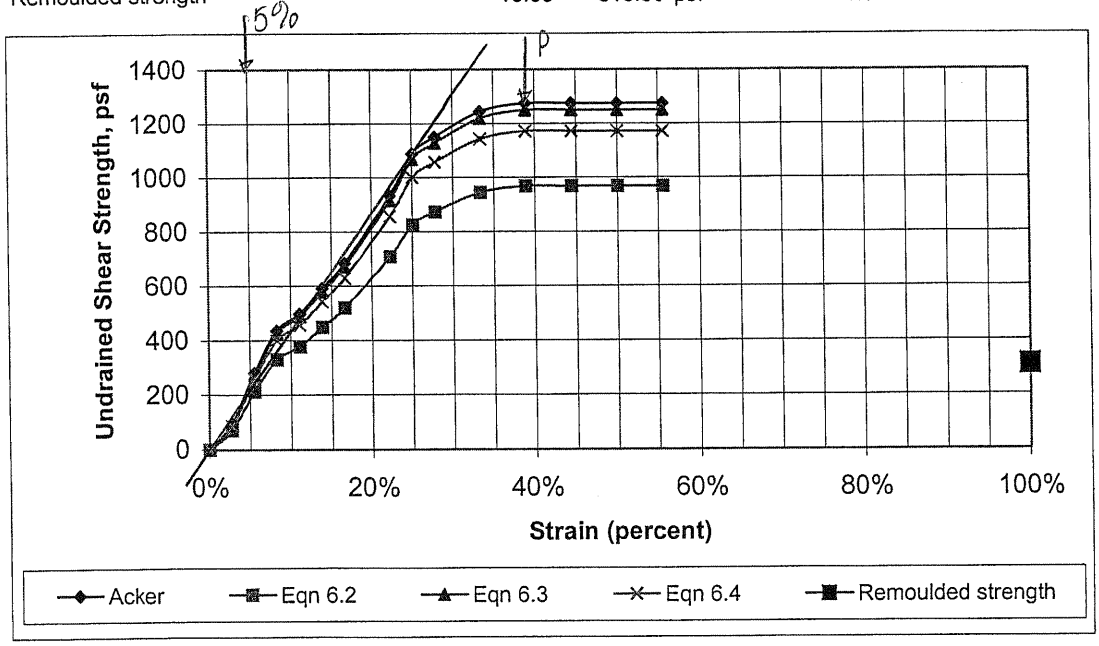
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Taper Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	3	93.24	70.80	91.43	85.69
5	0.0873	5.56%	9	279.72	212.39	274.29	257.08
7.5	0.1309	8.34%	14	435.12	330.39	426.67	399.91
10	0.1745	11.12%	16	497.28	377.59	487.62	457.04
12.5	0.2182	13.90%	19	590.52	448.39	579.05	542.73
15	0.2618	16.68%	22	683.76	519.19	670.48	628.43
20	0.3491	22.23%	30	932.40	707.98	914.29	856.95
22.5	0.3927	25.01%	35	1087.80	825.98	1066.67	999.77
25	0.4363	27.79%	37	1149.96	873.18	1127.62	1056.90
30	0.5236	33.35%	40	1243.20	943.98	1219.05	1142.59
35	0.6109	38.91%	41	1274.28	967.58	1249.52	1171.16
40	0.6981	44.47%	41	1274.28	967.58	1249.52	1171.16
45	0.7854	50.03%	41	1274.28	967.58	1249.52	1171.16
50	0.8727	55.58%	41	1274.28	967.58	1249.52	1171.16

Remoulded strength 10.00 310.80 psf 1.00



OK GK

PEAK = 1270 psf @ 38%

REMOULDED = 310 psf

5% = *210 psf

FAIL STRAIGHT = 1100 psf

* Revised from original

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 85.5

Estimated Overburden pressure = psf

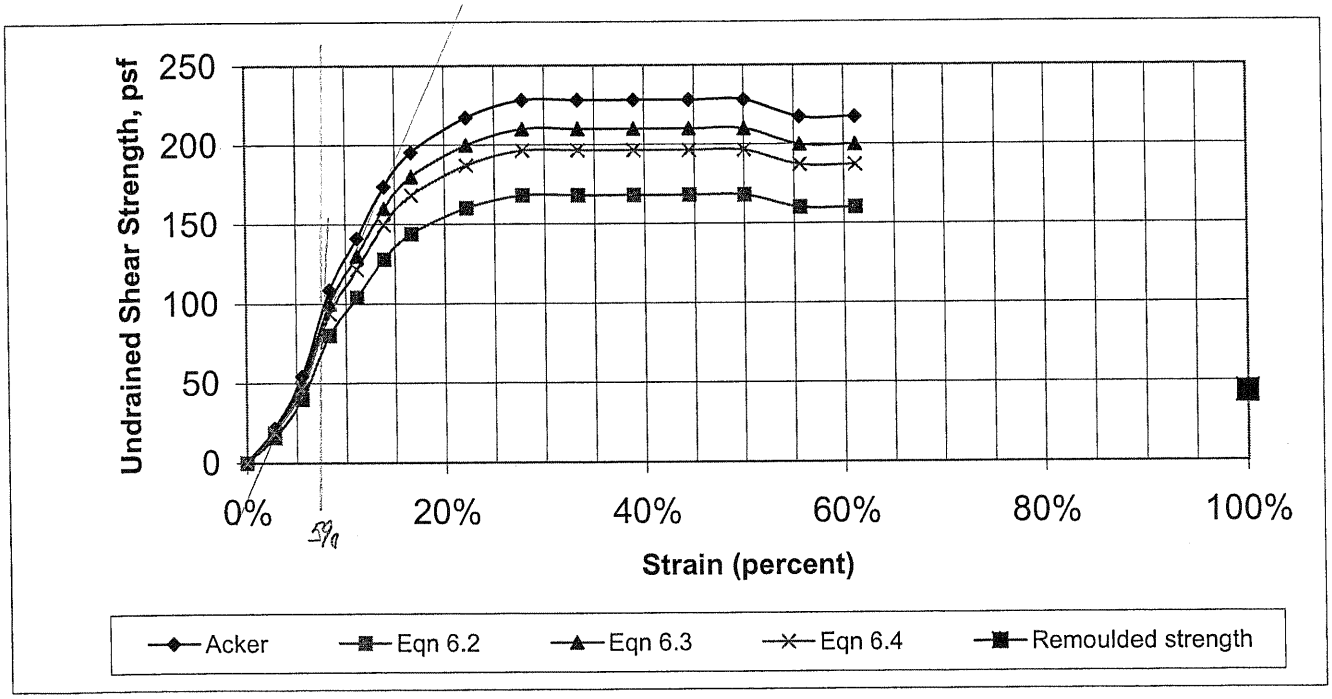
	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size

rod diam	0.75	in
Length	9.25	in
Width	3.625	in
Flat/Tapered	Tapered	
k =	0.905	Acker
moment arm	12	inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	2	21.72	16.01	19.99	18.71
5	0.0873	5.56%	5	54.30	40.02	49.98	46.77
7.5	0.1309	8.34%	10	108.60	80.05	99.97	93.54
10	0.1745	11.12%	13	141.18	104.06	129.96	121.60
12.5	0.2182	13.90%	16	173.76	128.07	159.95	149.66
15	0.2618	16.68%	18	195.48	144.08	179.94	168.36
20	0.3491	22.23%	20	217.20	160.09	199.93	187.07
25	0.4363	27.79%	21	228.06	168.10	209.93	196.42
30	0.5236	33.35%	21	228.06	168.10	209.93	196.42
35	0.6109	38.91%	21	228.06	168.10	209.93	196.42
40	0.6981	44.47%	21	228.06	168.10	209.93	196.42
45	0.7854	50.03%	21	228.06	168.10	209.93	196.42
50	0.8727	55.58%	20	217.20	160.09	199.93	187.07
55	0.9599	61.14%	20	217.20	160.09	199.93	187.07

Remoulded strength 4.00 43.44 psf 1.00



Peak = 230 psf
Remoulded = 40 psf
5% Strain = 100psf
Straight Line = 180psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~14~~ 13.5

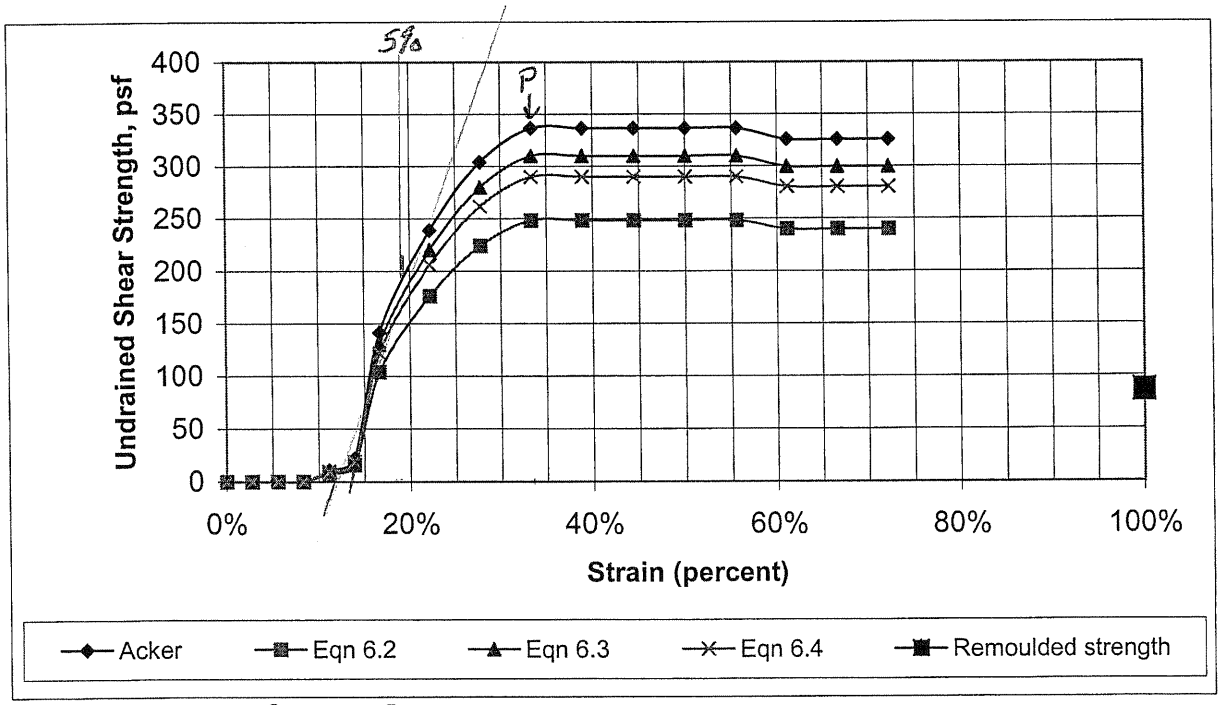
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Taper Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	0	0.00	0.00	0.00	0.00
5	0.0873	5.56%	0	0.00	0.00	0.00	0.00
7.5	0.1309	8.34%	0	0.00	0.00	0.00	0.00
10	0.1745	11.12%	1	10.86	8.00	10.00	9.35
12.5	0.2182	13.90%	2	21.72	16.01	19.99	18.71
15	0.2618	16.68%	13	141.18	104.06	129.96	121.60
20	0.3491	22.23%	22	238.92	176.10	219.93	205.78
25	0.4363	27.79%	28	304.08	224.13	279.91	261.90
30	0.5236	33.35%	31	336.66	248.15	309.90	289.96
35	0.6109	38.91%	31	336.66	248.15	309.90	289.96
40	0.6981	44.47%	31	336.66	248.15	309.90	289.96
45	0.7854	50.03%	31	336.66	248.15	309.90	289.96
50	0.8727	55.58%	31	336.66	248.15	309.90	289.96
55	0.9599	61.14%	30	325.80	240.14	299.90	280.61
60	1.0472	66.70%	30	325.80	240.14	299.90	280.61
65	1.1345	72.26%	30	325.80	240.14	299.90	280.61

Remoulded strength 8.00 86.88 psf 1.00



Peak = 340psf
Remoulded = 90psf
5% = 200psf
S.C. = 240psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~20~~ 19.5

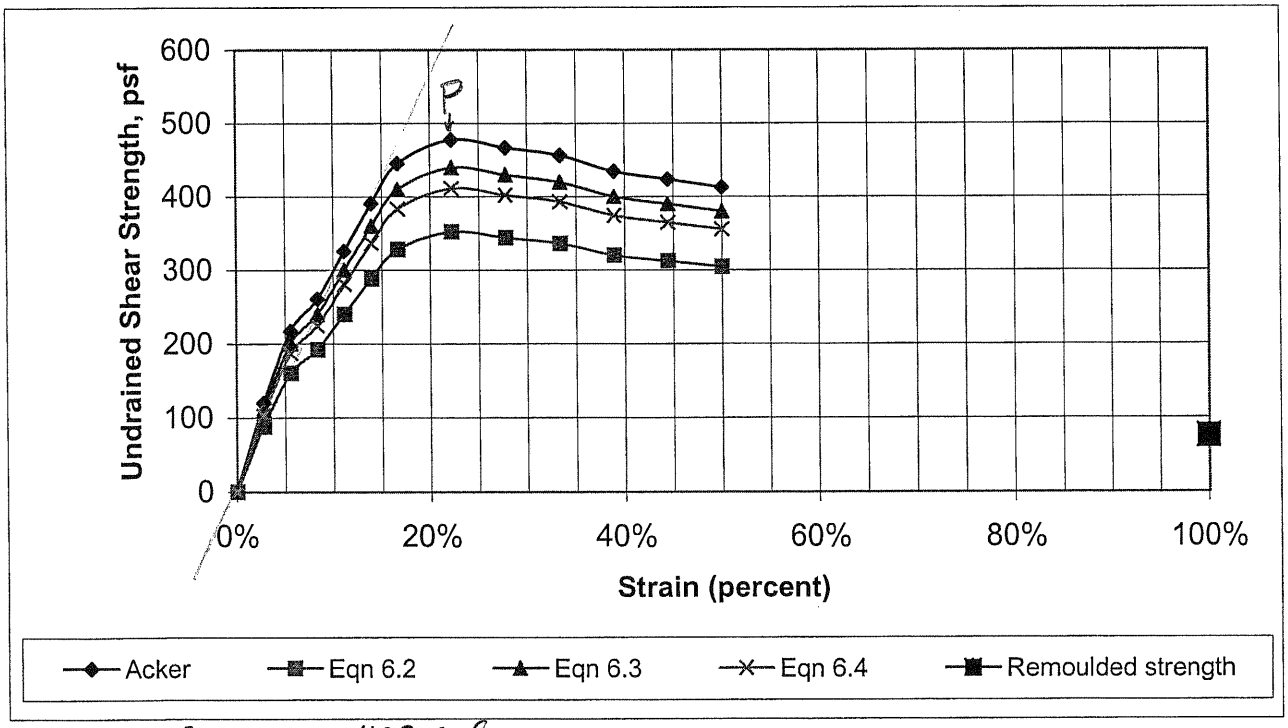
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Taper Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	11	119.46	88.05	109.96	102.89
5	0.0873	5.56%	20	217.20	160.09	199.93	187.07
7.5	0.1309	8.34%	24	260.64	192.11	239.92	224.48
10	0.1745	11.12%	30	325.80	240.14	299.90	280.61
12.5	0.2182	13.90%	36	390.96	288.17	359.88	336.73
15	0.2618	16.68%	41	445.26	328.19	409.86	383.49
20	0.3491	22.23%	44	477.84	352.21	439.85	411.56
25	0.4363	27.79%	43	466.98	344.20	429.86	402.20
30	0.5236	33.35%	42	456.12	336.20	419.86	392.85
35	0.6109	38.91%	40	434.40	320.19	399.87	374.14
40	0.6981	44.47%	39	423.54	312.18	389.87	364.79
45	0.7854	50.03%	38	412.68	304.18	379.87	355.43

Remoulded strength 7.00 76.02 psf 1.00



Peak = 480 psf
Remoulded = 76psf
5% Strain 200psf
Straight Line = 400 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~26~~ 25.5

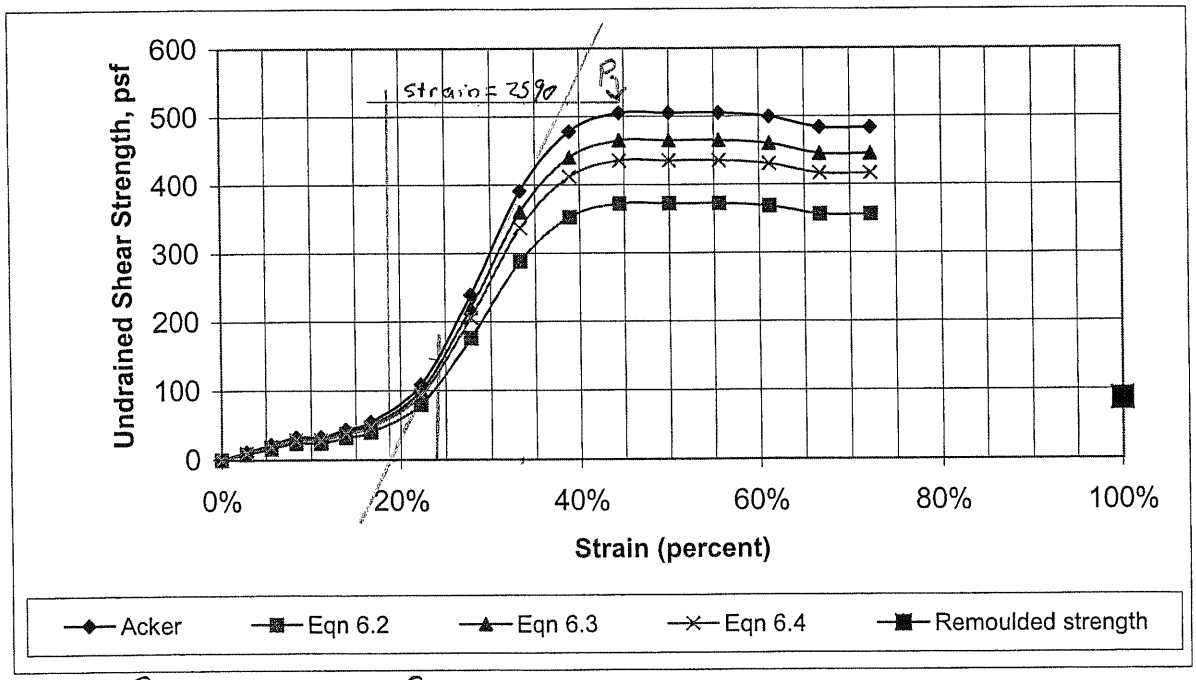
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size rod diam 0.75 in
Length 9.25 in
Width 3.625 in
Flat/Tapere Tapered
k = 0.905 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	1	10.86	8.00	10.00	9.35
5	0.0873	5.56%	2	21.72	16.01	19.99	18.71
7.5	0.1309	8.34%	3	32.58	24.01	29.99	28.06
10	0.1745	11.12%	3	32.58	24.01	29.99	28.06
12.5	0.2182	13.90%	4	43.44	32.02	39.99	37.41
15	0.2618	16.68%	5	54.30	40.02	49.98	46.77
20	0.3491	22.23%	10	108.60	80.05	99.97	93.54
25	0.4363	27.79%	22	238.92	176.10	219.93	205.78
30	0.5236	33.35%	36	390.96	288.17	359.88	336.73
35	0.6109	38.91%	44	477.84	352.21	439.85	411.56
40	0.6981	44.47%	46.5	504.99	372.22	464.85	434.94
45	0.7854	50.03%	46.5	504.99	372.22	464.85	434.94
50	0.8727	55.58%	46.5	504.99	372.22	464.85	434.94
55	0.9599	61.14%	46	499.56	368.22	459.85	430.26
60	1.0472	66.70%	44.5	483.27	356.21	444.85	416.23
65	1.1345	72.26%	44.5	483.27	356.21	444.85	416.23

Remoulded strength 8.00 86.88 psf 1.00



Peak = 500psf
Remoulded = 90 psf
5% Strain = 150psf
Straight Line = 400psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~34~~ 33.5

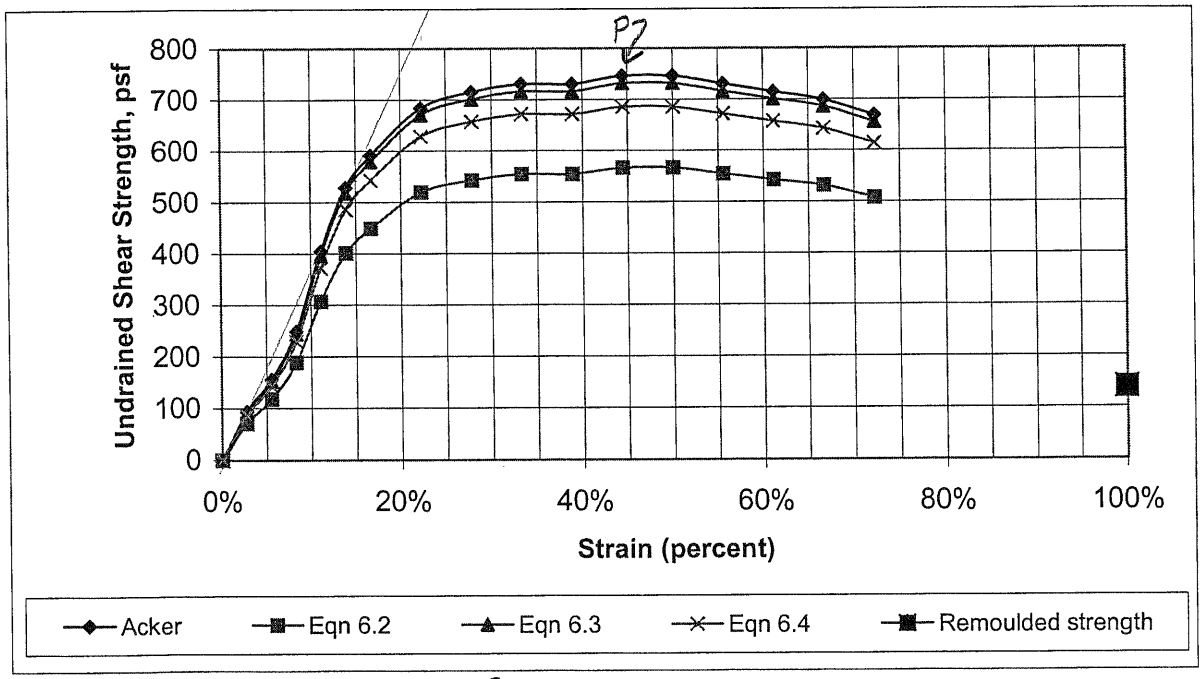
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Taper Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	3	93.24	70.80	91.43	85.69
5	0.0873	5.56%	5	155.40	118.00	152.38	142.82
7.5	0.1309	8.34%	8	248.64	188.80	243.81	228.52
10	0.1745	11.12%	13	404.04	306.79	396.19	371.34
12.5	0.2182	13.90%	17	528.36	401.19	518.10	485.60
15	0.2618	16.68%	19	590.52	448.39	579.05	542.73
20	0.3491	22.23%	22	683.76	519.19	670.48	628.43
25	0.4363	27.79%	23	714.84	542.79	700.95	656.99
30	0.5236	33.35%	23.5	730.38	554.59	716.19	671.27
35	0.6109	38.91%	23.5	730.38	554.59	716.19	671.27
40	0.6981	44.47%	24	745.92	566.39	731.43	685.56
45	0.7854	50.03%	24	745.92	566.39	731.43	685.56
50	0.8727	55.58%	23.5	730.38	554.59	716.19	671.27
55	0.9599	61.14%	23	714.84	542.79	700.95	656.99
60	1.0472	66.70%	22.5	699.30	530.99	685.71	642.71
65	1.1345	72.26%	21.5	668.22	507.39	655.24	614.14

Remoulded strength 4.50 139.86 psf 1.00



Peak = 750 psf
Remoulded = 140 psf
5% Strain = 175 psf
Straight Line = 550 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs ~~42~~ 41.5

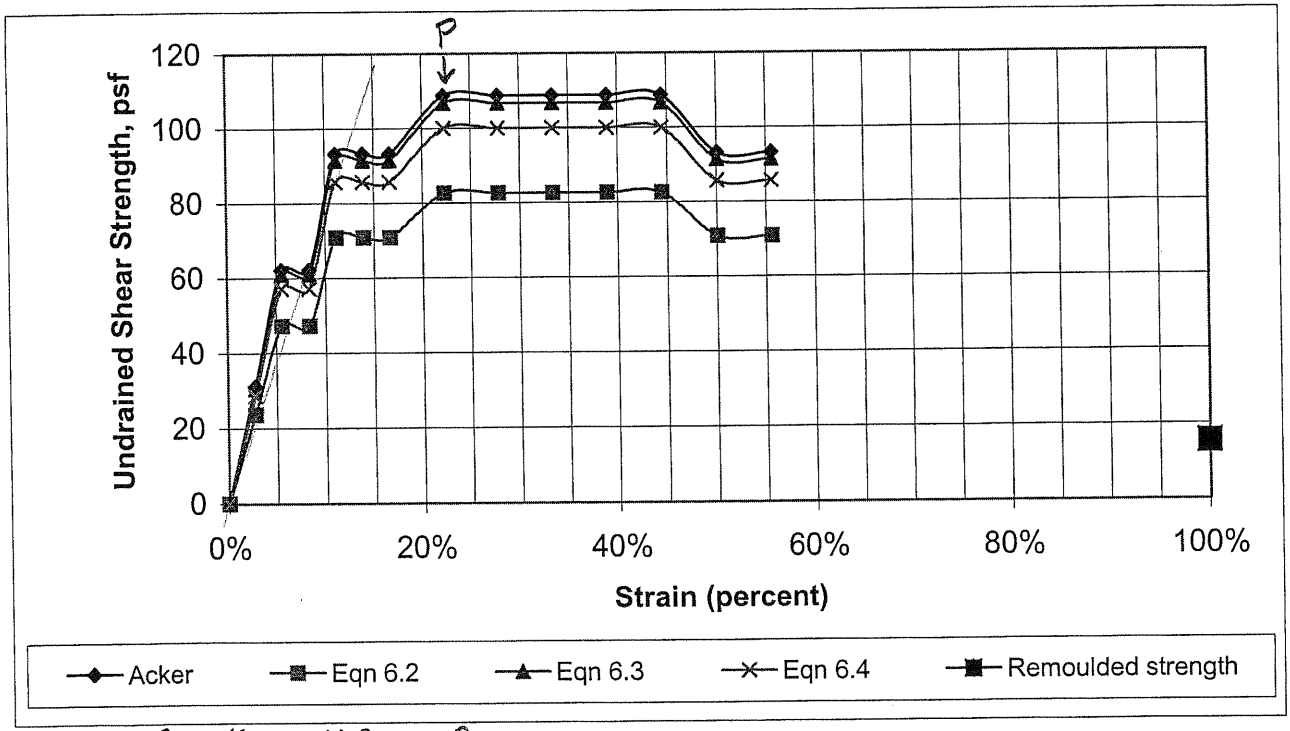
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
- rod diam 0.75 in
- Length 6.625 in
- Width 2.5 in
- Flat/Tapere Tapered
- k = 2.59 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	1	31.08	23.60	30.48	28.56
5	0.0873	5.56%	2	62.16	47.20	60.95	57.13
7.5	0.1309	8.34%	2	62.16	47.20	60.95	57.13
10	0.1745	11.12%	3	93.24	70.80	91.43	85.69
12.5	0.2182	13.90%	3	93.24	70.80	91.43	85.69
15	0.2618	16.68%	3	93.24	70.80	91.43	85.69
20	0.3491	22.23%	3.5	108.78	82.60	106.67	99.98
25	0.4363	27.79%	3.5	108.78	82.60	106.67	99.98
30	0.5236	33.35%	3.5	108.78	82.60	106.67	99.98
35	0.6109	38.91%	3.5	108.78	82.60	106.67	99.98
40	0.6981	44.47%	3.5	108.78	82.60	106.67	99.98
45	0.7854	50.03%	3	93.24	70.80	91.43	85.69
50	0.8727	55.58%	3	93.24	70.80	91.43	85.69

Remoulded strength 0.50 15.54 psf 1.00



Peak = 110 psf
Remoulded = 15 psf
5% Strain = 60 psf
Straight Line = 90 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-06
Bottom of Vane Depth, ft bgs ~~48~~ 47.5

Project: SAEP Causeway

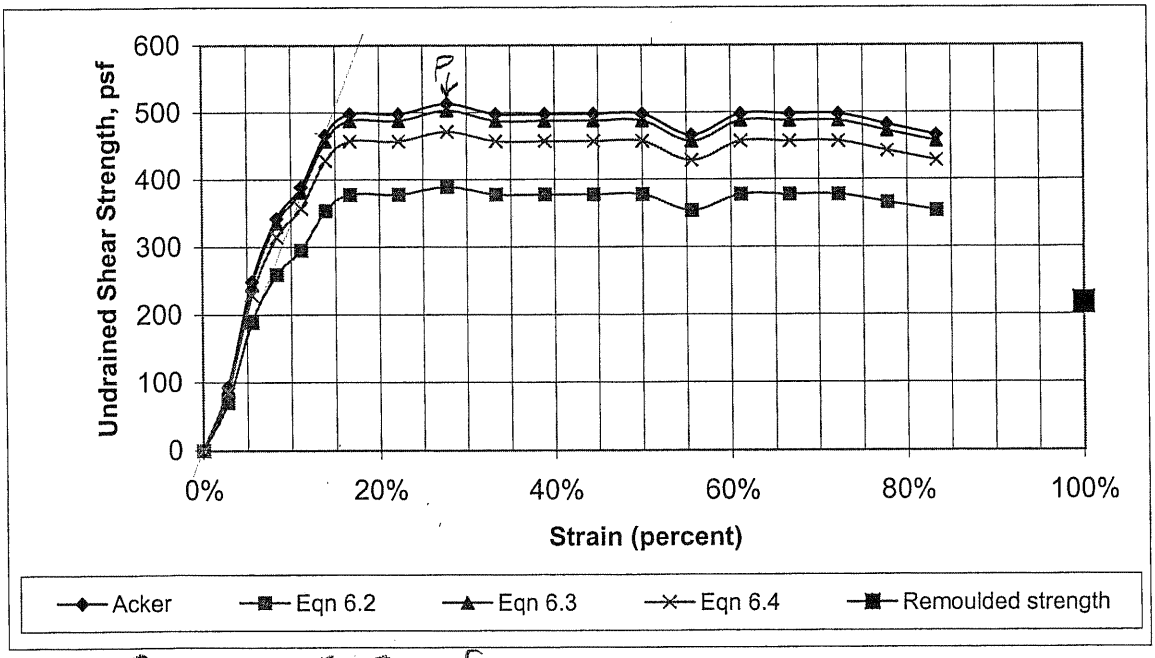
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size
rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Taper Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	3	93.24	70.80	91.43	85.69
5	0.0873	5.56%	8	248.64	188.80	243.81	228.52
7.5	0.1309	8.34%	11	341.88	259.59	335.24	314.21
10	0.1745	11.12%	12.5	388.50	294.99	380.95	357.06
12.5	0.2182	13.90%	15	466.20	353.99	457.14	428.47
15	0.2618	16.68%	16	497.28	377.59	487.62	457.04
20	0.3491	22.23%	16	497.28	377.59	487.62	457.04
25	0.4363	27.79%	16.5	512.82	389.39	502.86	471.32
30	0.5236	33.35%	16	497.28	377.59	487.62	457.04
35	0.6109	38.91%	16	497.28	377.59	487.62	457.04
40	0.6981	44.47%	16	497.28	377.59	487.62	457.04
45	0.7854	50.03%	16	497.28	377.59	487.62	457.04
50	0.8727	55.58%	15	466.20	353.99	457.14	428.47
55	0.9599	61.14%	16	497.28	377.59	487.62	457.04
60	1.0472	66.70%	16	497.28	377.59	487.62	457.04
65	1.1345	72.26%	16	497.28	377.59	487.62	457.04
70	1.2217	77.82%	15.5	481.74	365.79	472.38	442.76
75	1.3090	83.38%	15	466.20	353.99	457.14	428.47

Remoulded strength 7.00 217.56 psf 1.00



Peak = 510 psf
Remoulded = 220 psf
5% Strain = 250 psf
Straight Line = 470 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-07 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 11.5

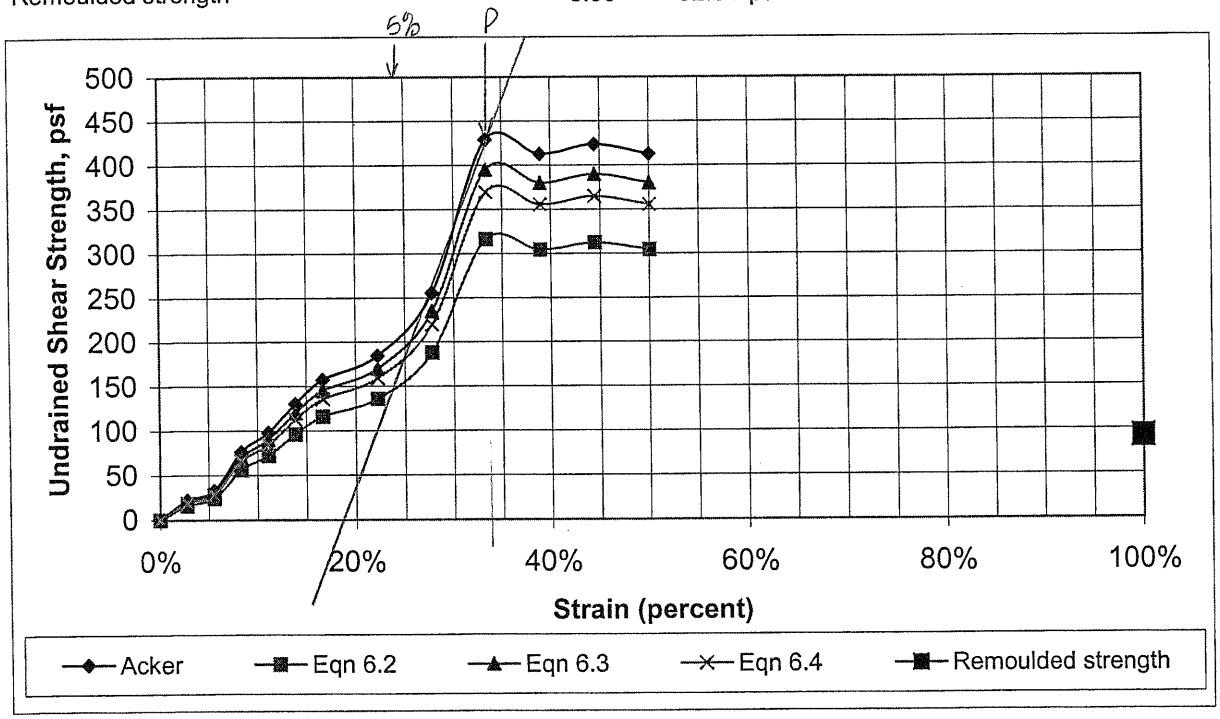
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size rod diam 0.75 in
Length 9.25 in
Width 3.625 in
Flat/Tapere Tapered
k = 0.905 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	2	21.72	16.01	19.99	18.71
5	0.0873	5.56%	3	32.58	24.01	29.99	28.06
7.5	0.1309	8.34%	7	76.02	56.03	69.98	65.47
10	0.1745	11.12%	9	97.74	72.04	89.97	84.18
12.5	0.2182	13.90%	12	130.32	96.06	119.96	112.24
15	0.2618	16.68%	14.5	157.47	116.07	144.95	135.63
20	0.3491	22.23%	17	184.62	136.08	169.94	159.01
25	0.4363	27.79%	23.5	255.21	188.11	234.92	219.81
30	0.5236	33.35%	39.5	428.97	316.19	394.87	369.46
35	0.6109	38.91%	38	412.68	304.18	379.87	355.43
40	0.6981	44.47%	39	423.54	312.18	389.87	364.79
45	0.7854	50.03%	38	412.68	304.18	379.87	355.43

Remoulded strength 8.50 92.31 psf 1.00



PEAK = 430 psf @ 15%

REMOULDED = 90 psf

5% = 150psf

END STRAIGHT = 430psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-07 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 5.5

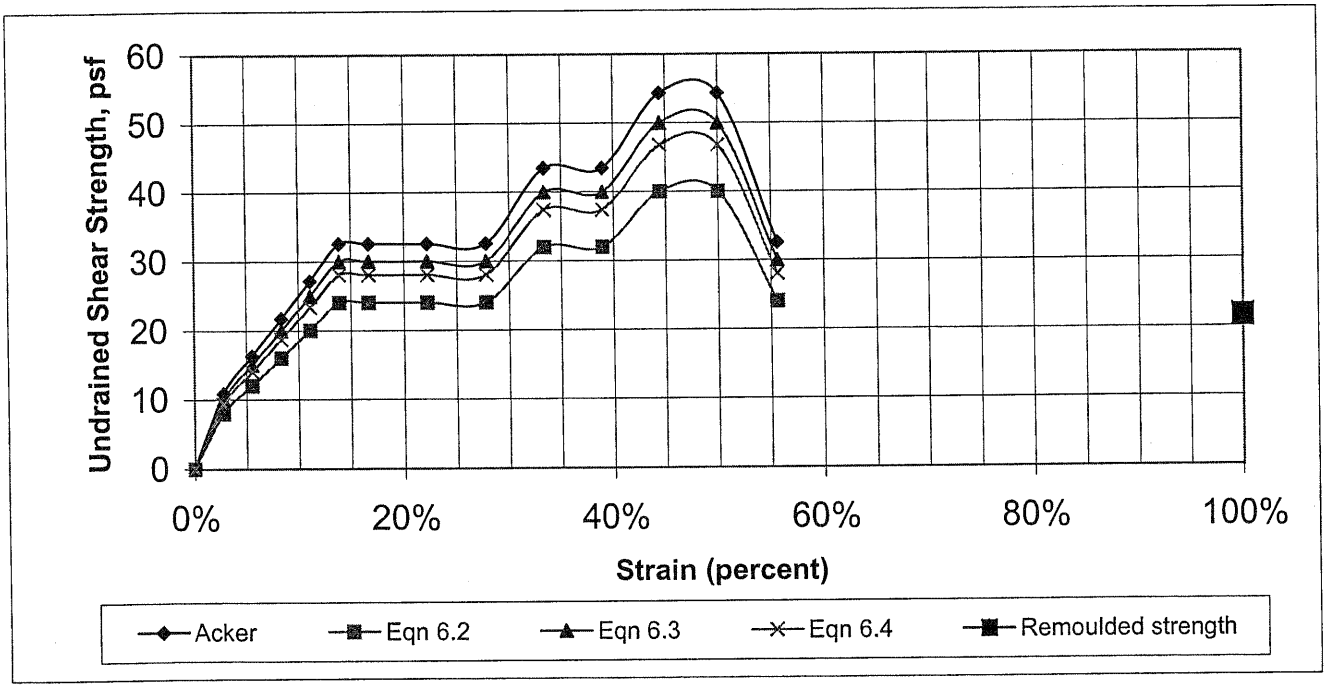
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Tapered Tapered
- k = 0.905 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	1	10.86	8.00	10.00	9.35
5	0.0873	5.56%	1.5	16.29	12.01	15.00	14.03
7.5	0.1309	8.34%	2	21.72	16.01	19.99	18.71
10	0.1745	11.12%	2.5	27.15	20.01	24.99	23.38
12.5	0.2182	13.90%	3	32.58	24.01	29.99	28.06
15	0.2618	16.68%	3	32.58	24.01	29.99	28.06
20	0.3491	22.23%	3	32.58	24.01	29.99	28.06
25	0.4363	27.79%	3	32.58	24.01	29.99	28.06
30	0.5236	33.35%	4	43.44	32.02	39.99	37.41
35	0.6109	38.91%	4	43.44	32.02	39.99	37.41
40	0.6981	44.47%	5	54.30	40.02	49.98	46.77
45	0.7854	50.03%	5	54.30	40.02	49.98	46.77
50	0.8727	55.58%	3	32.58	24.01	29.99	28.06

Remoulded strength 2.00 21.72 psf 1.00



Barge moving too much - bad test

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-08 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 11.5

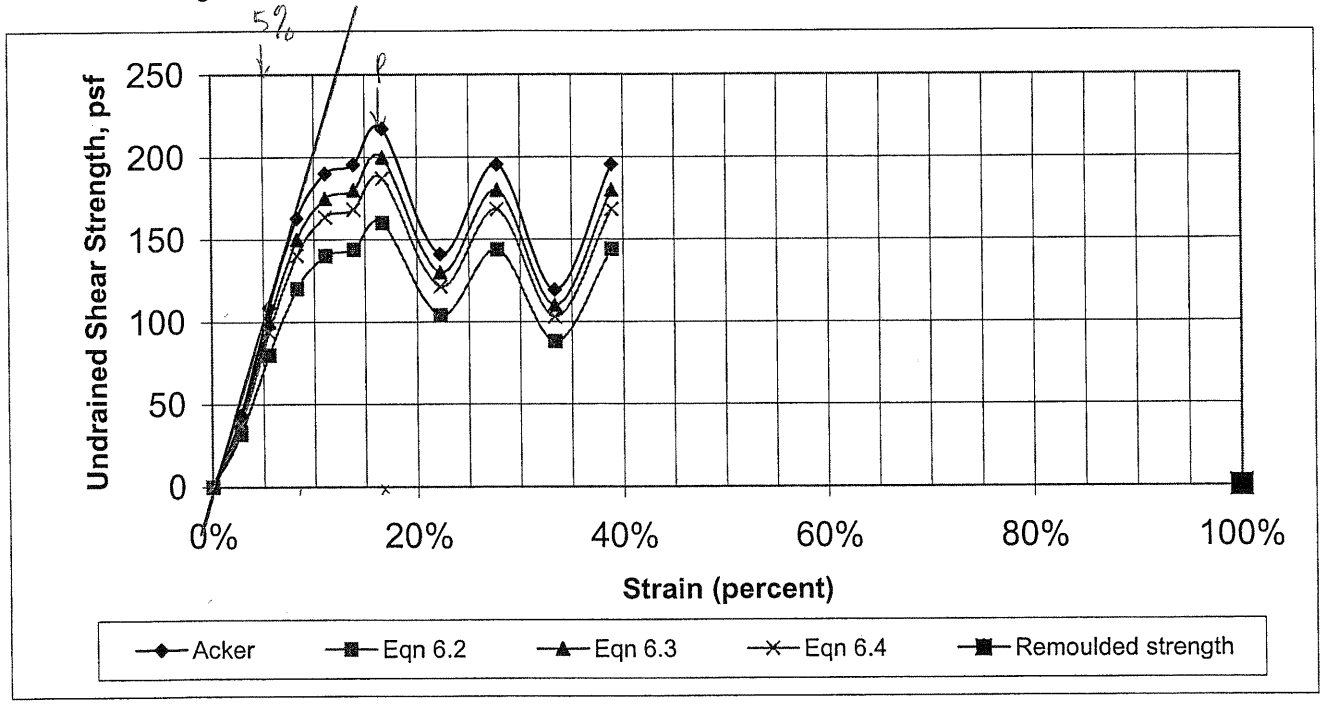
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Tapered Tapered
- k = 0.905 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	4	43.44	32.02	39.99	37.41
5	0.0873	5.56%	10	108.60	80.05	99.97	93.54
7.5	0.1309	8.34%	15	162.90	120.07	149.95	140.30
10	0.1745	11.12%	17.5	190.05	140.08	174.94	163.69
12.5	0.2182	13.90%	18	195.48	144.08	179.94	168.36
15	0.2618	16.68%	20	217.20	160.09	199.93	187.07
20	0.3491	22.23%	13	141.18	104.06	129.96	121.60
25	0.4363	27.79%	18	195.48	144.08	179.94	168.36
30	0.5236	33.35%	11	119.46	88.05	109.96	102.89
35	0.6109	38.91%	18	195.48	144.08	179.94	168.36

Remoulded strength 0.00 psf 1.00



PEAK = 220 psf @ 17 psf

REMOULDED = NC

5% = 100 psf

END STRAIGHT = 160 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-08 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 13.5

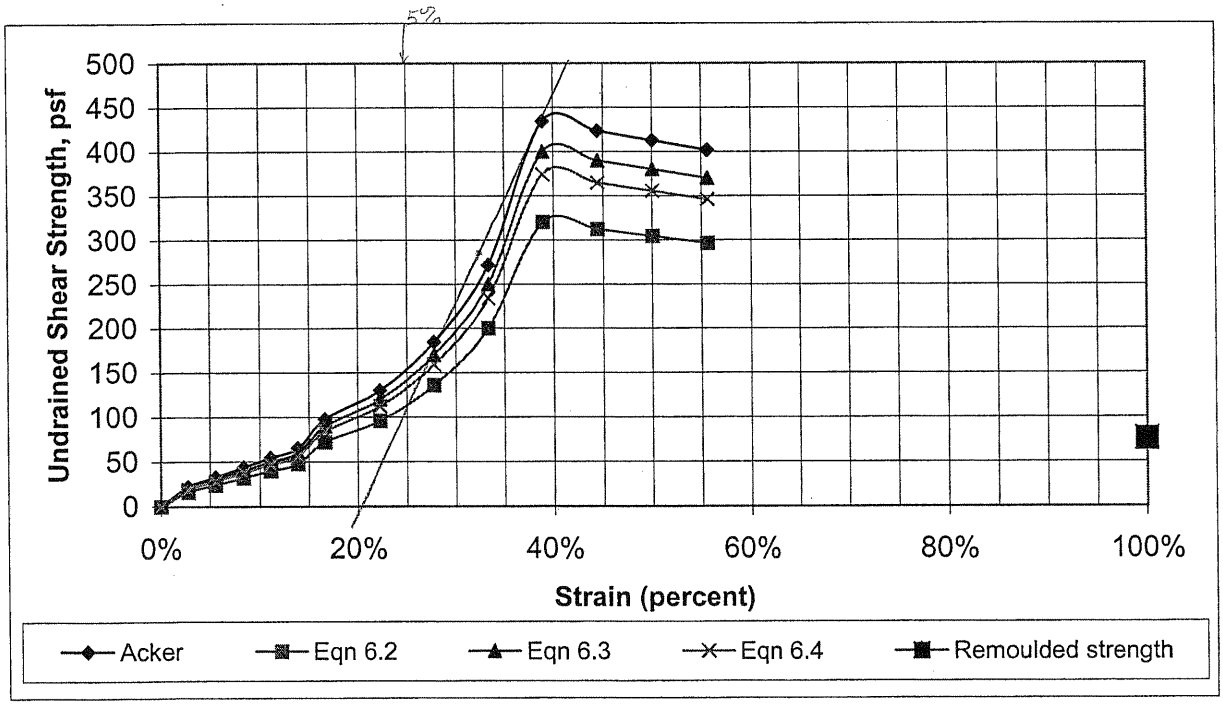
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size rod diam 0.75 in
Length 9.25 in
Width 3.625 in
Flat/Tapere Tapered
k = 0.905 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	2	21.72	16.01	19.99	18.71
5	0.0873	5.56%	3	32.58	24.01	29.99	28.06
7.5	0.1309	8.34%	4	43.44	32.02	39.99	37.41
10	0.1745	11.12%	5	54.30	40.02	49.98	46.77
12.5	0.2182	13.90%	6	65.16	48.03	59.98	56.12
15	0.2618	16.68%	9	97.74	72.04	89.97	84.18
20	0.3491	22.23%	12	130.32	96.06	119.96	112.24
25	0.4363	27.79%	17	184.62	136.08	169.94	159.01
30	0.5236	33.35%	25	271.50	200.12	249.92	233.84
35	0.6109	38.91%	40	434.40	320.19	399.87	374.14
40	0.6981	44.47%	39	423.54	312.18	389.87	364.79
45	0.7854	50.03%	38	412.68	304.18	379.87	355.43
50	0.8727	55.58%	37	401.82	296.17	369.88	346.08

Remoulded strength 7.00 76.02 psf 1.00



PEAK = 440 psf @ strain = 18%

Remolded = 76 psf

5% STRAIN = 110 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-08 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 37.5

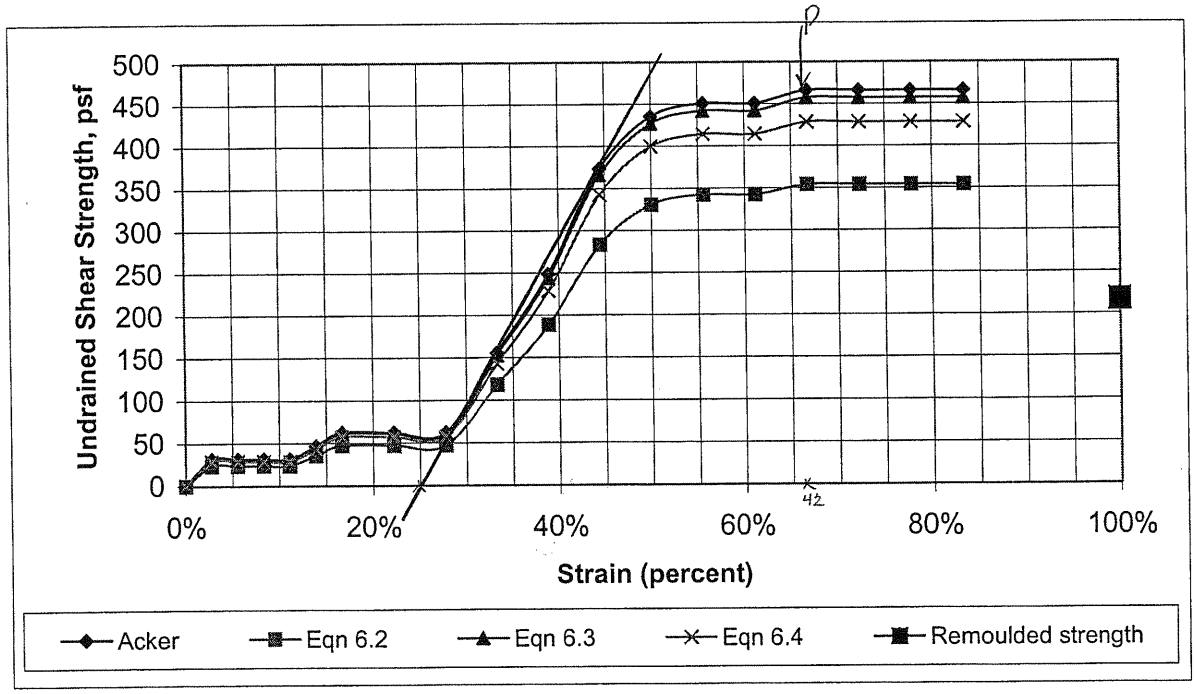
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.04	23.60
Eqn 6.3	0.03	30.48
Eqn 6.4	0.04	28.56

Vane size rod diam 0.75 in
Length 6.625 in
Width 2.5 in
Flat/Taperε Tapered
k = 2.59 Acker
moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	1	31.08	23.60	30.48	28.56
5	0.0873	5.56%	1	31.08	23.60	30.48	28.56
7.5	0.1309	8.34%	1	31.08	23.60	30.48	28.56
10	0.1745	11.12%	1	31.08	23.60	30.48	28.56
12.5	0.2182	13.90%	1.5	46.62	35.40	45.71	42.85
15	0.2618	16.68%	2	62.16	47.20	60.95	57.13
20	0.3491	22.23%	2	62.16	47.20	60.95	57.13
25	0.4363	27.79%	2	62.16	47.20	60.95	57.13
30	0.5236	33.35%	5	155.40	118.00	152.38	142.82
35	0.6109	38.91%	8	248.64	188.80	243.81	228.52
40	0.6981	44.47%	12	372.96	283.19	365.71	342.78
45	0.7854	50.03%	14	435.12	330.39	426.67	399.91
50	0.8727	55.58%	14.5	450.66	342.19	441.90	414.19
55	0.9599	61.14%	14.5	450.66	342.19	441.90	414.19
60	1.0472	66.70%	15	466.20	353.99	457.14	428.47
65	1.1345	72.26%	15	466.20	353.99	457.14	428.47
70	1.2217	77.82%	15	466.20	353.99	457.14	428.47
75	1.3090	83.38%	15	466.20	353.99	457.14	428.47

Remoulded strength 7.00 217.56 psf 1.00



PEAK = 470 psf @ 42%
REMOULDED = 220 psf
5% = 100 psf
END STRAIGHT = 380 psf

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-09 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 17.5

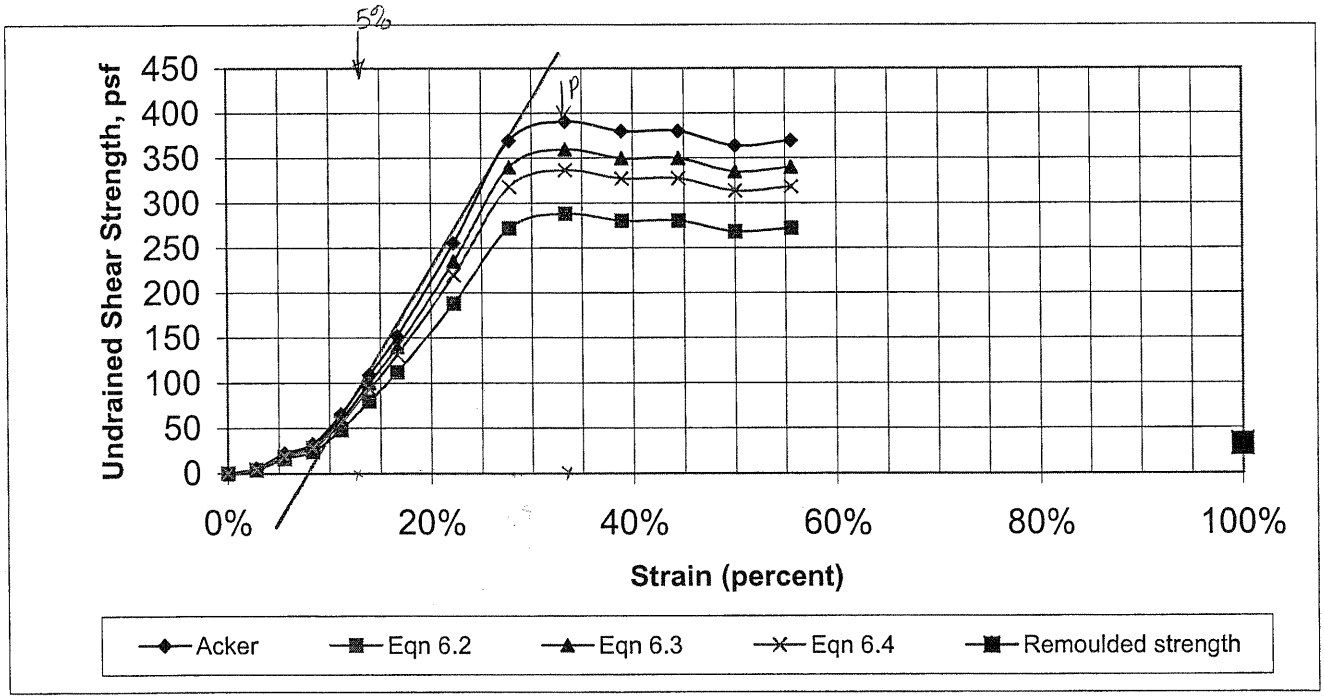
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Tapered Tapered
- k = 0.905 Acker
- moment arm 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	0.5	5.43	4.00	5.00	4.68
5	0.0873	5.56%	2	21.72	16.01	19.99	18.71
7.5	0.1309	8.34%	3	32.58	24.01	29.99	28.06
10	0.1745	11.12%	6	65.16	48.03	59.98	56.12
12.5	0.2182	13.90%	10	108.60	80.05	99.97	93.54
15	0.2618	16.68%	14	152.04	112.07	139.95	130.95
20	0.3491	22.23%	23.5	255.21	188.11	234.92	219.81
25	0.4363	27.79%	34	369.24	272.16	339.89	318.02
30	0.5236	33.35%	36	390.96	288.17	359.88	336.73
35	0.6109	38.91%	35	380.10	280.16	349.88	327.37
40	0.6981	44.47%	35	380.10	280.16	349.88	327.37
45	0.7854	50.03%	33.5	363.81	268.16	334.89	313.34
50	0.8727	55.58%	34	369.24	272.16	339.89	318.02

Remoulded strength 3.00 32.58 psf 1.00



PEAK = 390 psf @ 25%

REMOULDED = 30 psf

5% = 80 psf

END STRAIGHT = 370 psf

Using 335 psf @ 20%

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-09 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 25.5

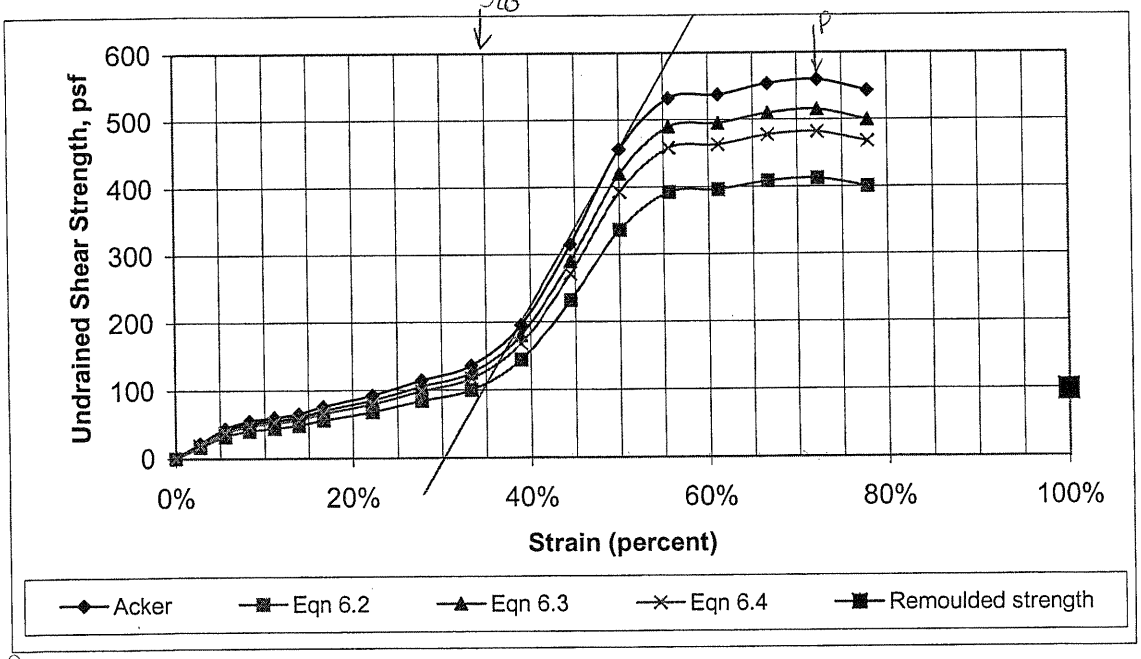
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Taper Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	2	21.72	16.01	19.99	18.71
5	0.0873	5.56%	4	43.44	32.02	39.99	37.41
7.5	0.1309	8.34%	5	54.30	40.02	49.98	46.77
10	0.1745	11.12%	5.5	59.73	44.03	54.98	51.44
12.5	0.2182	13.90%	6	65.16	48.03	59.98	56.12
15	0.2618	16.68%	7	76.02	56.03	69.98	65.47
20	0.3491	22.23%	8.5	92.31	68.04	84.97	79.51
25	0.4363	27.79%	10.5	114.03	84.05	104.97	98.21
30	0.5236	33.35%	12.5	135.75	100.06	124.96	116.92
35	0.6109	38.91%	18	195.48	144.08	179.94	168.36
40	0.6981	44.47%	29	314.94	232.14	289.90	271.25
45	0.7854	50.03%	42	456.12	336.20	419.86	392.85
50	0.8727	55.58%	49	532.14	392.23	489.84	458.32
55	0.9599	61.14%	49.5	537.57	396.23	494.84	463.00
60	1.0472	66.70%	51	553.86	408.24	509.83	477.03
65	1.1345	72.26%	51.5	559.29	412.24	514.83	481.71
70	1.2217	77.82%	50	543.00	400.23	499.84	467.68

Remoulded strength 9.00 97.74 psf 1.00



PEAK = 560 psf @ 42%

REMOULDED = 100 psf

5% = 100 psf

END STRAIGHT = 470 psf

Using

FIELD VANE SHEAR TEST SUMMARY

Boring ID GB-00-09 Project: SAEP Causeway

Bottom of Vane Depth, ft bgs 33.5

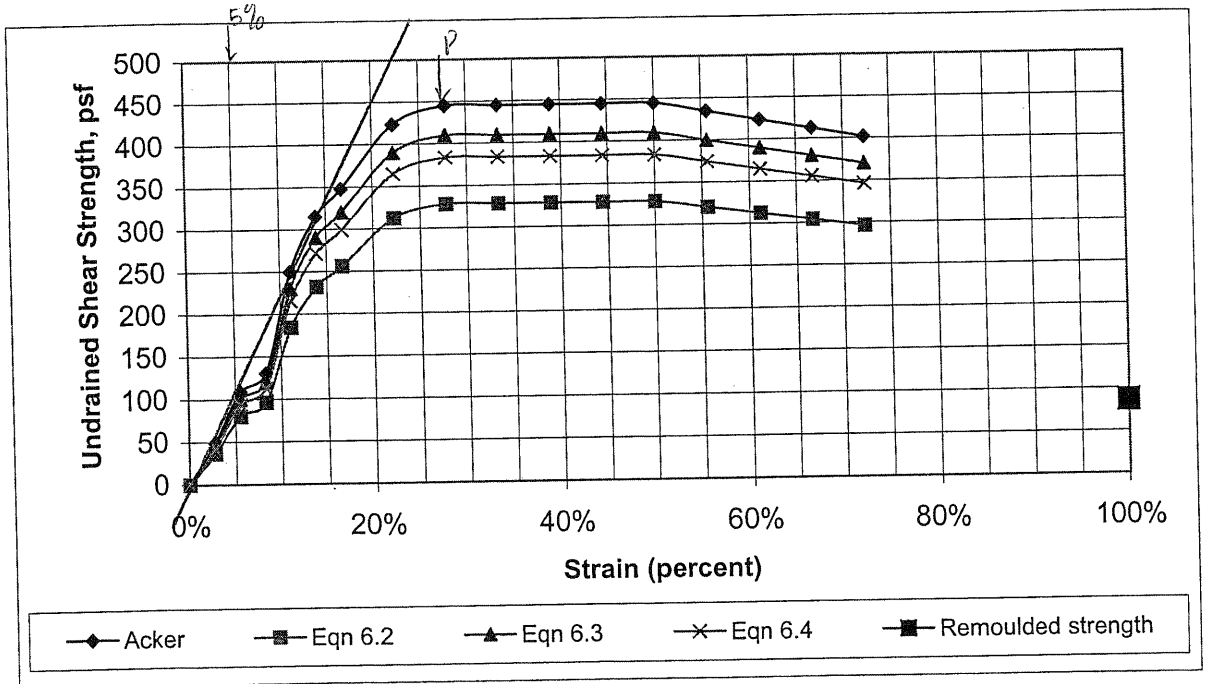
Estimated Overburden pressure = psf

	K =	k =
Eqn 6.2	0.12	8.00
Eqn 6.3	0.10	10.00
Eqn 6.4	0.11	9.35

Vane size
- rod diam 0.75 in
- Length 9.25 in
- Width 3.625 in
- Flat/Taper Tapered
- k = 0.905 Acker
- moment ar 12 inches

Degrees	Radians	Strain	Force	Shear	Eqn 6.2	Eqn 6.3	Eqn 6.4
0	0.0000	0.00%	0	0.00	0.00	0.00	0.00
2.5	0.0436	2.78%	4.5	48.87	36.02	44.99	42.09
5	0.0873	5.56%	10	108.60	80.05	99.97	93.54
7.5	0.1309	8.34%	12	130.32	96.06	119.96	112.24
10	0.1745	11.12%	23	249.78	184.11	229.92	215.13
12.5	0.2182	13.90%	29	314.94	232.14	289.90	271.25
15	0.2618	16.68%	32	347.52	256.15	319.89	299.31
20	0.3491	22.23%	39	423.54	312.18	389.87	364.79
25	0.4363	27.79%	41	445.26	328.19	409.86	383.49
30	0.5236	33.35%	41	445.26	328.19	409.86	383.49
35	0.6109	38.91%	41	445.26	328.19	409.86	383.49
40	0.6981	44.47%	41	445.26	328.19	409.86	383.49
45	0.7854	50.03%	41	445.26	328.19	409.86	383.49
50	0.8727	55.58%	40	434.40	320.19	399.87	374.14
55	0.9599	61.14%	39	423.54	312.18	389.87	364.79
60	1.0472	66.70%	38	412.68	304.18	379.87	355.43
65	1.1345	72.26%	37	401.82	296.17	369.88	346.08

Remoulded strength 8.00 86.88 psf 1.00



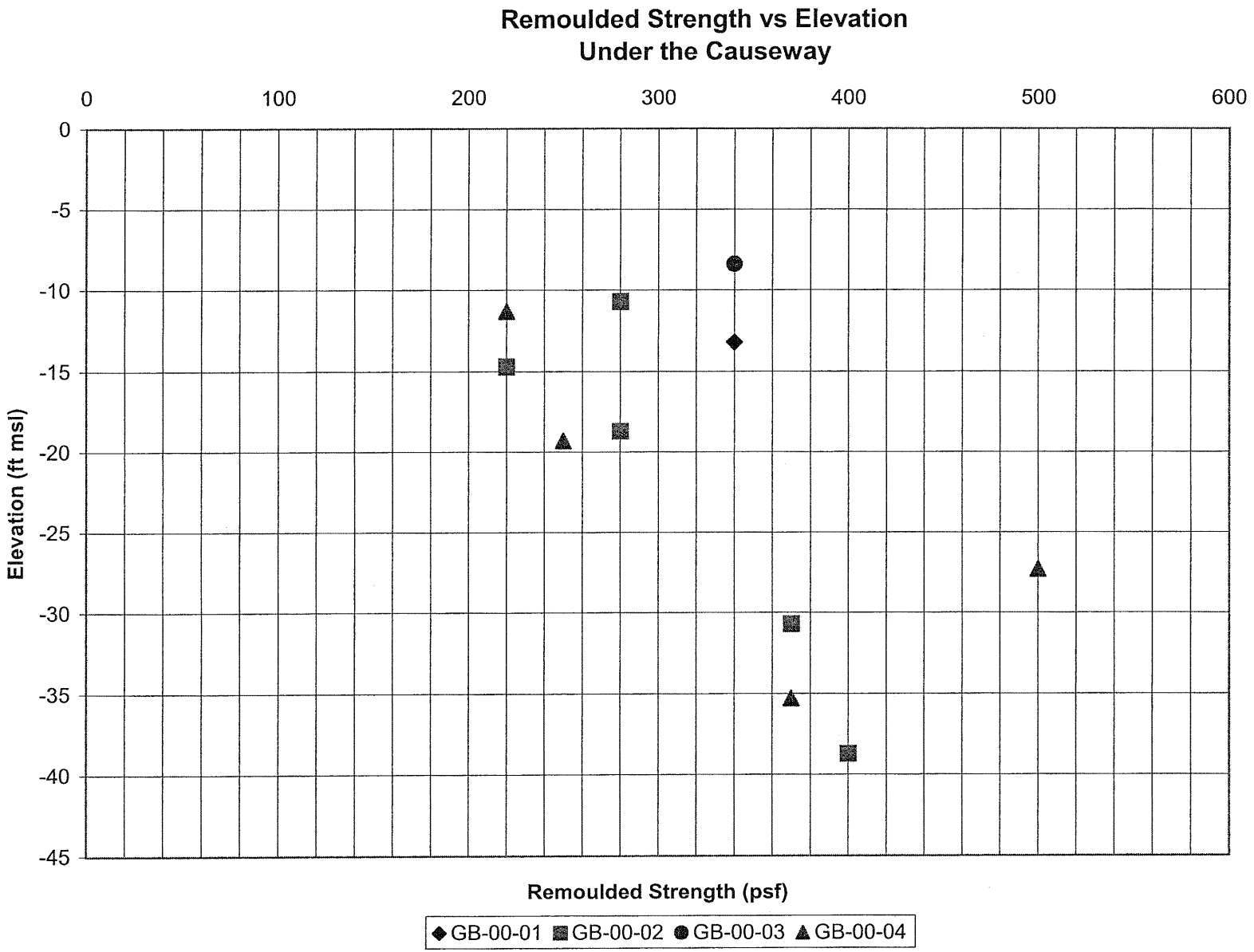
PEAK = 445 psf @ 28%

REMOULDED = 90 psf

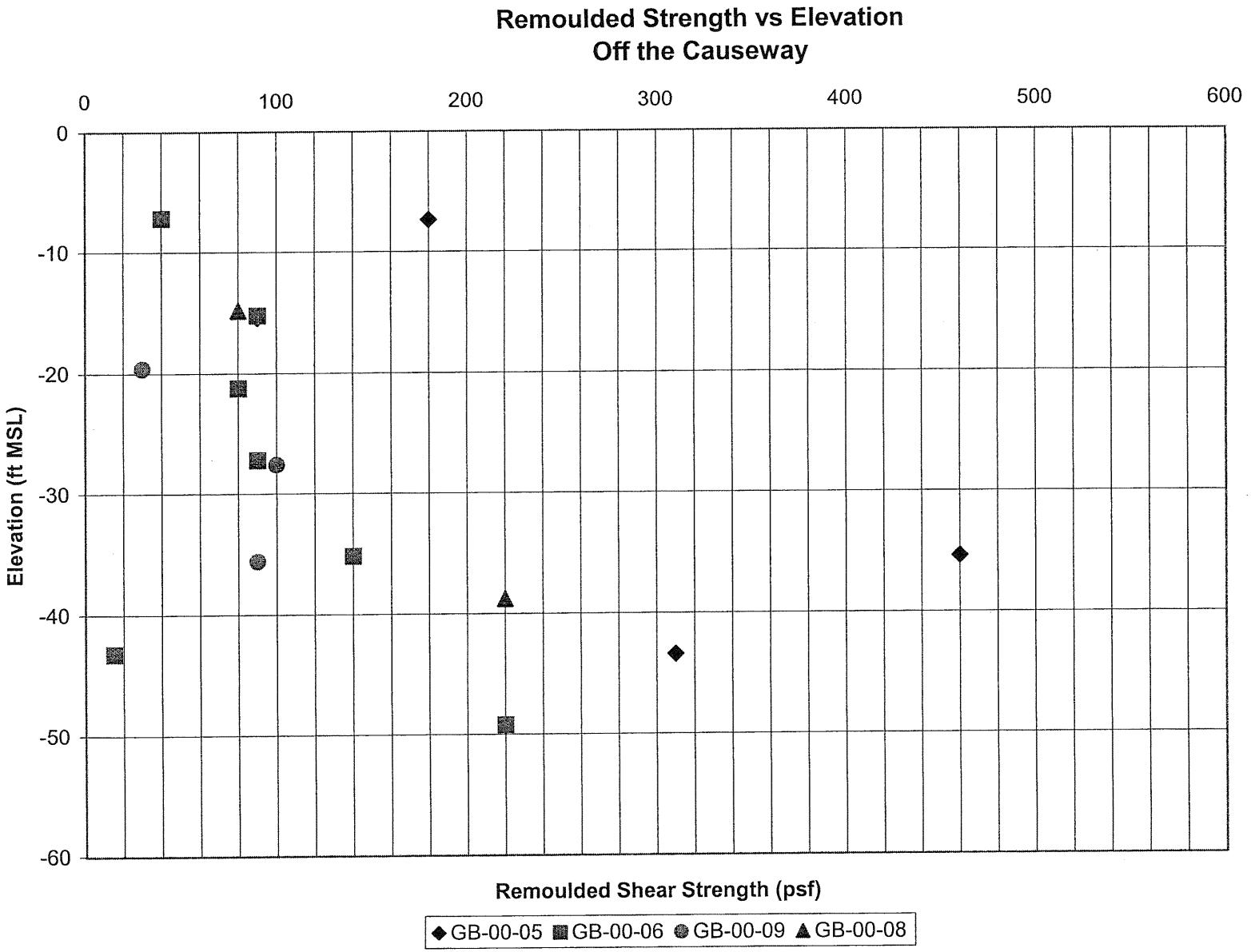
5% = 110 psf

EARLY STRAIGHT = 320 psf

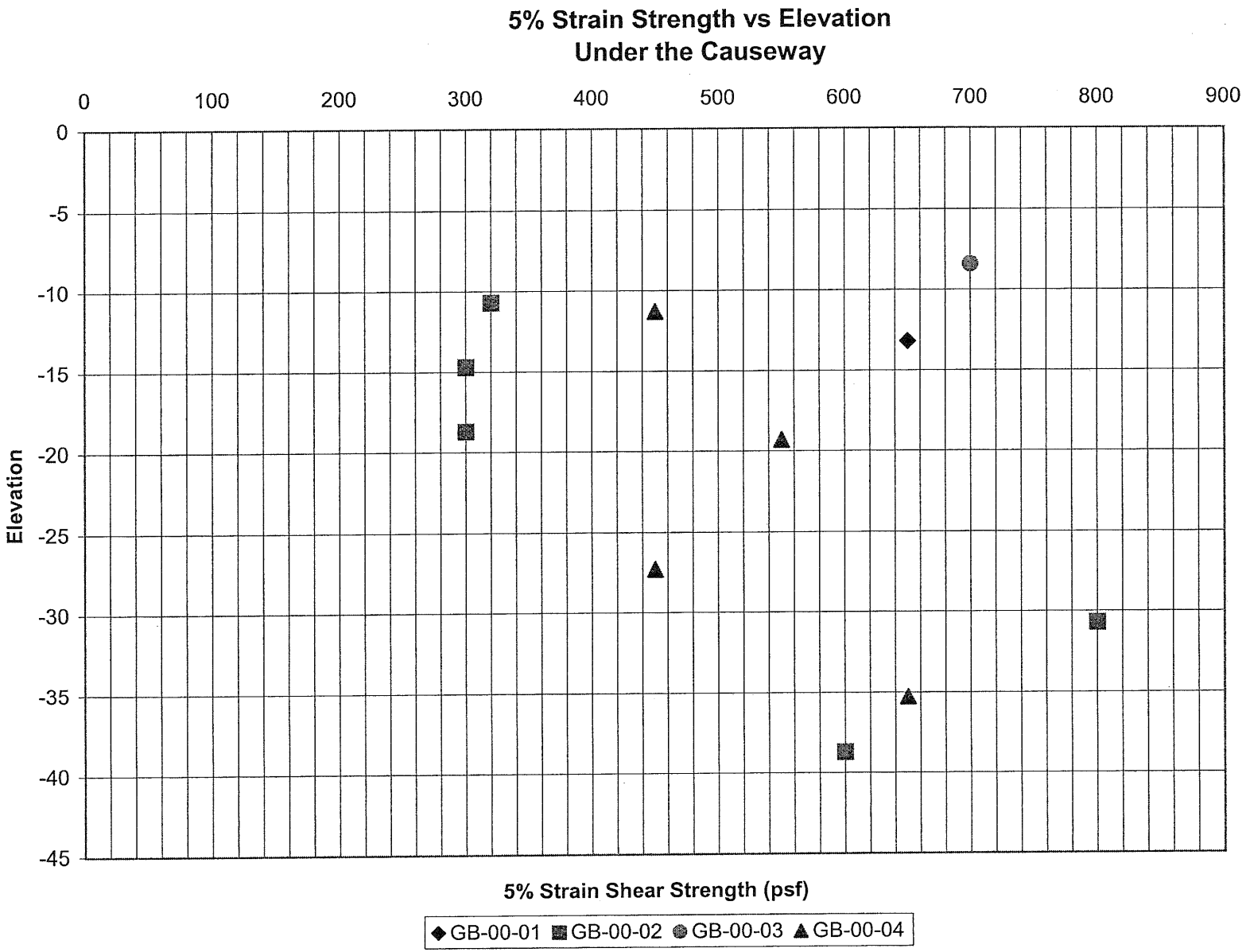
SHEAR STRENGTH VS. ELEVATION PLOTS



p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
Remould Under

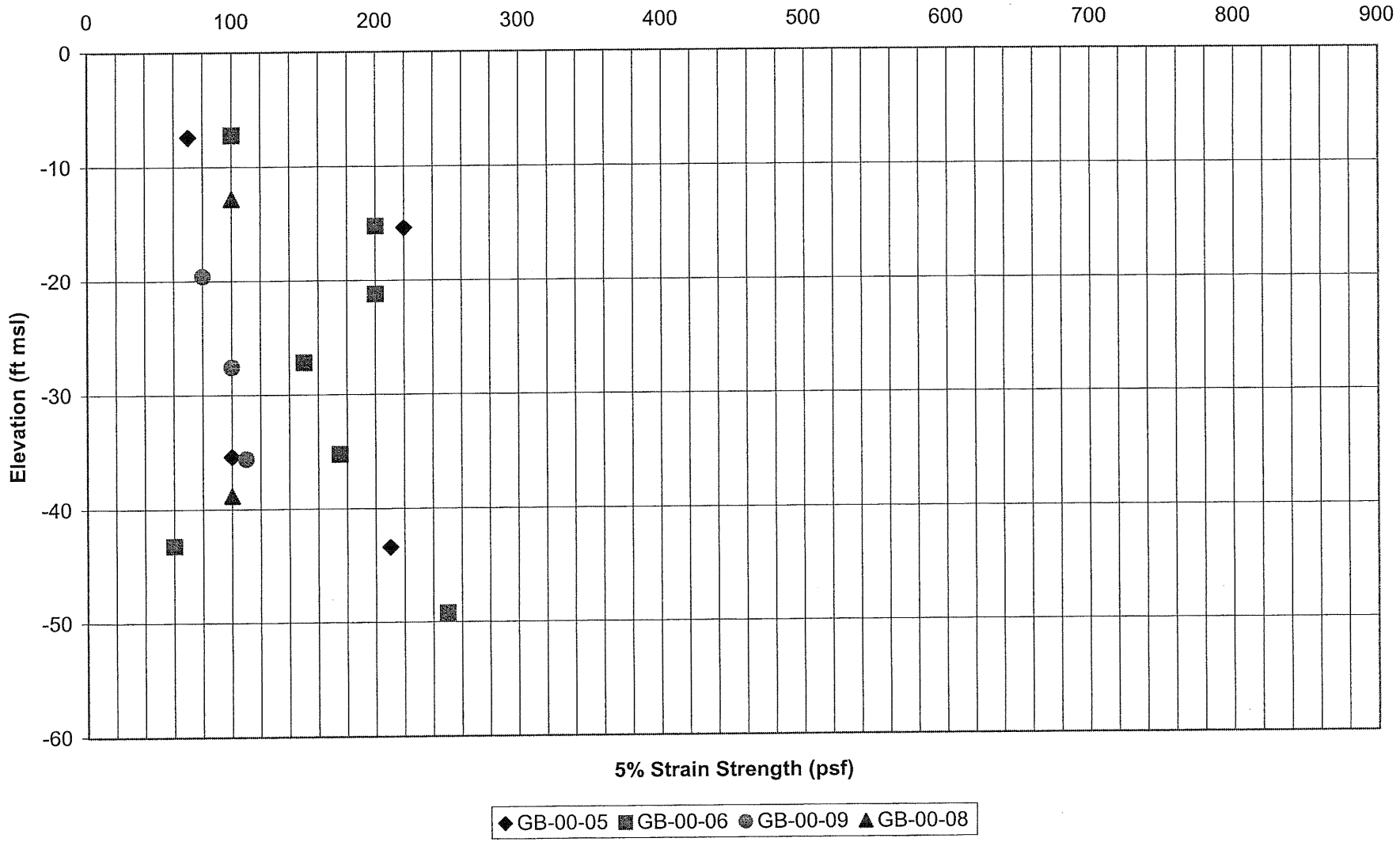


p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
Remoul



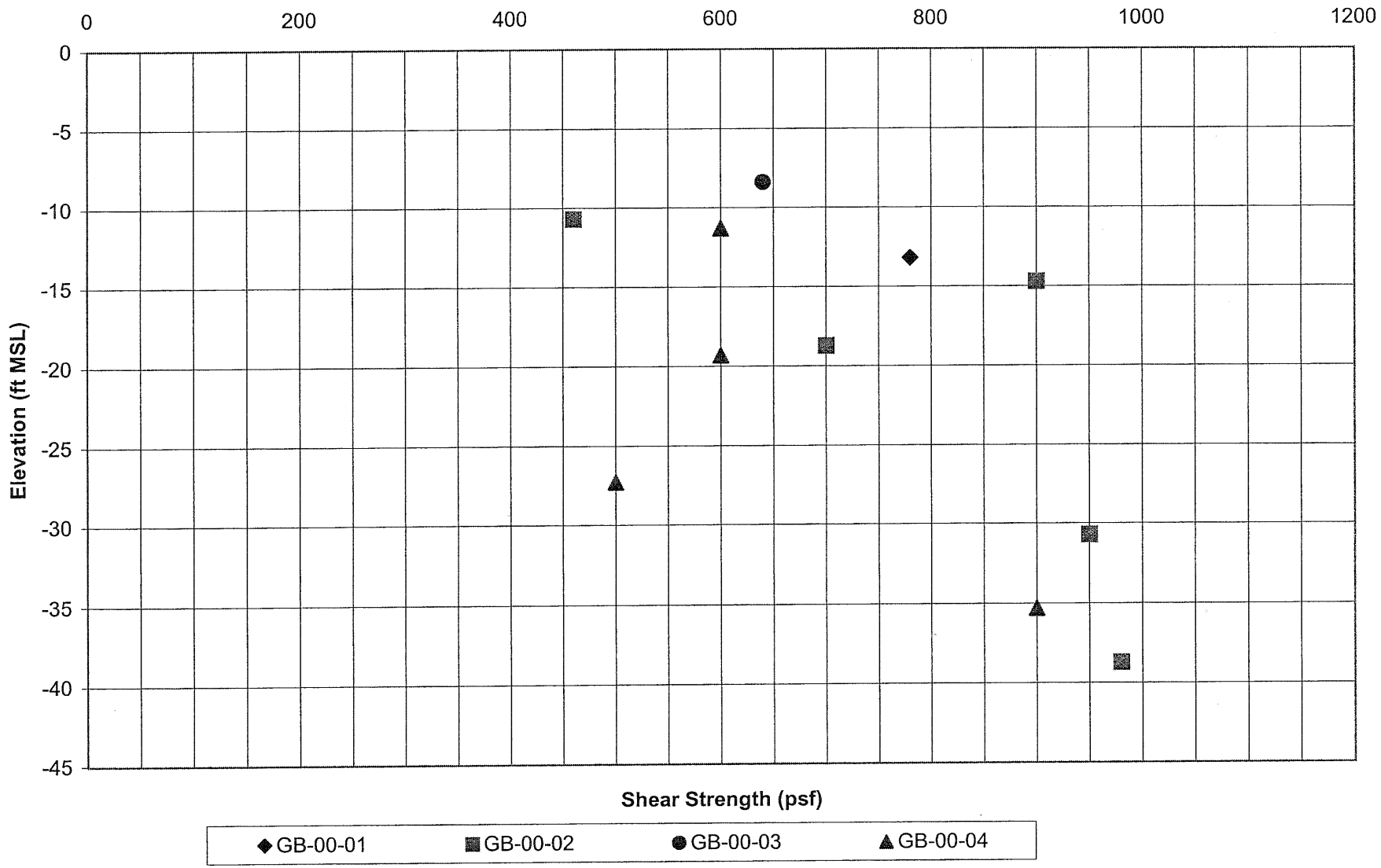
p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
5% Under

5% Strain Strength vs Elevation
Off the Causeway



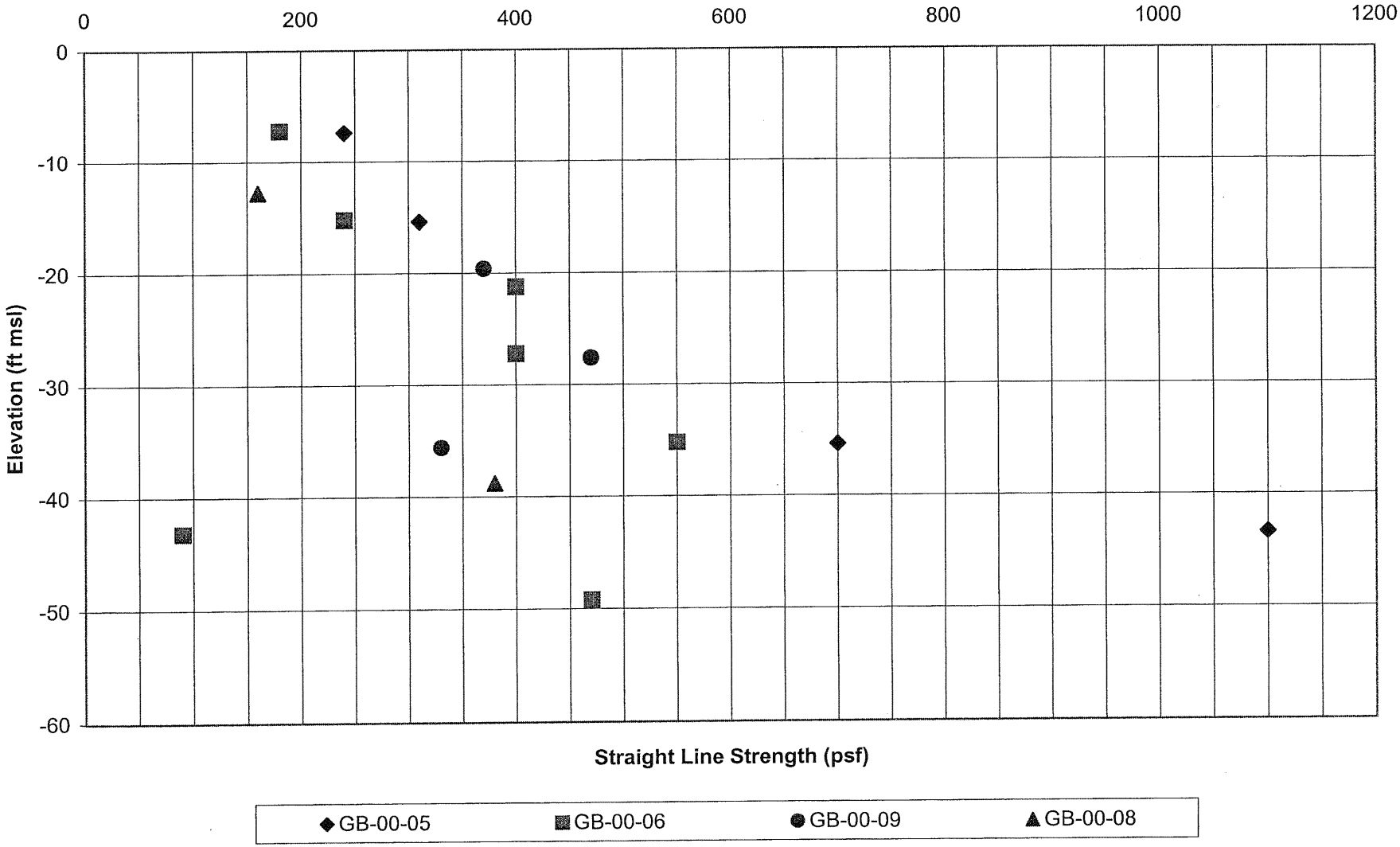
p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
5% Off

Straight Line (Elastic) Strength vs Elevation Under the Causeway



p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
Straight Under

Straight Line (Elastic) Strength vs Elevation
Off the Causeway



p:\projects\cbdcom\saep\causeway\geotech\field vanes\Strength vs Elevation.xls
Straight