APPENDIX G

GEOTECHNICAL FEASIBILITY REPORT

SOILS ENGINEERING, INC.

GEOTECHNICAL FEASIBILITY REPORT

FOR THE KINGS AREA RAPID TRANSIT (KART) STATION

APNS: 012-042-004, 009, 010, 011, 013, 014, &015 | E. 7TH STREET, N. HARRIS STREET, N. BROWN STREET, & 9TH STREET

HANSFORD, KINGS COUNTY, CA

Prepared for:

UltraSystems Environmental
16431 Scientific Way
Irvine, CA 92618

Attention: Ms. Betsy Lindsay

By:

SOILS ENGINEERING, INC.
SEI File No. 19-17156
July 18, 2019

REGISTERED PROFESSIONAL ENGINEER
TONY M. FRANGIE
No. 39549
CIVIL
STATE OF CALIFORNIA

Tony M. Frangie, P.E.
Vice President

4400 YEAGER WAY • BAKERSFIELD, CALIFORNIA 93313 • PHONE (661) 831-5100 • FAX: (661) 831-2111

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APNS: 012-042-004, 009, 010, 011, 013, 014, &015 | E. 7TH STREET, N. HARRIS STREET, N.

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July 24, 2019

INTRODUCTION

At your request, Soils Engineering, Inc. has prepared this Geotechnical Investigation for the subject site. This report includes recommendations for the site preparation and grading and for foundation design.

Appendix A, "Guide Specifications for Earthwork," is provide as supplement to Section I, "Earthwork," in the recommendations of the report.

Appendix B, "Field Investigation," contains a boring location map, Figure 1, and Logs of Test Borings, Figure 2 through Figure 7.

Appendix C, "Soils Test Data," contains tabulations of laboratory test data.

Appendix D, "Seismic Investigation," contains information provided by EQFAULT, the ASCE and LiquefyPro.

We hope this provides the information you require. If you have any questions regarding the contents of our report, or if we can be of further assistance, please contact us.

Respectfully submitted,
SOILS ENGINEERING, INC.

A. PROJECT DESCRIPTION

The proposed project is expected to consist of a three-story Transit Station Building with a 6,900 square foot ground floor, off-site parking, and on-site bus parking. The facility is to be situated in Hanford, California, between East 7th Street on the south and East 8th Street on the north and between North Brown Street on the east and North Harris Street on the west. The site comprises one city block. The site and the surrounding terrain are nominally flat and level.

There are existing commercial buildings on the properties and most of the non-structure portions are paved with either asphalt or concrete. The subject site is surrounded by a mixture of residential, commercial and light industrial properties. It appears that the block was originally residential. There is an east-west alley through the center of the block. It appears that the electric utility lines (and probably telephone) are overhead in the alley.

B. GEOLOGIC SETTING

According to the Geologic Atlas of California, Fresno Sheet, the project site is situated on Quaternary Great Valley fan (Qf) deposits. Although the site is not located in an Alquist-Priolo (earthquake fault) Special Study Zone, there are numerous earthquake faults in the vicinity. Nearby faults, with distances from the site, are tabulated below.

Great Valley 14	28.7 miles/ 46.2 kilometers
Great Valley 13	31.3 miles/ 50.4 kilometers
Great Valley 12	39.3 miles/ 63.2 kilometers
Kern Front	43.0 miles/ 69.2 kilometers
Great Valley 11	46.2 miles/ 74.4 kilometers

C. SUBSURFACE CONDITIONS

Site Geology and subsurface conditions are generally conducive to the construction of cost-effective foundation systems. Earth materials encountered during our investigation consisted mainly of an upper layer of Silty Sand, and Sandy or Clayey Silt underlain by layers of Poorly-Graded Sand and occasional layers of Sandy Clay.

These soils are classified as SM, ML, SP and CL respectively in the Unified Soils Classification System (USCS). The subsurface sandy soils in the proposed building area are loose to medium dense condition and should provide adequate support for the proposed structures provided that a portion of the surface soils are excavated and compacted as outlined in the earthwork recommendations of this report. Detailed descriptions of the various soils encountered during our field investigation are shown on Figures 2 through 18 in Appendix B, "Field Investigation." A "Key to Symbols" legend describing the symbols in the boring logs is also attached.

There are no conditions on site which present unusual grading or drainage problems. Soils within the zone-of-influence of proposed foundations, slabs, and pavements are:

- *essentially granular;*
- *have relatively high frictional resistance;*
- *possess low to no expansion potential;*
- *feature negligible tendency to consolidate when loaded and then are subjected in increased moisture conditions;*
- *are not corrosive;*

- *and can be easily compacted using heavy rubber-tired equipment, sheepsfoot rollers, or vibratory compactors.*
- *Subsurface drainage conditions are good. The sand layers at shallow depths will permit storm water to percolate with sufficient rapidity to augment retention basin construction if needed.*

D. GROUNDWATER

Groundwater was not encountered in the field exploration test borings, which extended to a maximum depth of sixty-one feet. According to the California Department of Water Resources Groundwater Information Center, the depths to groundwater were about 140 feet in the Spring of 2012 and about 140 feet in the Fall of 2018. It is our opinion that groundwater will remain below the zone of influence of the project foundations and that it will not affect the foundation stability of the project.

E. SEISMIC DESIGN VALUES

The seismic design values tabulated below are based on the 2016 California Building Code (CBC). The Site Class for the proposed project was determined using standard penetration test data obtained at the site and documented in the attached Logs of Borings. The site is not located within an Alquist-Priolo (earthquake fault) Special Study Zone.

SEISMIC DESIGN CRITERIA		VALUE	SOURCE
Risk Category		III	2016 CBC Table 1604.5
Site Class		D	2016 CBC § 1613.3.2; ASCE 7-10, Tbl. 20.3-1; Site Specific Soils Report
Mapped MCE_R Spectral Response Acceleration, short period	S_S	0.756g	SEAOC-OSHPD maps/software; 2016 CBC Figure 1613.31 (1)
Mapped MCE_R Spectral Response Acceleration, 1 second period	S_1	0.293g	SEAOC-OSHPD maps/software; 2016 CBC Figure 1613.3.1 (2)
Site Coefficient	F_a	1.198	SEAOC- OSHPD software; 2016 CBC Table 1613.3.3 (1)
Site Coefficient	F_v	1.815	SEAOC- OSHPD software; 2016 CBC Table 1613.3.3 (2)
Adjusted MCE_R Spectral Response Acceleration, short period, $F_a * S_s =$	S_{MS}	0.905g	SEAOC- OSHPD software; 2016 CBC Section 1613.3.3
Adjusted MCE_R Spectral Response Acceleration, 1 second period, $F_v * S_1 =$	S_{M1}	0.531g	SEAOC- OSHPD software; 2016 CBC Section 1613.3.3
Design Spectral Response Acceleration, short period, $2.3 * S_{MS} =$	S_{DS}	0.604g	SEAOC- OSHPD software; 2016 CBC Section 1613.3.4
Design Spectral Response Acceleration, 1 second period, $2.3 * S_{M1} =$	S_{D1}	0.354g	SEAOC- OSHPD software; 2016 CBC Section 1613.3.4
Peak Ground Acceleration for Max. Considered Earthquake (MCE_G)	PGA	0.287g	SEAOC- OSHPD software; ASCE 7-10 Fig 22-7

Using site coefficient F_{PGA} = 1.226, F_{PGA} * PGA =	**PGA_M**	**0.352g**	SEAOC- OSHPD software; ASCE 7-10 Table 11.8-1
Mapped value of the short period risk coefficient	**C_{RS}**	**1.016**	SEAOC- OSHPD software; ASCE 7-10 Figure 22-17
Mapped value of the 1 second period risk coefficient	**C_{R1}**	**1.056**	SEAOC- OSHPD software; ASCE 7-10 Figure 22-18
Seismic Design Category, short period		**D**	2016 CBC 1613.3.5 (1)
Seismic Design Category, 1 sec. period		**D**	2016 CBC 1613.3.5 (2)
MCE_R = Maximum Considered Earthquake (risk targeted) MCE_G = Maximum Considered Earthquake (geometric mean)			

Major fault systems and their distances from the site are given in the EQFault Summary attached in Appendix D. The largest estimated maximum site acceleration, based on deterministic methods, is 0.123g from an 8.0 magnitude earthquake on the San Andreas Fault. See Appendix D for copies of the computer modeling data.

F. LIQUEFACTION POTENTIAL & SETTLEMENT ANALYSIS

Liquefaction Potential

No shallow groundwater was encountered in any of the soil borings (B-1 to B-6) to a maximum depth explored of 61 feet below ground surface (bgs). Historic depth to water has been as high as 60 bgs in this area of Hanford based on DWR, Water Data Library going back to the 1960's. For this analysis we utilized SPT equivalent blow counts in our soil borings B-1 to B-6 ranged from 4 to 53 blow counts per foot to a depth of 61'. A very conservative historical depth to water of 50' was also used. The lithology encountered in the subsurface includes mainly silty sand, sandy silt and sand to a depth of 61' bgs. A liquefaction analysis was performed on boring B-1 and B-5 sample data utilizing the program LiquefyPro (version 5.9b). Site-specific information was used in this analysis including; SPT blow counts per foot, grain-size analysis, dry weight densities, and the PGA earthquake motion (0.352g). in this analysis. The liquefaction potential at this site appears to be very low. See attached LiquefyPro data and boring logs for more detail in Appendix D.

Potential Settlement

The estimated amount of dynamic settlement that would occur at this site during a major earthquake is approximately 0.26" (B-1) to 0.75" (B-5) based on the lithology encountered, the SPT blow counts recorded during sampling and the settlement analysis conducted on borings B-1 and B-5 sample data utilizing the program LiquefyPro. The estimated amount of differential settlement is 0.13" (B-1) to 0.375" (B-5) according to the program LiquefyPro. See attached Liquefaction Analysis Calculation Sheets and graphs for more detail in Appendix D.

EARTHWORK RECOMMENDATIONS

"Earthwork Specifications," in Appendix A are provided for general guidance in preparing site grading plans and earthwork estimates. The following special provisions are made and supersede any conflicts which may be present in the Guide Specifications for Earthwork wherever discrepancies may exist:

A. COMPACTION AND OPTIMUM MOISTURE

Unless otherwise specified herein, the terms "compaction" or "compacted", wherever used or implied in this report, should be interpreted as compaction to ninety percent (90%), or greater, of the laboratory maximum density (as determined in accordance with ASTM Test Method D1557). The term, "Optimum Moisture," wherever use or implied within this report, should be interpreted as that obtained by the above described test method.

B. CLEARING AND GRUBBING

Clearing and grubbing should consist of stripping grasses; removing existing structures...foundations, slabs, and miscellaneous concrete; removing buried utility lines; locating and removing or disposing of abandoned septic tanks and seepage pits (dry well) if any are encountered during site clearing and grubbing operations.

Stripping - Prior to soil compaction, existing ground surfaces should be stripped of surface vegetation. A stripping depth of one inch should be adequate. In no instances should stripped material be used in engineered fill or blended with and compacted in original ground.

Slabs and Pavements - Shall be completely removed. Asphaltic concrete fragments may be used in fill provided they are broken down to a maximum dimension of two inches and adequately disbursed within a friable soil matrix. Soil-AC mixtures should not be used above the elevation bottom of the lowest structure footing.

Foundations - Existing at the time of grading should be completely removed.
Basements and septic tanks located in proposed structure areas should be completely removed. Basements or septic tanks situated outside structure areas may be removed or disposed of by breaking the walls down to not less than two feet below finished grade; breaking the bottom out to provide drainage, and back-filling and compacting the resulting cavity using a sand slurry or by placing and compacting acceptable soils engineered fill. If sand slurry is used, no compaction tests will be required.
Seepage pits in proposed structure areas should be removed to a minimum depth of five feet below finished grade or two feet below existing ground, whichever is lower. If a portion of the pit liner is to be abandoned in place, the void should be backfilled with sand slurry. In no instances should liners be left in place within a depth of two feet below existing ground.

Backfilling Cavities - All voids or depressions created by clearing and grubbing operations should be backfilled with either on-site soils or acceptable imported fill materials (see Section F, "Imported Fill," below). Materials used to backfill cavities should be placed and compacted in accordance with Section E, "Engineered Fill."

Buried Utilities - such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed exterior footings of structures.

Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade. Concrete lines deeper than two (2.0) feet below finished building pad grade and having diameters less than six (6.0) inches can be crushed in placed.

C. GROUND SURFACE PREPARATION

Ground surfaces in the proposed building area should be compacted in accordance with the following procedures:

1. The over-excavation depth in the proposed building areas should range between one (1) to five (5) below the proposed foundation elevations depending the structural details of each structure.

   A specific Geotechnical Engineering Investigation will be required for each structure to determine the geotechnical parameters, depending upon foundation sizes and magnitude of proposed loads.

2. The bottom of the excavation shall be reviewed by the soil engineer's representative prior to any backfill operations. The top twelve inches of materials exposed at the bottom of the excavation shall be scarified and compacted to a minimum of 90 percent of ASTM D1557.

3. Moisten excavated and imported soils to near the optimum moisture or to a moisture content consistent with effective compaction and soil stability. Compact moistened soils to a minimum of 90 percent of the maximum density obtained by ASTM Test Method D1557.

4. Work to lines at least ten (10) feet beyond the outside edges of exterior footings and two feet beyond pavement edges except if the excavation undermines adjacent improvements or structure foundations. In these situations, the geotechnical engineer should review these areas to determine if additional reinforcement is needed.

Review of Excavation Bottoms

Prior to placement of backfill, excavations on all surfaces to receive engineered-fill or to support foundations, pavements, walkways, or slabs-on-grade shall be reviewed for indications of loose-fill, discoloration, or loose, compressible, native materials. Where these are encountered, they should be excavated and removed, or excavated and compacted as directed by the geotechnical engineer.

Excavation of native soils shall continue in vertical increments of one foot until relative compaction tests taken at the bottom of the working surface (excavation bottom) equal or exceed 82% relative compaction.

Fill placement in and on all surfaces to receive engineered-fill or to support foundations, pavements, walkways, or slabs-on-grade shall not proceed until the geotechnical engineer or his representative on the site has reviewed, tested as described above and accepted materials exposed at the bottom of the excavation.

Pavement Areas:

Ground surfaces to receive concrete driveways or bituminous pavements should be scarified and compacted to a minimum depth of 12 inches below the grading plane in cut areas or to 12 inches in areas to receive fill.
Engineered fill placed in proposed pavement areas should conform to the requirements of Section 5.4, "Placing, Spreading and Compacting Fill Materials," of Appendix A. Compaction in proposed pavement areas should be a minimum of 90 percent of the maximum density as obtained by ASTM Test Method D1557 and should extend to a minimum of two feet beyond the outside edges of pavements. The top eight (8) inches of subgrade below the grading plane shall be compacted to a minimum of 95%.

Utility Lines:

Backfill for utility lines traversing areas proposed for facilities, pavements, concrete slabs-on-ground, or areas to receive engineered fill for future construction should be compacted in accordance with the same requirements for adjacent and/or overlying fill materials.
Compaction should include haunch area, spring line, and from top of pipe to finished subgrade. The haunch area up to one foot above the top of the pipe should be backfilled with "cohesionless" material. Cohesionless native materials may be used for trench and pipe or conduit backfill.
The term "cohesionless," as used herein, is defined as material which when dry, will flow readily in the haunch areas of the pipe trench. Pipe backfill materials should not contain rocks larger than two inches in maximum dimension. Where adjacent native materials exposed on the trench bottoms contain protruding rock fragments larger than two inches in maximum dimension, conduits and pipelines should be laid on a bedding consisting of clean, cohesionless sand (SP), in the Unified Soils Classification System.

Compaction Requirements - where not otherwise specified in our plans or in these recommendations, the following compaction requirements are applicable to all electrical, gas or water conduits:

TABLE A Compaction Depth			
Area	**Haunch to 1 ft. Above Top of Pipe**	**1 ft. Above Top of Pipe To 2'6" Below Finish Grade**	**2'6" Below Finished Grade to Finished Subgrade**
Structural	90%	90%	90%
Pavements	90%	90%	90%
Non-Structural	90%	90%	90%

D. ENGINEERED FILL

Earth materials obtained on-site are acceptable for use as engineered fill provided that all grasses, weeds and other deleterious debris are first removed. Engineered fill materials should be placed in thin layers (less than ten inches uncompacted thickness), brought to near the optimum moisture content or to a moisture content commensurate with effective compaction and soil stability, and compacted to a minimum of 90 percent of the maximum density obtainable by ASTM Test Method D1557, "Placing, Spreading and Compacting Fill Materials," in Appendix A.

E. IMPORTED FILL

The table shown below provides general guidelines for acceptance of import engineered fill. Materials of equal or better quality than on-site material could be reviewed by the Geotechnical Engineer of Record (GEOR) on a case-by-case basis. No soil materials shall be imported onto the project site without prior approval by the GEOR. Any deviation from the specifications given below shall be approved by the GEOR prior to import operations.

Maximum Percent Passing #200 Sieve	40
Maximum Percent Retained 3" Sieve	0
Maximum Percent Retained 1½" Sieve for Building Footing Zones	15
Maximum Percent Retained ¾" Sieve for Landscape Areas	5
Maximum Liquid Limit	40
Maximum Plasticity Index	14
Maximum Expansion Index	20

Furthermore, the soils proposed for import shall be generally homogenous and shall not contain cemented or clayey and/or silty lumps larger than one inch. When such lumps are present, they shall not represent more than ten percent (10%) of the material by dry weight. Where a proposed import source contains obviously variable soils, such as clay and/or silt layers, the soils which do not meet the above requirements shall be segregated and not used for this project or the various layers shall be thoroughly mixed prior to acceptance testing by the GEOR.
The contractor shall provide sufficient advanced notice, prior to import operations, to allow testing and evaluation of the proposed import materials. Because of the time needed to perform the above tests, the contractor shall provide a means by which the GEOR or others can verify that the soil(s) which was sampled and tested is the same soil(s) which is being imported to the project.

F. DRAINAGE

Finished ground grades adjacent to the proposed buildings should be sloped to provide positive free drainage away from the foundations. No areas should be constructed that would allow drainage generated on the site, or water impinging upon the site from outside sources, to pond near footings and slabs or behind curbs. Where ground surfaces adjacent to subsurface walls are to be landscaped, walls should be waterproofed. Installation of gravel-filled drains to route subsurface drainage away from walls will reduce the thickness of damp-proofing resulting in a considerable savings.

G. SLOPES

Both fill and cut slopes should be constructed at 2:1 (horizontal to vertical) in accordance with the 2016 Uniform Building Code. Finished slopes nearer than five feet from building foundations should be graded no steeper than five horizontal to one vertical (5:1). A slope ratio of two horizontal to one vertical (2:1) should provide adequate stability for slopes farther than five feet from footing lines. The fill slopes shall be compacted to a minimum of 90% of ASTM D-1557 and in accordance with the Guide specifications for Earthwork, Appendix A. This may be achieved by overfilling the constructed slope and trimming to a compacted finished surface, rolling the slope face with a sheepsfoot as the level of the fill is raised, or any method that achieves the desired product. The cut portion of the slope should be constructed first. Prior to construction of the fill slope, incompetent surface soils should be removed from the top of the cut. Areas to receive fill or to support structures, slabs or pavements should be removed of all vegetation, debris and disturbed soils.

All existing uncertified fill soils should be excavated to expose competent native soils. Existing underground pipelines, private sewage disposal systems and any water or oil wells, if encountered during grading, should be removed or capped in accordance with procedures considered acceptable by the appropriate governing agency. Tree roots to 2 inches in diameter should be removed. Both fill and cut slopes will be subject to erosion immediately after grading and should be designed to reduce surficial sloughing by implementing a permanent slope maintenance program as soon as practical after completion of slope construction. Slope maintenance should include proper care of erosion and drainage control devices, rodent control, and immediate planting with deep-rooting, lightweight, drought-resistant vegetation. An erosion control geotextile may also be used in combination with vegetation to control erosion.

Experience has shown that slope performance is largely dependent upon proper slope maintenance (i.e., planting, proper watering, clearing of drainage devices, etc.). Slopes properly placed and conscientiously maintained are not expected to display excessive raveling or sloughing.

FOUNDATION RECOMMENDATIONS

General foundation criteria for the area are provided below in Table B. These recommendations should be updated once structures location and details are finalized.

TABLE B
FOUNDATION DESIGN CRITERIA

Footing Type	Minimum Width (ft.)	Minimum Depth Below Lowest Adjacent Subgrade (ft.)	Maximum Allowable Soil Bearing Pressure (lbs. / sq. ft.)
Continuous	1	1	2000
Isolated	1	1	2000

Bearing pressures given are for the minimum widths and depths shown above. Bearing pressures given above are for dead and sustained (loads acting most of the time) live loads; they may be increase by one-third for wind and/or seismic loading conditions. The proposed foundations shall be reinforced in accordance with the structural engineer's recommendations.

Settlement

Provided maximum allowable soil bearing pressures given above are not exceeded, total settlement should not exceed one inch. A major portion, two-thirds to one-half, of total settlement should occur before the end of construction. Differential settlements should occur before the end of construction. Differential settlements should, accordingly, be less than one-half of an inch for a horizontal span of thirty feet.

MODULUS OF SUBGRADE REACTION

Modulus of subgrade reaction for use in design of foundations is based on ranges of values for soil types provided by Foundation Analysis and Design by Joseph E Bowles.[1] Equation 1 should be used for footings on sandy soils. Foundations on clay soils should employ Equation 2.

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[1] Bowles, Joseph E; FOUNDATION ANALYSIS AND DESIGN; McGraw-Hill Book Company (1977); Table 9-1 pg. 269

Equation 3 is for rectangular footings having dimensions w= **b** (width) and l = **mb** (length) the variable "m" being the ratio of the length to the width of the foundation. **K_s1** is the modulus of subgrade reaction from the source referenced above based on a 1-foot x 1-foot square plate. For general guidance K_s1 of 100 kcf may be used for the subsurface sandy soils.

Equation (1) $$k_{sf} = K_{s1} \times \left(\frac{B+1}{2B}\right)^2$$

Equation (2) $$k_{sf} = K_{s1}/ B$$

Equation (3) $$k_{sf} = K_{s1} \times \frac{m+.5}{1.5 \times m}$$

Values given above should be used for guidance. Local values may be higher or lower and should be based on results of in-situ plate bearing tests performed in accordance with ASTM Test Method D1194.

LATERAL EARTH PRESSURES

Lateral earth pressures and friction coefficients for determining the passive lateral resistance of foundations against lateral movement and the active lateral forces against retaining walls and subsurface walls, expressed as equivalent fluid pressures, are given below in Table C. Lateral earth pressures were computed assuming that backfill materials are essentially free draining and level; and that no surcharge loads, or sloping backfills are present within a distance from the wall equal to or less than the height (H)* of the wall.

(H)* = the height of backfill above the lowest adjacent ground surface.

TABLE C
LATERAL EARTH PRESSURE

Case	Lateral Earth Pressures
Active	35 P.C.F
Passive	350 P.C.F.
At-Rest	50 P.C.F.

Active Case: Active lateral earth pressures should be used when computing forces against free standing retaining walls, unrestrained at the tops. Active pressures should not be used where tilting outward of the walls is greater than .002H would not be desirable.

Passive Case: Passive lateral earth pressures should be used when computing the lateral resistance provided by undisturbed or compacted native soils against the movement of footing. When computing passive resistance, the upper one foot of embedment depth should be discounted.

At-Rest Case: At-rest pressures should be used for subsurface walls restrained at their tops by floor diaphragms or tie-backs and for retaining walls where tilting outward greater than .002 H would not be desirable.

Frictional Resistance: A friction coefficient of **0.42** may be used when computing the frictional resistance to sliding of footings, grade beams, and slabs-on-grade. Frictional resistance and passive lateral soil resistance may be combined without reduction.

SLABS-ON-GROUND

Slabs-on-ground may be supported on earth materials prepared in accordance with the recommendations of the Geotechnical Investigation.
We recommend that moisture protection be provided for interior concrete slabs-on-ground that will receive moisture-sensitive floor coverings, or where moisture-sensitive equipment, products, or environments may be present. For exceptions to slab moisture protection, refer to the 2016 California Building Code, Section 1907.1. The project designer should provide specific details regarding construction of the concrete slab-on-ground, including a moisture barrier or vapor retarder/barrier, capillary break (if included), and blotter material (if included). The American Concrete Institute recommends a minimum moisture vapor retarder of 10 mil thick polyethylene. The vapor retarder should be protected from damage. Punctures and tears should be repaired prior to concrete placement.

It has been common local practice to use a sandy material as a blotter layer between the moisture barrier and the concrete to absorb some of the bleed water, potentially reducing slab curling. The blotter layer may act as a moisture reservoir and all apparent advantages of its use negated if it is wet at the time of concrete placement.

Therefore, it should not be incorporated into the section design for moisture-sensitive slabs if it cannot be kept dry prior to concrete placement or if water may migrate into the layer after slab construction (e.g. wet curing, rainfall). If the slab-on-ground section is to include a blotter layer between the moisture barrier and the concrete, it is our recommendation that the blotter material consist of crusher fines (rock dust) or sand with angular, interlocking grains. The material should be easily compacted and should be screened so that 100% of the material is finer than ¼".

Do not use blotter material which may be potentially reactive with the alkalis in the concrete or which has high sulfate content. At the time of concrete placement, the blotter material should be dry to damp, compact, and smooth. For slabs which are to be water-cured, a blotter layer should not be used. For further consideration, refer to the American Concrete Institute *Manual of Concrete Practice 302.1R and 360.*Slab thicknesses, reinforcing, and the concrete characteristics should be in accordance with the project designer's recommendations. The 2016 California Building Code, Section 1907.1 requires that the slab thickness be not less than 3½". Pressurized water lines should not be installed beneath slabs-on-ground. Where pressurized water lines must be routed beneath the slab, they should be routed entirely inside continuous sleeves with both ends open to the atmosphere above the slab surface. Gravity flow sewer lines may underlie slabs-on-ground, but they should be routed to the point of connection by the shortest feasible path.

SOIL CORROSIVITY

Soluble Sulfates (SO_4)

The highest Sulfate (SO4) concentration measured was 39 ppm. Generally, sulfate concentrations greater than 1,500 ppm are considered to be corrosive to foundation elements. (Ref: ACI 318, Section 4.3, Table 4.3.1)

Chlorides (Cl)

The highest Chloride (Cl) concentration measured was 59 ppm. Generally, chloride concentrations greater than 500 ppm are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines / Version 1.0) pH

The soil pH test results ranged from was 8.19 to 9.38. Generally, a pH level less than 5.5 are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines/ Version 1.0).

Preliminary test results indicate that existing subsurface soils at the locations and depths tested are **non-corrosive** based on the above test results. If the site grading operations will result in a blend of native and imported materials at finished subgrade elevations, additional tests should be performed after rough grading has been completed and prior to concrete design.

PAVEMENT

HMA design should meet the requirements of the 2010 or newer, State of California, Standard Specifications Manual (SSM), Section 39. Aggregate Base should also meet the Class 2 requirements of the SSM, Section 26.PCC design should meet the requirements of the American Concrete Institute (ACI) 330R, Guide for the Design and Construction of Concrete.

Ground surfaces to receive HMA or Portland Cement Concrete (PCC) pavements should be scarified and compacted to a minimum depth of 12 inches below the grading plane in cut areas or to 12 inches in areas to receive fill. Engineered fill placed in proposed pavement areas should conform to the requirements of section 5.4, "Placing, Spreading and Compacting Fill Materials," of Appendix A. Compaction in proposed pavement areas should be a minimum of 90 percent of the maximum density as obtained to ASTM Test Method D1557 and should extend to a minimum of two feet beyond the outside edges of pavements.

These recommendations are valid only if the pavement is properly drained and shoulder areas are graded to prevent water ponding at pavement edges. All construction should be subject to adequate tests and observations to verify conformance with these recommendations.

LIMITATIONS, OBSERVATION, AND TESTING

Conclusions and recommendations in this report are given for the proposed Kings Area Rapid Transit (KART) System, located on APN: 012-042-004, 009, 010, 011, 013, 014, & 015 | East 7th Street, North Harris Street, Hanford, Kings County CA, and are based on the following:

a. The information retrieved from six (6) exploratory borings drilled at the subject site to a maximum depth of 61.5 feet below the existing ground surface;

b. Our laboratory testing program results;

c. Our engineering analysis based on the information defined in this report;

d. Our experience in the Kings County area.

Variations in soil type, strength and consistency may exist between specific boring locations. These variations may not become evident until after the start of construction. If such variations appear, a re-evaluation of the soils test data and recommendations may be necessary.

Unless a Geotechnical Engineer of this firm is afforded the opportunity to review plans and specifications, we accept no responsibility for compliance with design concepts or interpretations made by others about foundation support, fill selection, fill placement or other recommendations presented in this report.

Changes in conditions of the subject property can occur with time because of natural processes or the works of man on the subject site or on adjacent properties.

Changes in applicable engineering and construction standards can also occur as the result of legislation or from the broadening of knowledge.

Accordingly, the finding of this report may be invalidated, wholly or in part, by changes beyond our control. Therefore, this report is subject to review and should not be relied upon without review after a period of two years or after any modifications to the site.

REVIEW OF EARTHWORK OPERATIONS

Review of earthwork operations relating to site clearing, ground stabilization, placement and compaction of fill materials, and finished grading is critical to the structural integrity of building foundation and floor systems. While the preliminary Geotechnical investigation and report provide guidelines, which are used by the design team, i.e., architects, grading engineers, structural engineers, landscape engineers, etc., in completing their respective tasks, review of plans and site review and testing during earthwork operations are vital adjuncts to the completion of the Geotechnical engineer's tasks.

The most prevalent cause of failure of a structure foundation system is lack of adequate review and testing during the earthwork phase of the project. Projects rarely reach completion without some alteration being required such as may result from a change in subsurface conditions, an amendment in the size and scope of the project, a revision of the grading plans or a variation in structural details.

Occasionally, even minor changes can significantly affect the performance of foundations. The most prevalent secondary cause for foundation failure is inadequate implementation of Geotechnical recommendations during the formulation of foundation designs and grading plans. The error in a foundation design or an omission of a key element from a grading plan occurs most often as a result of inadequate communication between the various project consultants and -- when a change in consultants occurs -- improper transfer of authority and responsibility.

It is imperative, therefore, that any revisions to the project scope, any change in structural detail, or change in consultant, be brought to the attention of Soils Engineering, Inc. to allow for timely review and revision of recommendations and for an orderly transfer of responsibility and approval.

It is the responsibility of the owner or his representative to ensure that a representative of our firm is always present during earthwork operations relating to site preparation and grading, so that relative compaction tests can be performed, earthwork operations can be observed and compliance with the recommendations provided herein can be established.

This engineering report has been prepared within the limits prescribed to us by the client or his representative, in accordance with the generally accepted principles and practices of Geotechnical engineering. No other warranty, expressed or implied, is included or intended in this report.

Respectfully submitted,
SOILS ENGINEERING, INC.

APPENDIX A

GENERAL GUIDE SPECIFICATIONS FOR EARTHWORK

1. GENERAL

1.1 Scope

These specifications and plans include all earthwork pertaining to site rough grading including, but not limited to, furnishing all labor and equipment necessary for clearing and grubbing; stripping; preparation of ground surfaces to receive fill; excavation; placement and compaction of structural and non-structural fill; disposal of excess materials and products of clearing, grubbing, and stripping; and any other work necessary to bring ground elevations to the lines and grades shown on the project plans. Wherever discrepancies between these guide-specifications and the earthwork recommendations in Section I of the above geotechnical report, the most stringent recommendations shall supersede.

1.2 Performance:

It shall be the responsibility of the contractor to complete all earthwork in accordance with project plans and specifications. No variance from plans and specifications shall be permitted without written approval of the Engineer-of-Record, hereinafter referred to as the "Engineer" or his designated representative, hereinafter referred to as the "Soils Engineer." Earthwork shall not be considered complete until the "engineer" has issued a written statement confirming substantial compliance of earthwork operations to these specifications and to the project plans. The contractor shall assume sole responsibility for job site conditions during earthwork operations on the project, including safety of all persons and preservation of all property. This requirement shall apply continuously and not be limited to normal working hours. The contractor shall defend, indemnify, and hold harmless the owners, engineer, and soils engineer from all liability and claims, real or alleged, arising out of performance of earthwork on this project, except from liability incurred through sole negligence of the owner, engineers, or soils engineers.

2. DEFINITIONS

2.1 Excavations:

Excavation shall be defined within the content of these specifications as earth material excavated for constructing fill embankment; grading the site to elevations shown on project plans; or placing underground pipelines, conduits, or other subsurface utilities or minor structures. Excavations shall be made true to the lines shown on project plans and to within plus or minus one-tenth (0.1) of a foot, of grades shown on the accepted site grading plans.

2.2 Engineered Fill:

Engineered fill shall be construed within the body of these specifications as earth materials conforming to specifications provided in the soils or geotechnical report placed to raise the grade of the site, to backfill excavations, or to construct asphaltic concrete or Portland cement concrete pavement; and upon which the soils engineer has performed sufficient tests and has made sufficient observation during placement and compaction to enable him to issue a written statement confirming substantial conformance of the work to project earthwork specifications.

2.3 On-Site Material:

On-site material is earth material obtained in excavation made on the project site.

2.4 Imported Material:

Imported materials are earth materials obtained off the site, hauled in, and placed as fill.

2.5 "Compaction" or "Compacted:"

Wherever expressed or implied within the context of these specifications shall be interpreted as compaction to ninety (90) percent of the maximum density obtainable by ASTM Test Method D1557.

2.6 Grading Plane:

The grading Plane is the surface of the basement material upon which the lowest layer of subbase, base, asphaltic or Portland cement concrete, surfacing, or another specified layer is placed.

3. SITE CONDITIONS

The contractor shall visit the site, prior to bid submittal, to explore existing subsurface conditions; to survey site topographic, and to define the nature of materials that may be encountered while performing its work under this contract. Moreover, the contractor shall make his own interpretation of the contents of the Geotechnical Report, as they pertain to said conditions. The contractor shall assume all liability under the contract for any loss sustained because of variations which may exist between specific soil boring locations or changed conditions resulting from natural or man-made circumstances occurring after the date of the Preliminary Field Investigations.

4. CLEARING AND GRUBBING

4.1 Clearing and Grubbing

Clearing and grubbing shall consist of removing all debris such as metal, broken concrete, trash, vegetation growth and other biodegradable substances, from all areas to be graded. Existing obstructions below shall be removed in accordance with the following procedures:

4.1.1 Slabs and Pavements - Shall be completely removed. Asphaltic or Portland Cement, concrete fragments may be used in engineered fills provided they are broken down to a maximum dimension of six (6.0) inches and thoroughly dispersed within a friable soil matrix. Engineered fill containing said fragments should not be placed above the elevation of the bottom of the lowest structure footing.

4.1.2 Foundations - Existing at the time of grading shall be removed to a depth not less than two (2.0) feet below the bottom of the lowest structure footing.

4.1.3 Basements, Septic Tanks – Buried concrete containers of similar construction located within areas destined to receive pavements, structures, or engineered fills should be completely removed and disposed of off the site.
Basements, septic tanks, etc., situated outside structures, or structural fill areas shall be disposed of by breaking an opening in bottoms to permit drainage, and by breaking walls down to not less than two (2.0) feet below finished subgrade.

4.1.4 Buried Utilities – Such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed exterior footings of structures. Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade. Concrete lines deeper than two (2.0) feet below finished building pad grade and having diameters less than six (6.0) inches can be crushed in place.

4.1.5 Root Systems – Shall be completely removed to a minimum depth of two (2.0) feet below the bottom of the lowest proposed structure footing or to two (2.0) feet below finished subgrade, whichever depth is lower. Root systems deeper than the elevation indicated above shall be excavated to allow no roots larger than two (2.0) inches in diameter.

4.1.6 Cavities – Resulting from clearing and grubbing or cavities existing on the site because of man-made or natural activity shall be backfilled with earth materials placed and compacted in accordance with Sections 5.3 and 5.4 of these specifications.

4.1.7 Preservation or Monuments, Construction Stakes, Property Corner Stakes, or other temporary or permanent horizontal or vertical control reference points shall be the responsibility of the contractor. Where these markers are disturbed, they shall be replaced at the contractor's expense.

5. SITE GRADING

Site grading shall consist of excavation and placement of fills to lines and grades shown on the project plans and in accordance with project specifications and recommendations of the Preliminary Soils Report, whichever is more stringent. The following are recommendations issued in this report:

5.1 Areas to Receive Fill:

5.1.1 Surfaces to receive fill shall be scarified to a depth of at least six (6.0) inches, or as recommended in this report, whichever is greater, until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

5.1.2 After the area to receive fill has been cleared and scarified, it shall be moistened and compacted to a depth of at least six (6.0) inches in accordance with specifications for compacting fill material in paragraph 5.4, below.

5.2 Excavation:

5.2.1 Excavations shall be cut to elevations plus or minus 0.1 foot of the grades shown on the accepted plans.

5.2.2 When excavated materials are to be used in engineered fill, the excavation shall be made in a manner to produce as much mixing of the excavated materials as practicable.

5.2.3 When excavations are to be backfilled, and where surfaces exposed by excavation are to support structures or concrete floor slabs, the exposed surfaces shall be scarified, moistened and compacted, as stated above, for areas to receive fill. Over excavation below specified depths will not eliminate the requirement for exposed surface compaction.

5.3 Fill Materials:

5.3.1 Materials obtained from on-site excavations will be considered satisfactory for construction of on-site engineered fills, unless otherwise stated in the Soils Report or Foundation Investigation. If unexpected pockets of poor or weak materials are encountered in excavations, and they cannot be upgraded by mixing with other materials or by other means, they may be rejected by the soils engineer for use in engineered fill. Rocks larger than 12 inches in size in any dimension shall not be allowed in the proposed building area. If a large amount of rocks greater than 12 inches in size in any dimension is encountered, a rock disposal area shall be located on the grading plan. Rocks shall be mixed with well-graded soils to assure that the voids in these areas will fill properly.

5.3.2 When imported fill materials are necessary to bring the site up to planned grades, no material shall be imported prior to its approval and acceptance by the soils engineer.

5.3.3 The soils engineer shall be given notice of the proposed source of imported materials with adequate time allowance for his testing of the proposed materials. The time required for testing will vary with different types of materials, job conditions, and ultimate function of filled areas. Under best conditions the time requirement will not be less than 48 hours.

5.4 Placing, Spreading, and Compacting Fill Material:

5.4.1 The fill materials shall be placed in layers which, when compacted, shall not exceed six (6.0) inches in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Increased thickness of layers may be approved by the soils engineer when conditions warrant.

5.4.2 All fills shall be placed in level layers; layers shall be continuous over the area of any structural unit, and all portions of the fill shall be brought up simultaneously within the area of any structural unit. When imported material is used, it must be placed so that its thickness is as uniform as possible within the area of any structural unit.

5.4.3 When materials are to be excavated and replaced in a compacted condition, segmented, or leap-frogging of cut-fill operations within the area of any structural unit will not be permitted unless the method is specifically described by the soils engineer.

5.4.4 When the moisture content of fill material is below the lower limit specified by the Soils Engineer, water shall be added until the moisture content is as specified; and when it is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

5.4.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than ninety (90) percent of maximum density in accordance with ASTM Density Test Method D1557. Compaction shall be by equipment of such design that it will be able to compact the fill to specified density. When the soils engineer specifies a specific type of compaction equipment to be used, such equipment shall be used as specified.

5.4.6 Compaction of each layer shall be continuous over its entire area and the equipment shall make sufficient trips to ensure that the desired density has been obtained.

5.4.7 Field density tests shall be made by the soils engineer. The compaction of each layer of fill shall be subject to testing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in the compacted material below the disturbed surface. When tests indicate the density of any layer of fill or portion thereof is below the required ninety (90) percent density, the layer or portion shall be re-worked until the required density has been obtained.

5.4.8 When the soils engineer specifies compaction to other standards or to percentages other than ninety (90) percent, such specification, with respect to the items, shall supersede these specifications.

5.4.9 The fill operation shall be continued in six (6) inch compacted layers, as specified above, until the fill has been brought to within 0.1 foot, plus or minus, of the finished slopes and grades, as shown on the accepted plans. The finished surface of fill areas shall be graded or bladed to a smooth and uniform surface and no loose material shall be left on the surface.

5.4.10 No fill materials shall be placed, spread, or compacted while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, fill operations shall not be resumed until the soils engineer indicates that moisture content and density of previously placed fill are satisfactory.

5.5 <u>Observations and Testing</u>:

The soils engineer shall be provided with a 48-hour notice, in order that he may be present at the site during all earthwork activities related to excavation, tree root removal, stripping, backfill, and compaction and filling of the site and to perform periodic compaction tests so that substantial conformance to these recommendations can be established.

APPENDIX B

FIELD INVESTIGATION

Six (6) test borings were drilled at the subject site and terminated at a maximum depth of 61.5 feet below the existing ground surface. Borings were advanced using an eight (8.0) inch hollow-stem auger. Test data and descriptions from these holes form the basis of the conclusions and recommendations contained in this report.

Undisturbed samples and disturbed bulk samples were obtained. Undisturbed samples were taken using either a 2-3/8" (inside diameter) split-barrel sampler or a 1-3/8" (inside diameter), 2" (outside diameter) Standard Penetration Sampler (SPT). Penetration resistance of undisturbed soils was obtained by driving the above described sampler using a one-hundred-forty-pound hammer falling thirty inches (30"). Blow counts for each six inch (6") driven increment was recorded and are reported on the Test Borings Logs. In addition, bulk soil samples, selected as most representative of near surface soils encountered, were taken for laboratory testing.

As drilling progressed, earth materials encountered were logged and classified in accordance with the Unified Soils Classification System and presented graphically on Logs of Test Borings, Figures 2 through 7, along with the Legend. Approximate locations of test borings are shown on the Boring Location Map, Figure 1.


Legend
Boring
N Harris St & E Eighth St
E Eighth St
N Harris St
N Brown St
B-1
B-2
B-3
B-4
B-5
B-6
Boring Location Map
17/56

LOG OF TEST BORING
BORING B-1

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 — 0		SM	3" Asphaltic Concrete SILTY SAND; yellowish brown, damp, fine, cohesive			
	4/6 2/6 4/6		Loose, trace of gravel		97.6	13.3
230 — 5						
	4/6 6/6 5/6		Medium dense		109.4	9.6
225 — 10						
	3/6 3/6 5/6				99.7	7.3
220 — 15						
	6/9 9/6 9/6				0.0	9.5
215 — 20						
	5/6 7/6 12/6	ML	SANDY SILT; light brown, damp, very stiff, low plasticity		0.0	11.4
210 — 25						
	4/6 10/6 13/6	SM	SILTY SAND; olive brown, cohesive, damp, medium dense		0.0	10.1
205 — 30						
200 — 35						

LOG OF TEST BORING
BORING B-1

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A* **CAVING -** : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	9/6 20/6 15/6	ML	SANDY SILT; olive brown, low plasticity, moist, hard		0.0	15.6
195 — 40						
190 — 45						
	5/6 10/6 15/6		Very stiff, moist		0.0	24.6
185 — 50						
180 — 55						
	3/6 5/6 10/6		CLAYEY SILT; stiff		0.0	31.0
175 — 60						
	7/6 12/6 12/6		Brown, very stiff		0.0	23.9
			BOTTOM			
170 — 65						
165 — 70						

LOG OF TEST BORING
BORING B-2

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

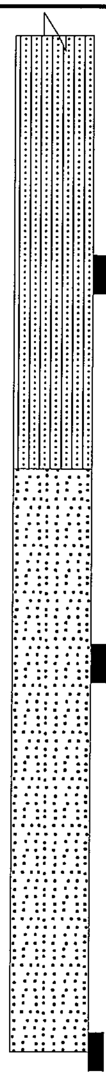
FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 / 0		SM	2" Asphaltic Concrete SILTY SAND; yellowish brown, damp, fine			
	2/6 2/6 3/6	CL	SANDY CLAY; dark brown, damp, medium stiff, medium plasticity		86.0	29.9
230 / 5	3/6 4/6 7/6	SM	SILTY SAND; dark yellowish brown, dry to damp, fine, medium dense Medium dense		107.6	9.6
225 / 10	4/6 6/6 7/6		light yellowish brown		98.2	10.6
220 / 15	2/9 5/6 9/6	CL	SANDY CLAY; brown, damp, low plasticity Stiff		103.8	12.1
215 / 20	9/6 13/6 17/6	SM	SILT SAND; light brown, dry, fine Dense		94.6	10.1
210 / 25						
205 / 30	15/6 22/6 28/6	ML	SANDY SILT; light brown, dry, low plasticity HARD		91.1	15.1
200 / 35		SM	SILTY SAND; light yellowish brown, dry, fine			

LOG OF TEST BORING
BORING B-2

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A* **CAVING -** : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
195 — 40						
	9/6 19/6 25/6		dense, trace of clay		87.7	22.2
190 — 45						
		SP	POORLY GRADED SAND; light yellowish brown, dry, fine			
185 — 50						
	12/6 20/6 25/6		Dense		92.2	2.8
180 — 55						
175 — 60						
	18/6 24/6 32/6		Very dense		94.6	2.1
			BOTTOM			
170 — 65						
165 — 70						

LOG OF TEST BORING
BORING B-3

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 / 0		SM	2" Asphaltic Concrete SILTY SAND; yellowish brown, damp, fine			
	4/6 4/6 5/6		Loose		96.2	13.7
230 / 5	3/6 5/6 5/6	ML	SANDY SILT; brown, damp, low plasticity Stiff		89.7	18.7
225 / 10	3/6 4/6 6/6				85.5	19.7
220 / 15	3/9 4/6 6/6	SM	SILTY SAND; brown, damp, fine, low cohesion Loose		88.3	7.7
215 / 20	9/6 15/6 16/6	ML	SANDY SILT; brown, dry to damp, low plasticity, trace of clay Hard		84.8	22.6
210 / 25						
		SM	SILTY SAND; light yellowish brown, dry, fine			
205 / 30	10/6 14/6 24/6		Dense		104.2	1.7
200 / 35						

LOG OF TEST BORING
BORING B-3

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
195 — 40	10/6 18/6 26/6	SP	POORLY GRADED SAND; light yellowish brown, dry, fine Dense		95.1	2.7
190 — 45						
185 — 50	11/6 20/6 20/6				101.2	2.3
180 — 55						
175 — 60	14/6 26/6 34/6		Very dense BOTTOM		96.5	3.8
170 — 65						
165 — 70						

LOG OF TEST BORING
BORING B-4

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 — 0		SM	1" Asphaltic Concrete 3" Concrete, traces of brick SILTY SAND; yellowish brown, damp, fine, low cohesion Loose, cohesive			
	2/6 3/6 3/6				101.4	12.2
230 — 5						
	3/6 4/6 4/6				97.3	10.1
225 — 10						
	3/6 5/6 5/6				89.8	8.9
220 — 15						
	2/9 3/6 6/6				95.3	5.6
215 — 20						
		ML	SANDY SILT; brown, dry to damp, low plasticity			
210 — 25						
	9/6 14/6 15/6	SM	SILTY SAND; yellowish brown, dry to damp, fine Medium plasticity			
205 — 30						
200 — 35						

LOG OF TEST BORING
BORING B-4

PROJECT: *The Kings Area Rapid Transit (KART) Station*
FILE NO: *17156*
BORING DATE: *07/01/19*
ELEV.: *235'*
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *06-25-19*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
FINISH: *06-25-19*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - ≚ **:** *N/A*
CAVING - ➧ **:** *N/A*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	6/6 16/6 22/6	SP	POORLY GRADED SAND; light yellowish brown, dry, dense, fine		88.0	0.9
195 — 40						
190 — 45		CL	SANDY CLAY; brown, damp, low plasticity			
	4/6 14/6 24/6		HARD		121.6	11.5
185 — 50						
180 — 55						
	9/6 30/6 43/6	SM	SILTY SAND; damp, very dense, fine		114.6	6.1
175 — 60			BOTTOM			
170 — 65						
165 — 70						

LOG OF TEST BORING
BORING B-5

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 / 0		SM	4" Concrete			
			SILTY SAND; yellowish brown, damp, fine			
	2/6 3/6 4/6		Medium stiff		88.4	22.8
230 / 5	2/6 4/6 5/6		Stiff		97.1	20.4
225 / 10	3/6 5/6 7/6		Medium dense		91.6	6.7
220 / 15	2/9 3/6 3/6	ML	CLAYEY SILT; brown, damp, high plasticity, trace of sand		0.0	26.3
			Medium stiff			
215 / 20	4/6 5/6 6/6		SANDY SILT; light yellowish brown, dry, low plasticity		0.0	16.0
			Stiff			
			Olive			
210 / 25	6/6 11/6 11/6		Very stiff		0.0	19.4
		SM	SILTY SAND; light yellowish brown, dry, fine			
205 / 30						
200 / 35						

LOG OF TEST BORING
BORING B-5

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	5/6 8/6 9/6 22/6	SP-SM	POORLY GRADED SAND with low fine content; light yellowish brown, dry, fine Medium dense		0.0	2.5
195 — 40						
190 — 45						
	5/6 8/6 9/6				0.0	4.2
185 — 50						
180 — 55		SM	SILTY SAND, olive brown, damp, fine, trace of clay, low plasticity Medium dense			
	9/6 7/6 8/6				0.0	10.9
175 — 60						
	7/6 9/6 9/6		BOTTOM		0.0	8.2
170 — 65						
165 — 70						

LOG OF TEST BORING
BORING B-6

PROJECT: *The Kings Area Rapid Transit (KART) Station*
BORING DATE: *07/01/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - : *N/A*
CAVING - : *N/A*

FILE NO: *17156*
ELEV.: *235'*
START: *06-25-19*
FINISH: *06-25-19*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
235 / 0		SM	SILTY SAND; yellowish brown, damp, fine			
	2/6 2/6 4/6		Loose		95.0	7.4
230 / 5						
	3/6 3/6 6/6				94.7	10.2
225 / 10		ML	SANDY SILT; light yellowish brown, dry, trace of clay, low plasticity			
	2/6 8/6 11/6	SP	NO RECOVERY		78.7	3.7
			POORLY GRADED SAND; light yellowish brown, dry, fine			
220 / 15						
	2/6 3/6 3/6		NO RECOVERY, sand trap used sugar sand is too fine		0.0	1.7
215 / 20						
210 / 25		ML	CLAYEY SILT; olive, damp, medium plasticity			
	9/6 15/6 22/6		Hard		104.2	19.3
205 / 30						
200 / 35						

LOG OF TEST BORING
BORING B-6

PROJECT: *The Kings Area Rapid Transit (KART) Station*
FILE NO: *17156*
BORING DATE: *07/01/19*
ELEV.: *235'*
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *06-25-19*
DRILL METHOD: *4.25" I.D. Hollow Stem Auger*
FINISH: *06-25-19*
DESCRIPTION: *Geotechnical Feasability Report*
DEPTH TO WATER - ▼ **:** *N/A*
CAVING - ➤ **:** *N/A*
LOGGER: *M.Watts*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	9/6 22/6 33/6				98.3	26.8
195 — 40						
		SP	POORLY GRADED SAND; light yellowish brown, dry, fine			
190 — 45						
	15/6 21/6 39/6		Very dense		103.7	1.4
185 — 50						
180 — 55						
	21/6 39/6 50/5				111.4	3.3
175 — 60			BOTTOM			
170 — 65						
165 — 70						

KEY TO SYMBOLS

Symbol Description

Strata symbols

Paving

Silty sand

Silt

Low plasticity clay

Poorly graded sand

EXTRA: semi-random triangle pattern

EXTRA: dashed lines with 3 dots above each dash

Poorly graded sand with silt

Misc. Symbols

Boring continues

Soil Samplers

California sampler

Standard penetration test

Notes:

1. Six (6) exploratory borings were drilled from 06/25/19 through 06/27/19 using an 8-inch outside diameter hollow-stem auger.
2. No free groundwater was encountered to the maximum depth drilled of 61.5'.
3. Boring locations are shown on the Boring Location Map, Figure 1.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.

APPENDIX C

SOIL TEST DATA

SIEVE ANALYSES (ASTM D422 and/or ASTM D1140)

Grain size distributions for specimens retrieved from various subsurface elevations were tested to classify the materials. Test results are presented on Figures A-1 through A-15.

IN-SITU DENSITY & MOISTURE RELATIONSHIPS (ASTM D2216 & D2937)

Moisture & density data for undisturbed native soils was obtained by use of a 2-3/8-inch (inside diameter) split-barrel sampler. Test results are given on the Logs of Test Borings, Figures 2 through 7.

CONSOLIDATION TESTS (ASTM D2435)

Compressibility of soils was determined on saturated, undisturbed samples of native materials. Consolidation Test Diagrams, Figures B-1 through B-6, graphically express the relationship of vertical strain vs. applied vertical (normal) load for earth materials selected as most representative of the soil strata within the anticipated zone of influence of foundation loads.

DIRECT SHEAR TESTS (ASTM D3080)

Three (3) quick-consolidated direct shear tests were performed on an undisturbed, saturated sample of native earth materials. These tests provide information on soil shear strength vs. normal load and is used to determine the angle of internal friction and cohesion of earth materials under essentially drained conditions. Test results are presented in Figures C-1 through C-3.

EXPANSION INDEX (ASTM D4829)

The Expansion Index test is designed to measure a basic index property of soil and in this respect is comparable to other index tests such as the Atterberg Limits. In formulating the test procedures, no attempt has been made to duplicate any particular moisture or loading conditions which may occur in the field. Rather, an attempt has been made to control all variables which influence the expansive characteristics of a particular soil and still retain a practical test for general engineering usage. Near surface soils were obtained and tested for expansiveness. Test results are presented on the Laboratory Testing Recap Table 1.

SOIL CORROSIVITY (SO4 / pH / Chlorides)

Tests for Soluble Sulfates (SO4), Soluble Chlorides (Cl), and pH values were performed on three (3) composite sample retrieved from the upper 3 feet to determine the corrosion potential of the soils. Corrosion prevention measures and the extent to which measures should be taken (if any) should be addressed with the corrosion engineer. Soluble Sulfates and Soluble Chlorides values were determined according to EPA 300.0M. The pH values were determined according to EPA 9045C. Results of all the constituents are discussed in the Soil Corrosivity section.

UltraSystems Environmental

Geotechnical Feasability Report
The Kings Area Rapid Transit (KART) Station
APNs: 012-042-004, 009, 010, 011, 013, 014, & 015 | E 7th St., N. Harris St., N. Brown St., & 9th St., Hanford, Kings County, CA

SEI File No. 19-17156
July 17, 2019

TABLE 1

TEST LOCATION	USCS	% < # 200	CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		E.I.	ATTERBERG LIMITS			R-VALUE @ 300 psi		MAXIMUM DENSITY	
			C_C	C_S	S.P. (psf)	HV %	C, (ksf)	F.A.	Q_U, (psi)	C, (ksf)		LL	PL	PI	R.V.	E.P. (psi)	MDD (pcf)	O.M.
B-1 @ 3'	SM	33	0.07	0.01	0	-1												
B-1 @ 6'	SM						0.06	36.5										
B-1 @ 11'	SM	29																
B-1 @ 21'	ML	70																
B-1 @ 26'	SM	46																
B-1 @ 36'	ML	71																
B-1 @ 56'	ML	100																
B-2 @ 0-5'	ML										20							
B-2 @ 6'	SM	35	0.05	0.01	0	-0.8												
B-3 @ 3'	SM	49	0.06	0.01	0	-0.8												
B-4 @ 3'	SM						0.06	38.1										
B-4 @ 6'	SM	42	0.08	0.01	0	-0.7												
B-5 @ 3'	SM	49	0.07	0.01	0	-0.3												
B-5 @ 16'	ML	98																
B-5 @ 26'	ML	83																
B-5 @ 36'	SP-SM	6.5																
B-5 @ 56'	SM	35																
B-6 @ 3'	SM	38	0.09	0.01	0	-1.3												
B-6 @ 6'	SM						0.09	37.3										

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (psf) - Swell Pressure
HV % - Heave Precentage / Collapase

UNCONFINED COMPRESSION
Q_U (psi) - Unconfined Compression Strength
C, (ksf) - Cohesion

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle

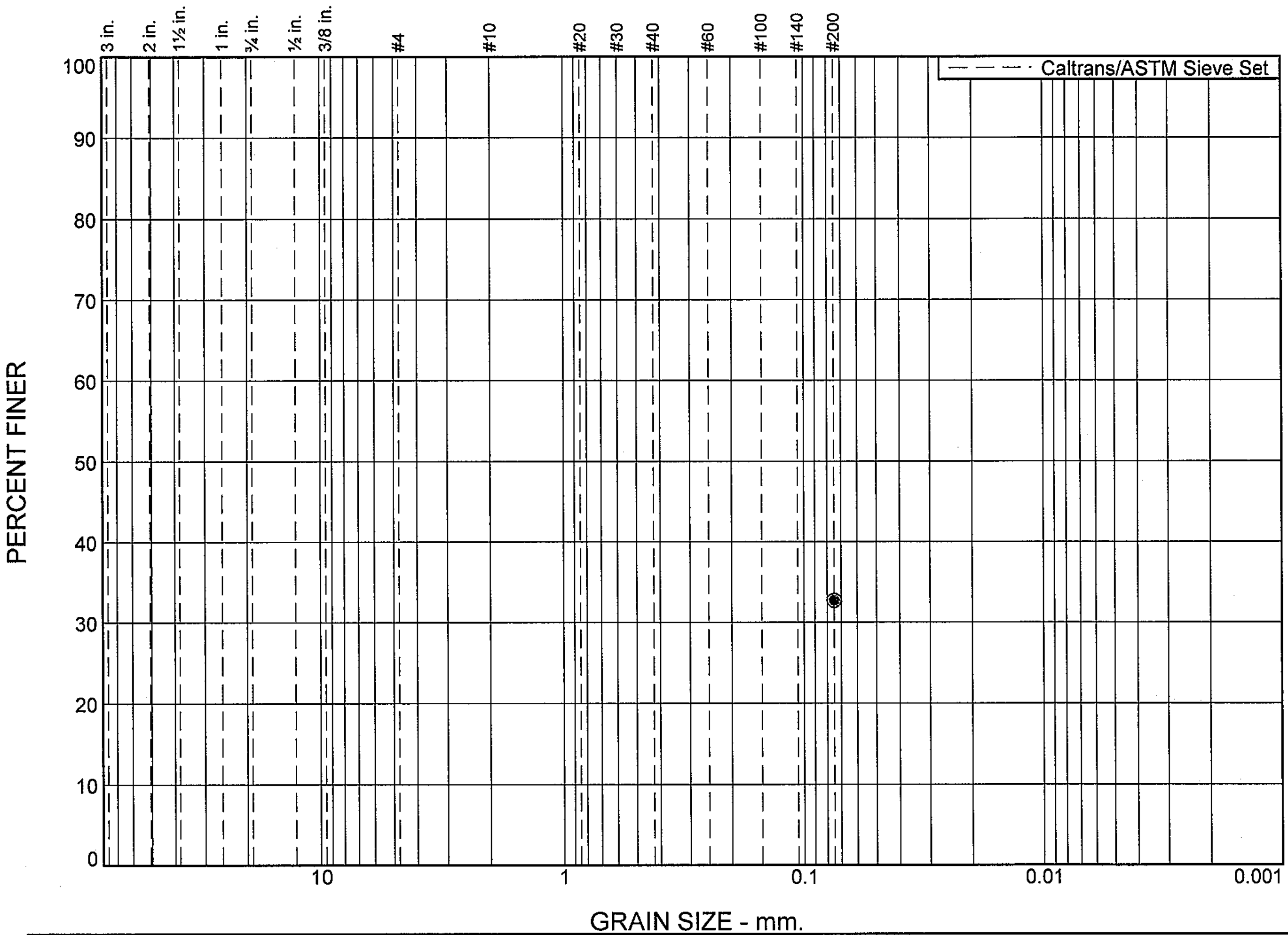
E.I. - EXPANSION INDEX

ATTERBERG LIMITS
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index

(R)ESISTANCE VALUE
RV - R-Value @ 300 psi
EP - Expansion Press @ 300 psi

MAXIMUM DENSITY
MDD (pcf) - Max Dry Density
O.M. - Optimum Moisture

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							33	

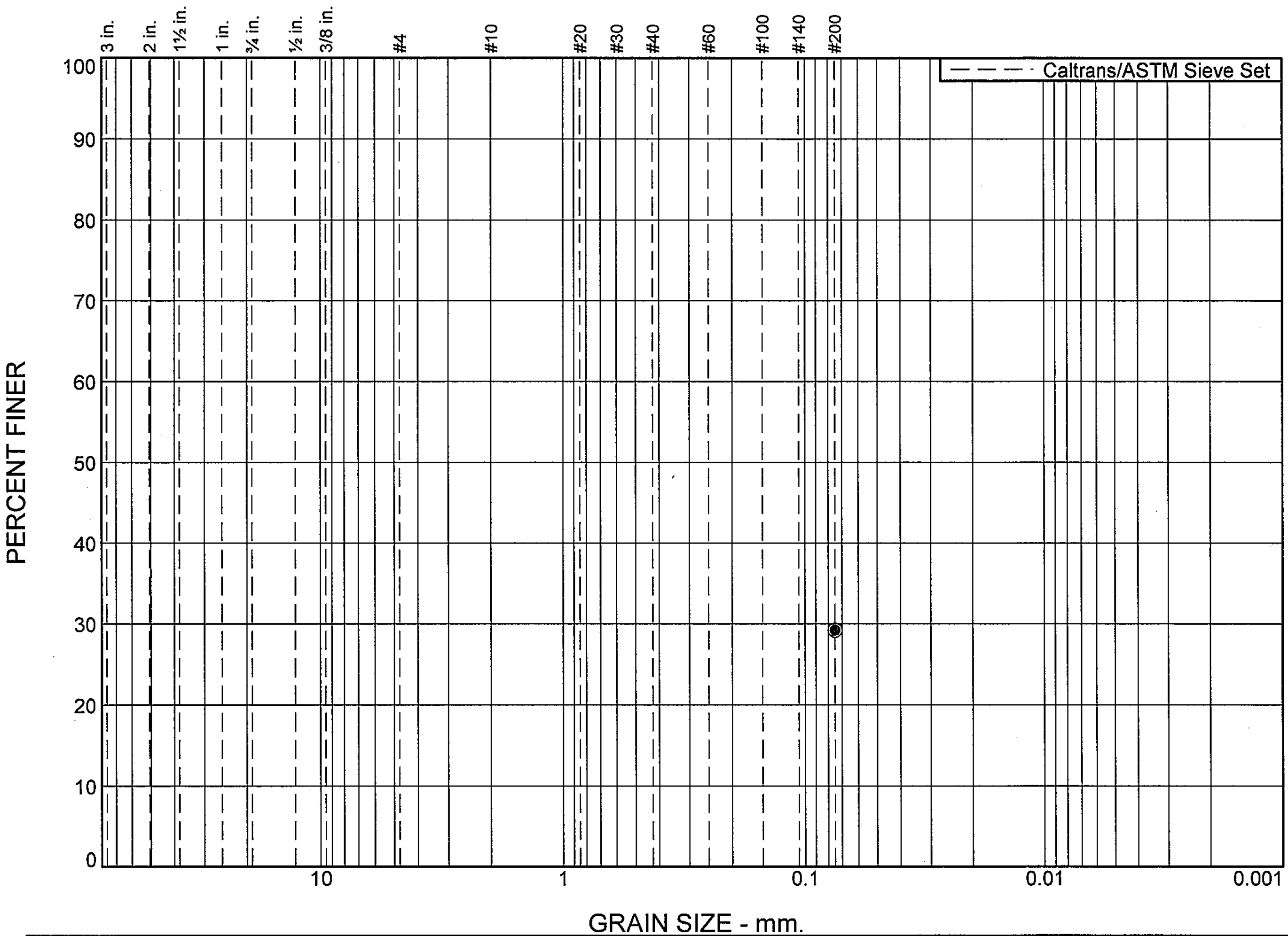
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		3'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station
Project No.: 17165 **Figure** A-1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							29	

SOIL DATA

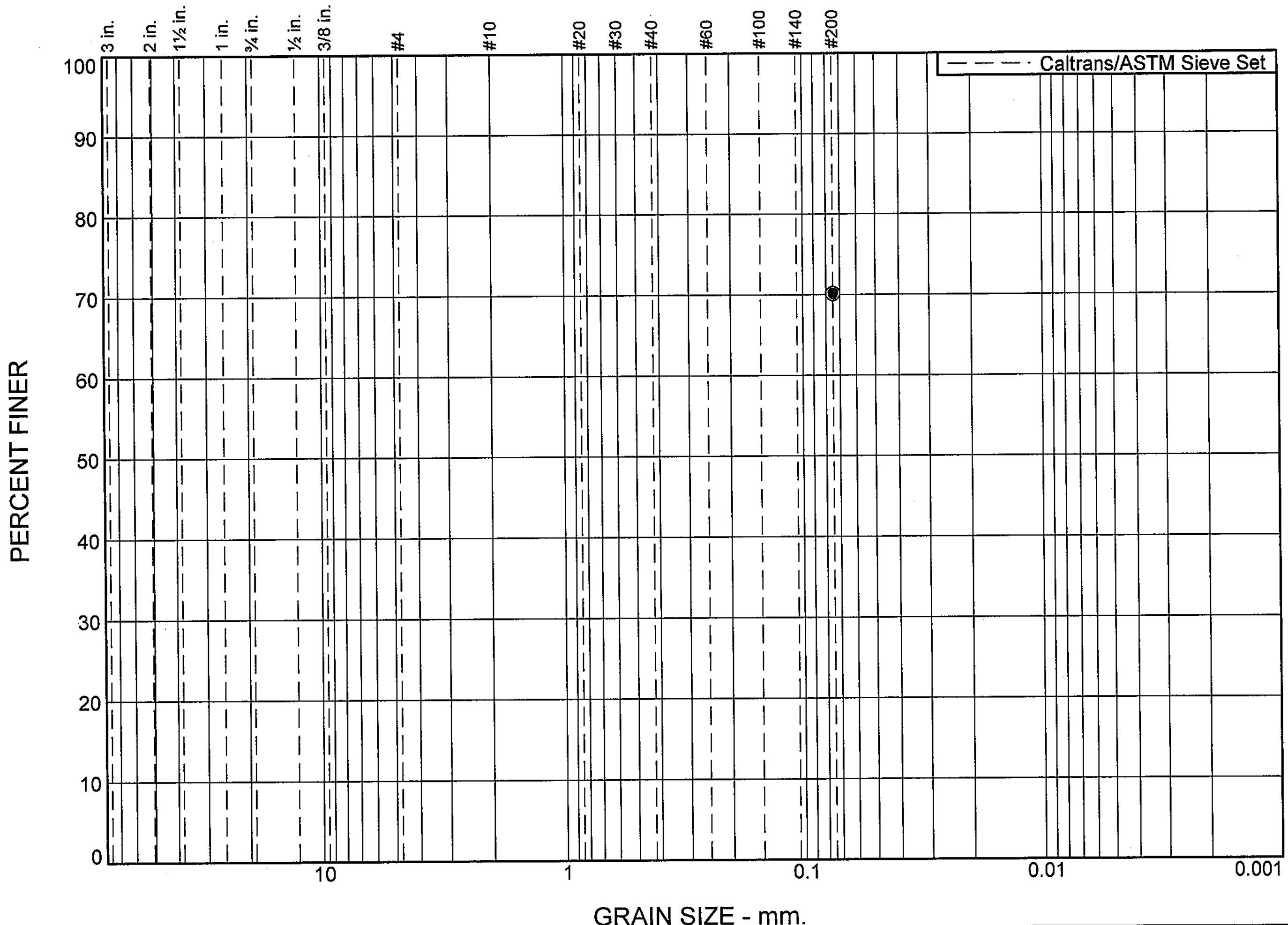
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		11'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							70	

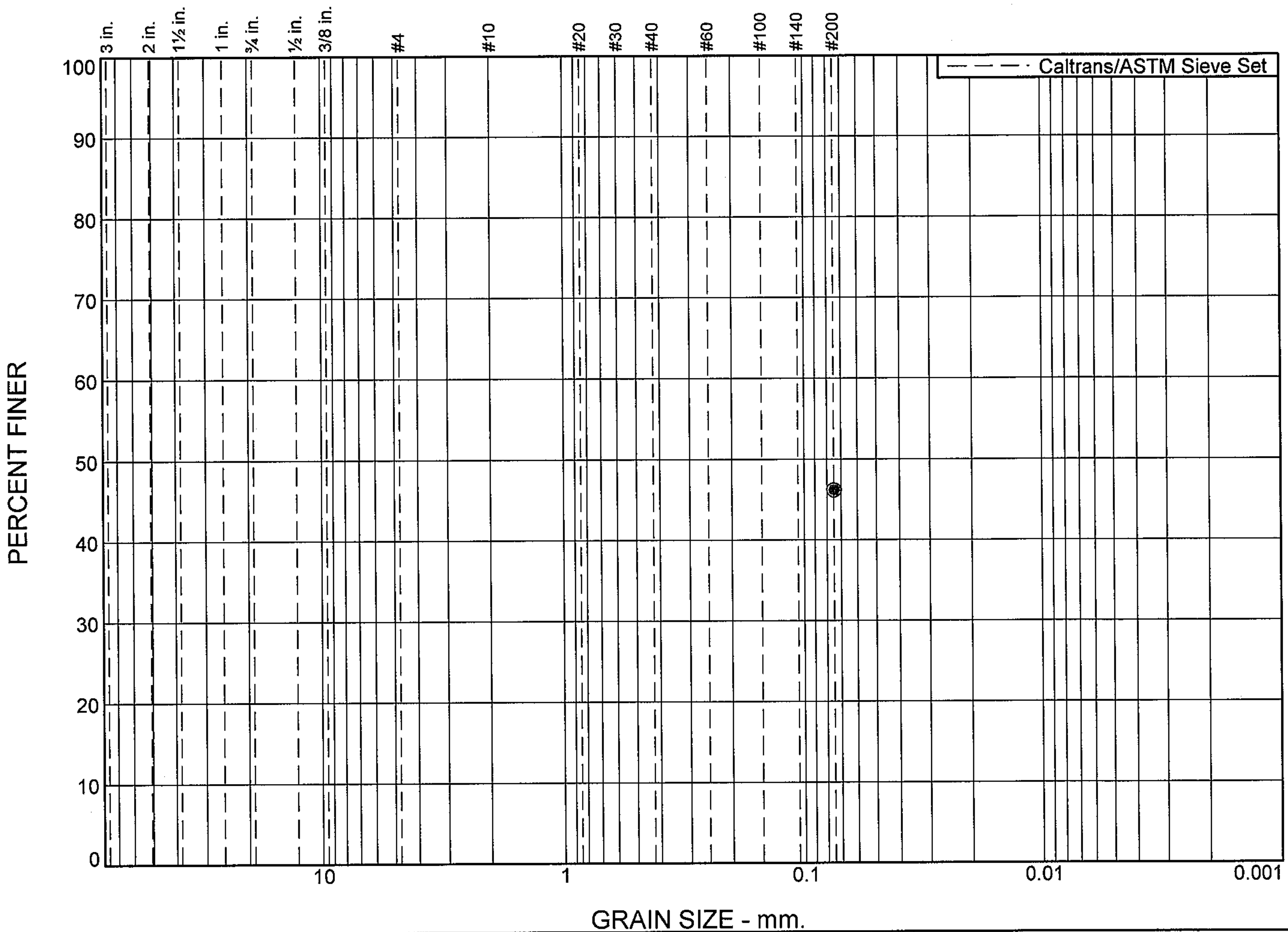
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		21"	SANDY SILT	ML

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station
Project No.: 17165 **Figure** A-3

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							46	

SOIL DATA

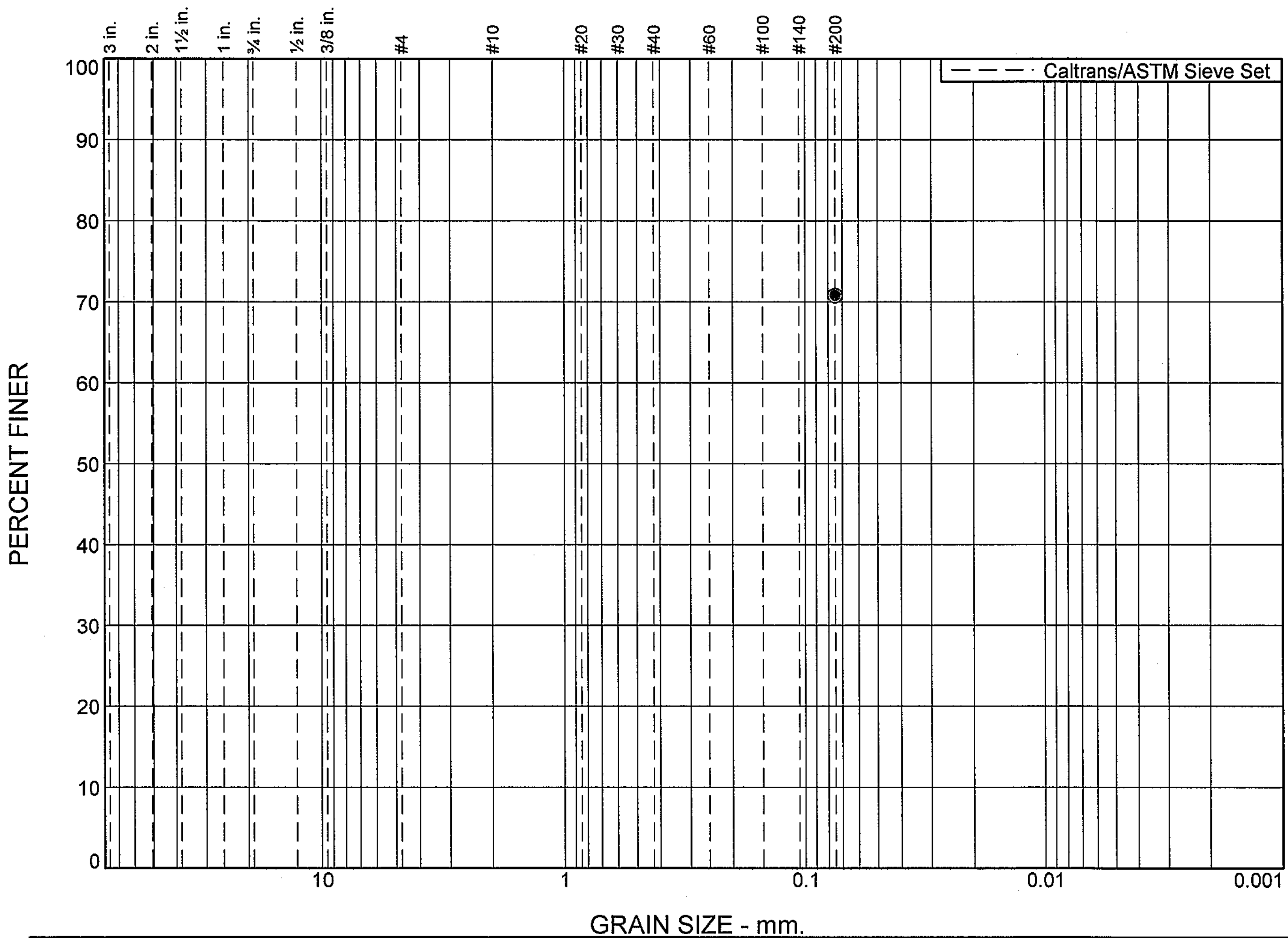
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		26'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-4

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							71	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		36'	SANDY SILT	ML

SOILS ENGINEERING, INC.

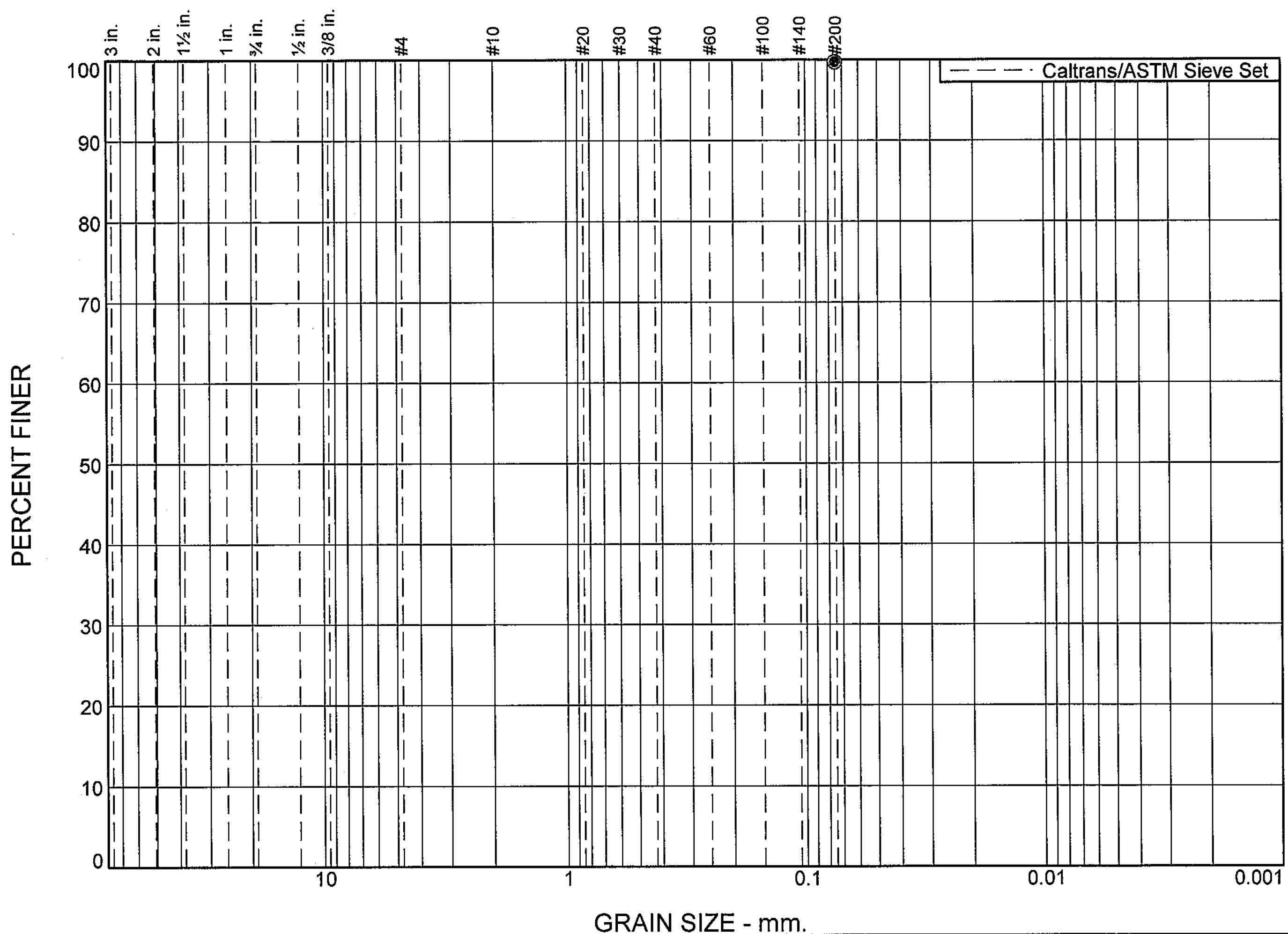
Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165

Figure A-5

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							100	

SOIL DATA

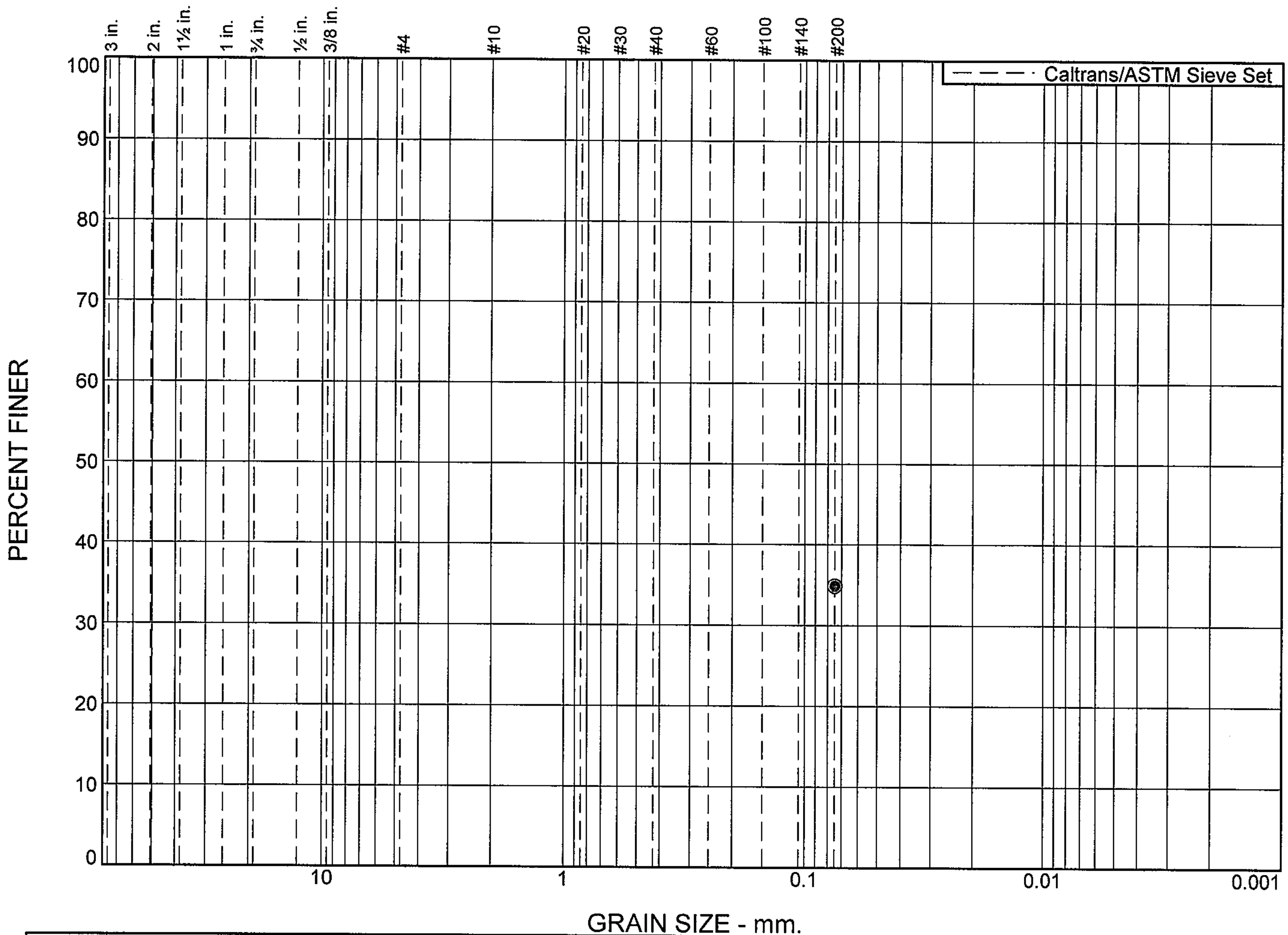
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		56'	CLAYEY SILT	ML

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-6

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							35	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-2		6'	SILTY SAND	SM

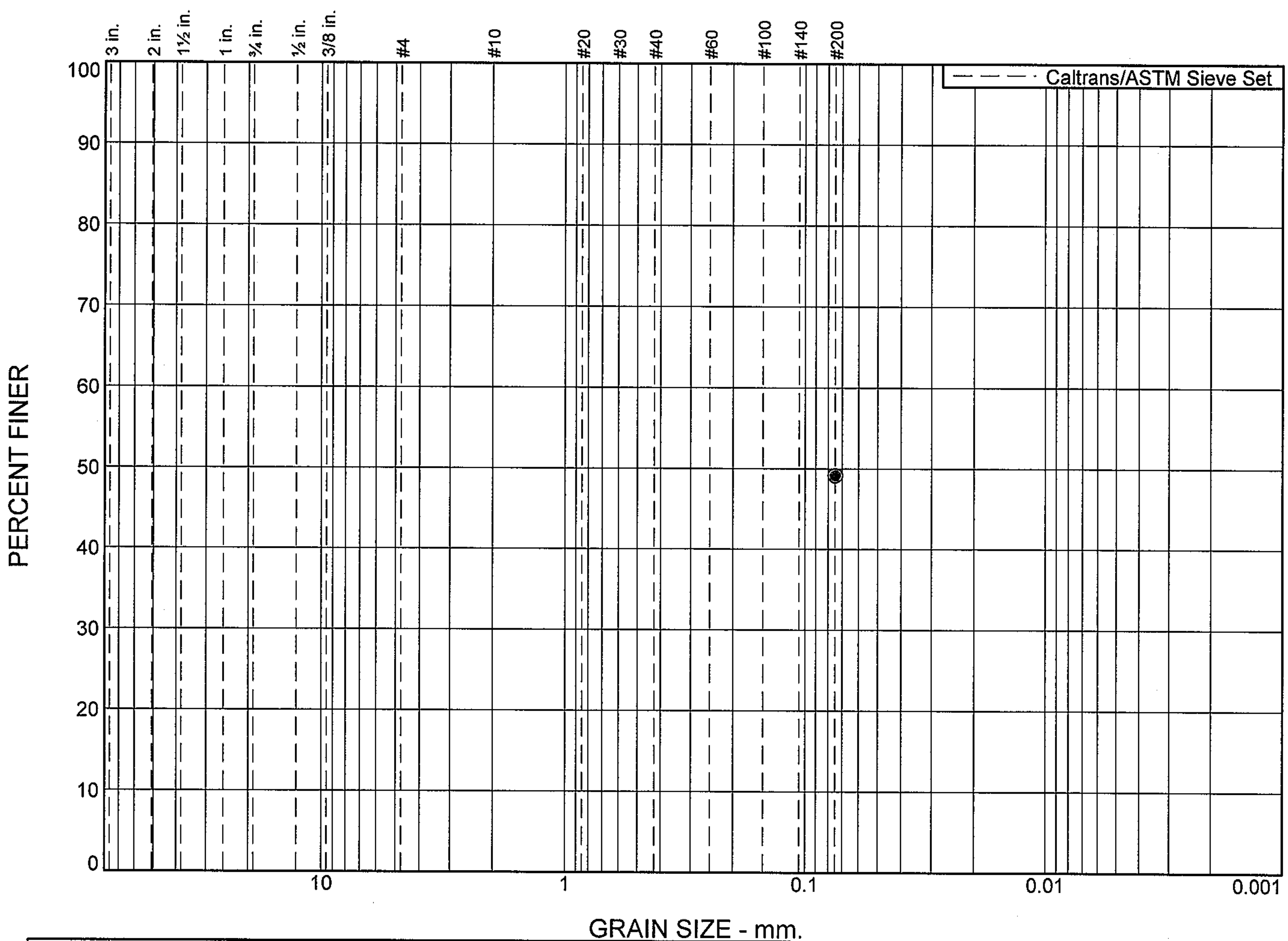
SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165

Figure A-7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							49	

SOIL DATA

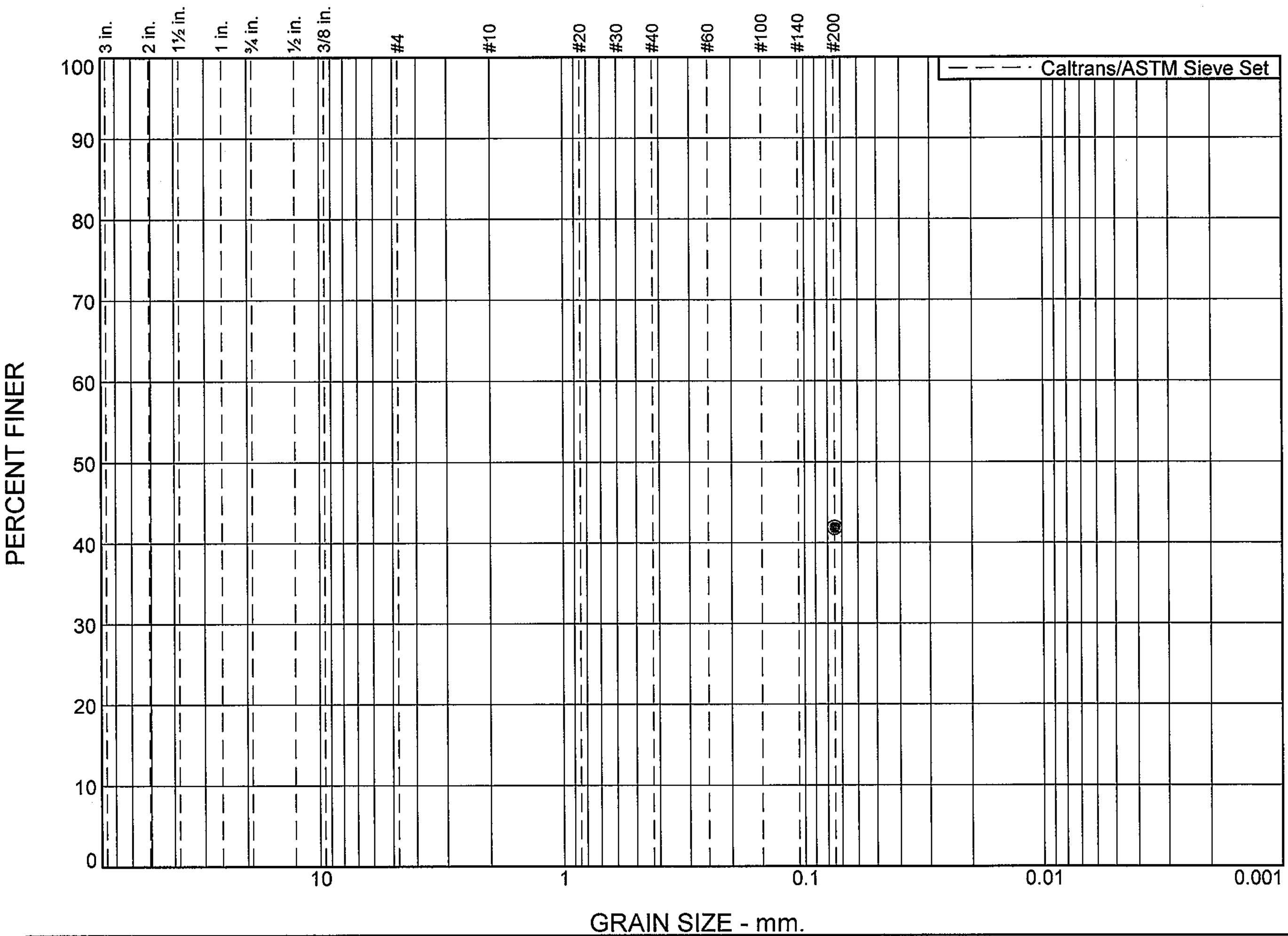
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3		3'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-8

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							42	

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-4		6'	SILTY SAND	SM

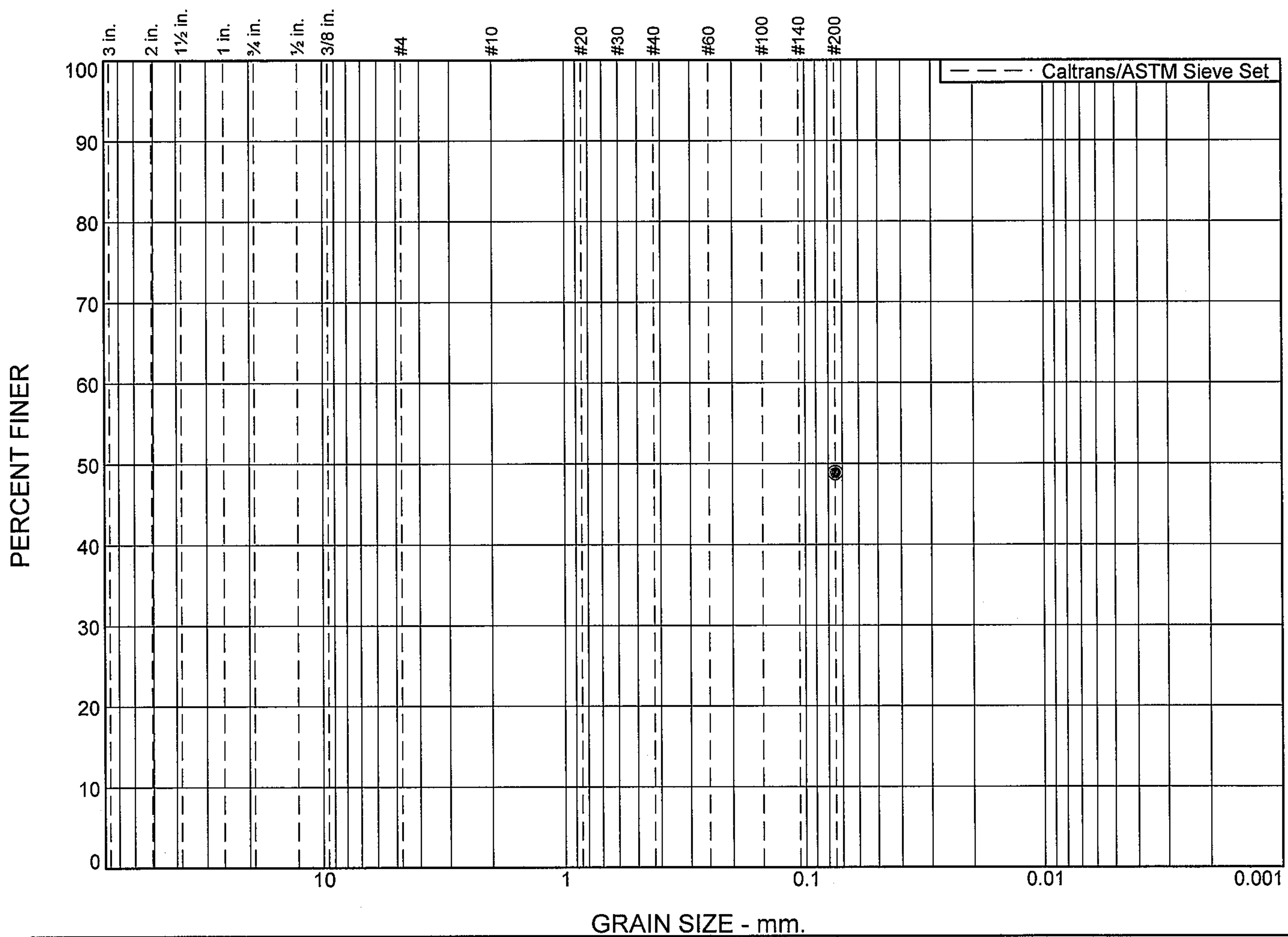
SOILS ENGINEERING, INC.

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-9

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							49	

SOIL DATA

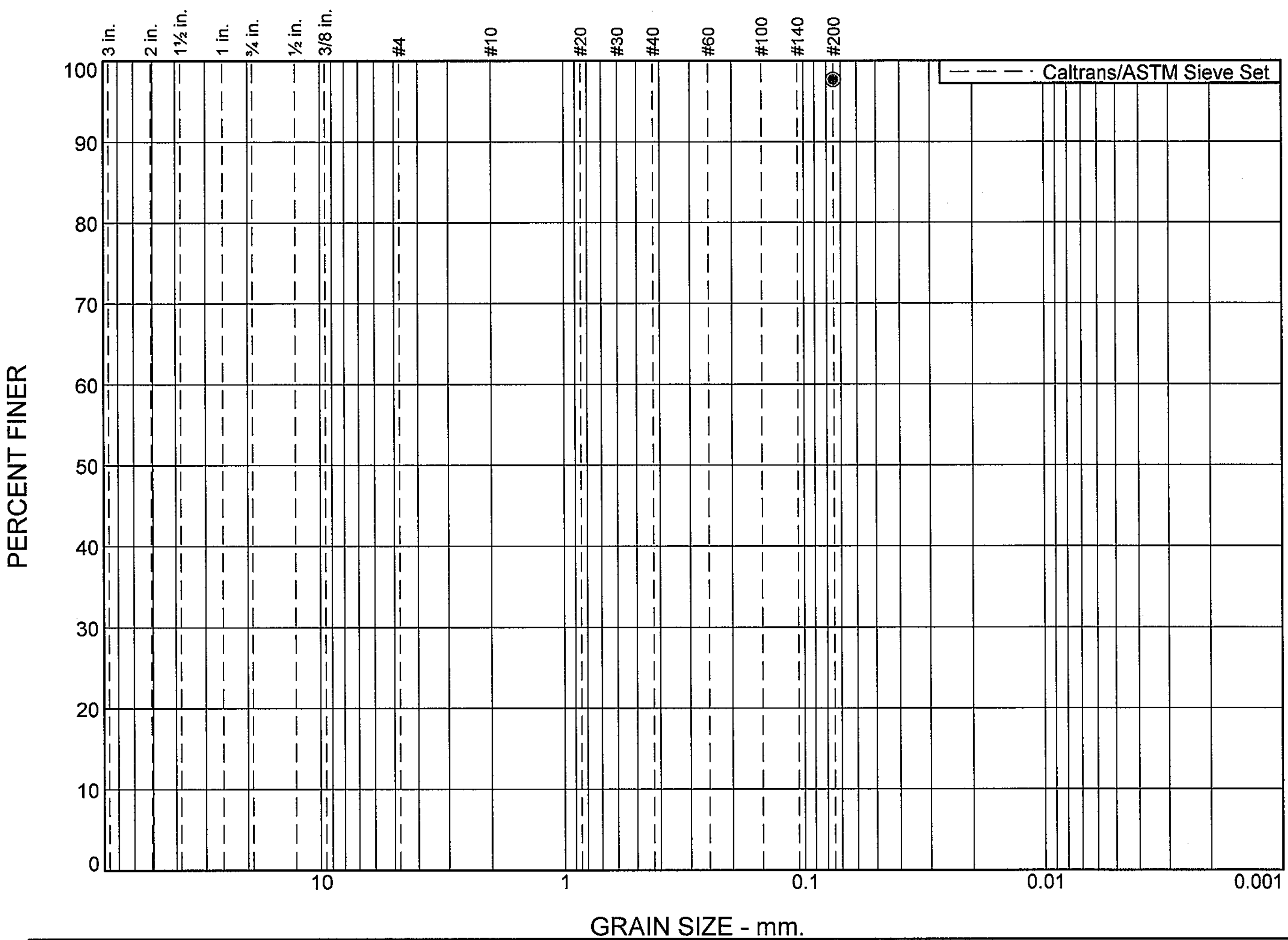
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5		3'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-10

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							98	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5		16'	CLAYEY SILT	ML

SOILS ENGINEERING, INC.

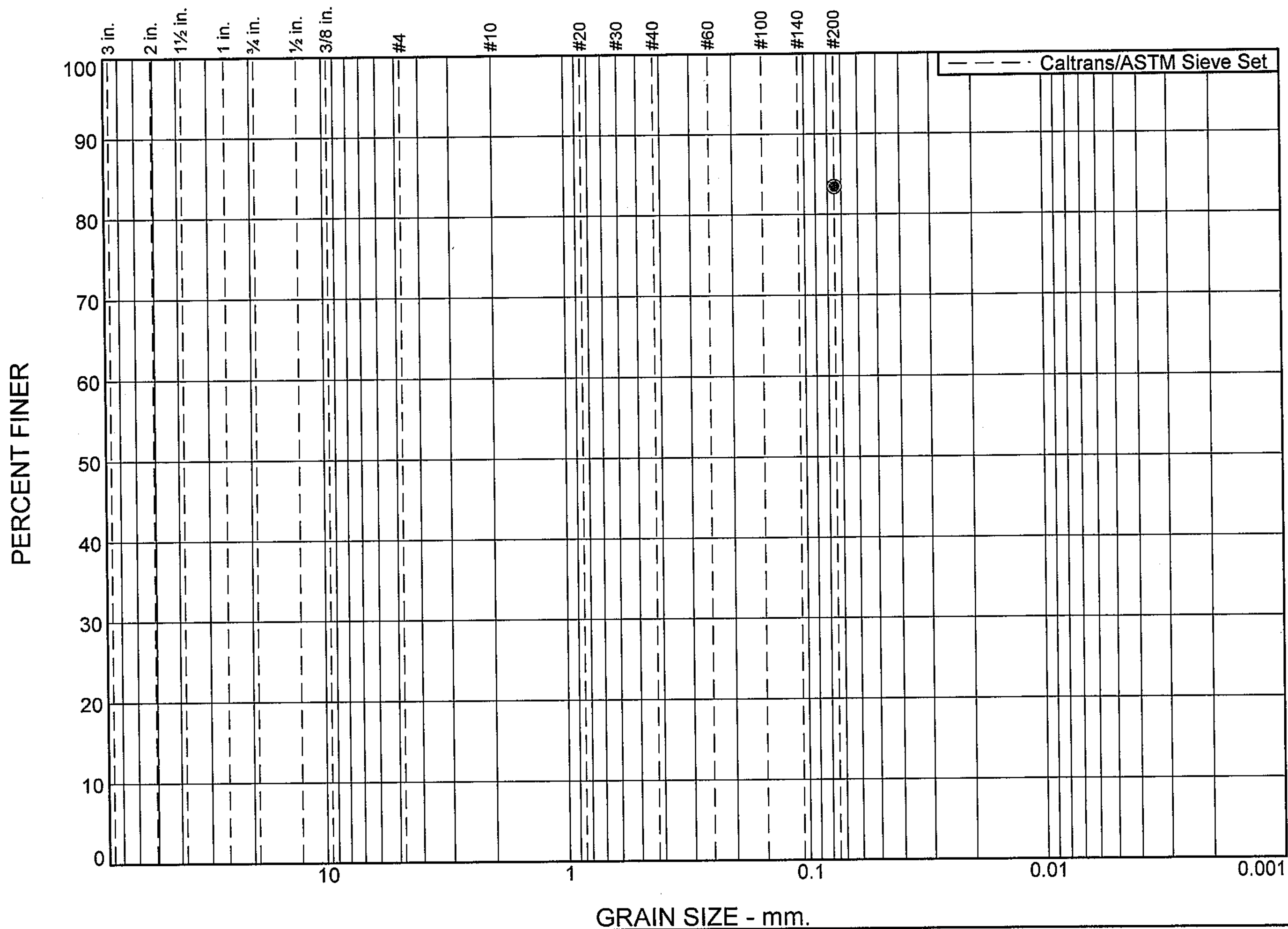
Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165

Figure A-11

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							83	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5		26'	SANDY SILT	ML

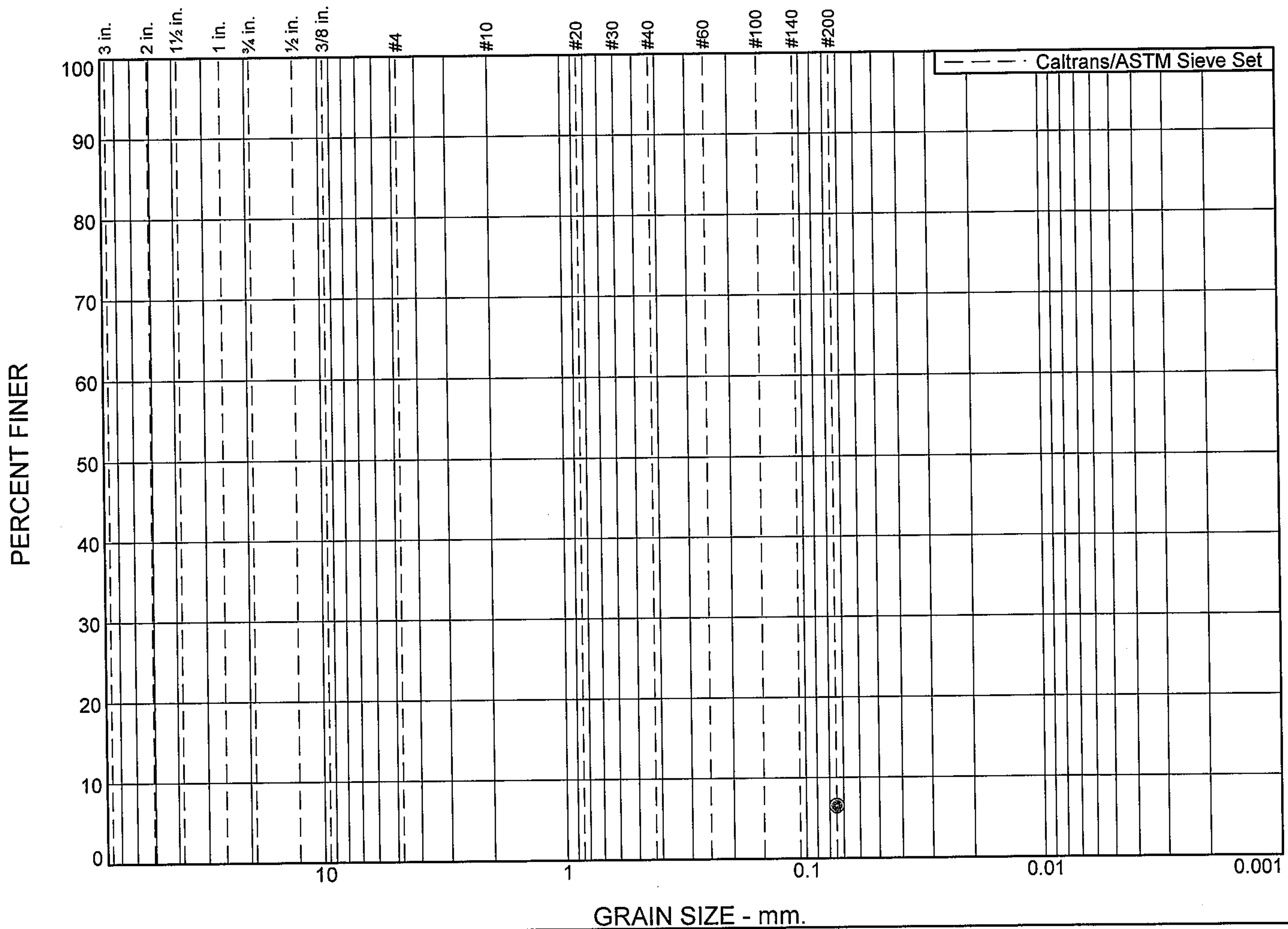
SOILS ENGINEERING, INC.

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-12

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							6.5	

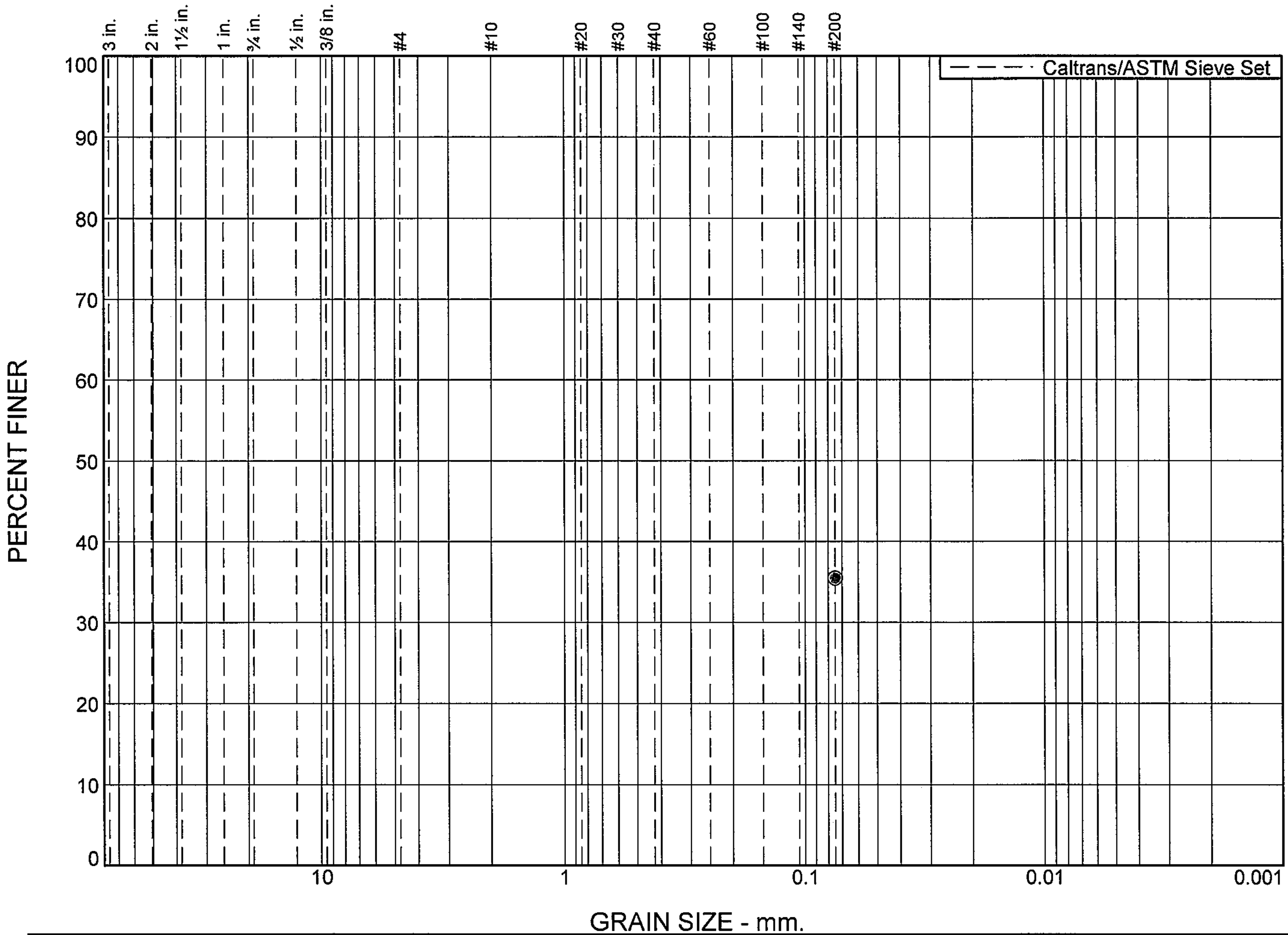
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5		36'	POORLY GRADED SAND with low fine content	SP-SM

SOILS ENGINEERING, INC.

Client: UltraSystems Environmental
Project: The Kings Area Rapid Transit (KART) Station
Project No.: 17165 **Figure** A-13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							35	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5		56'	SILTY SAND	SM

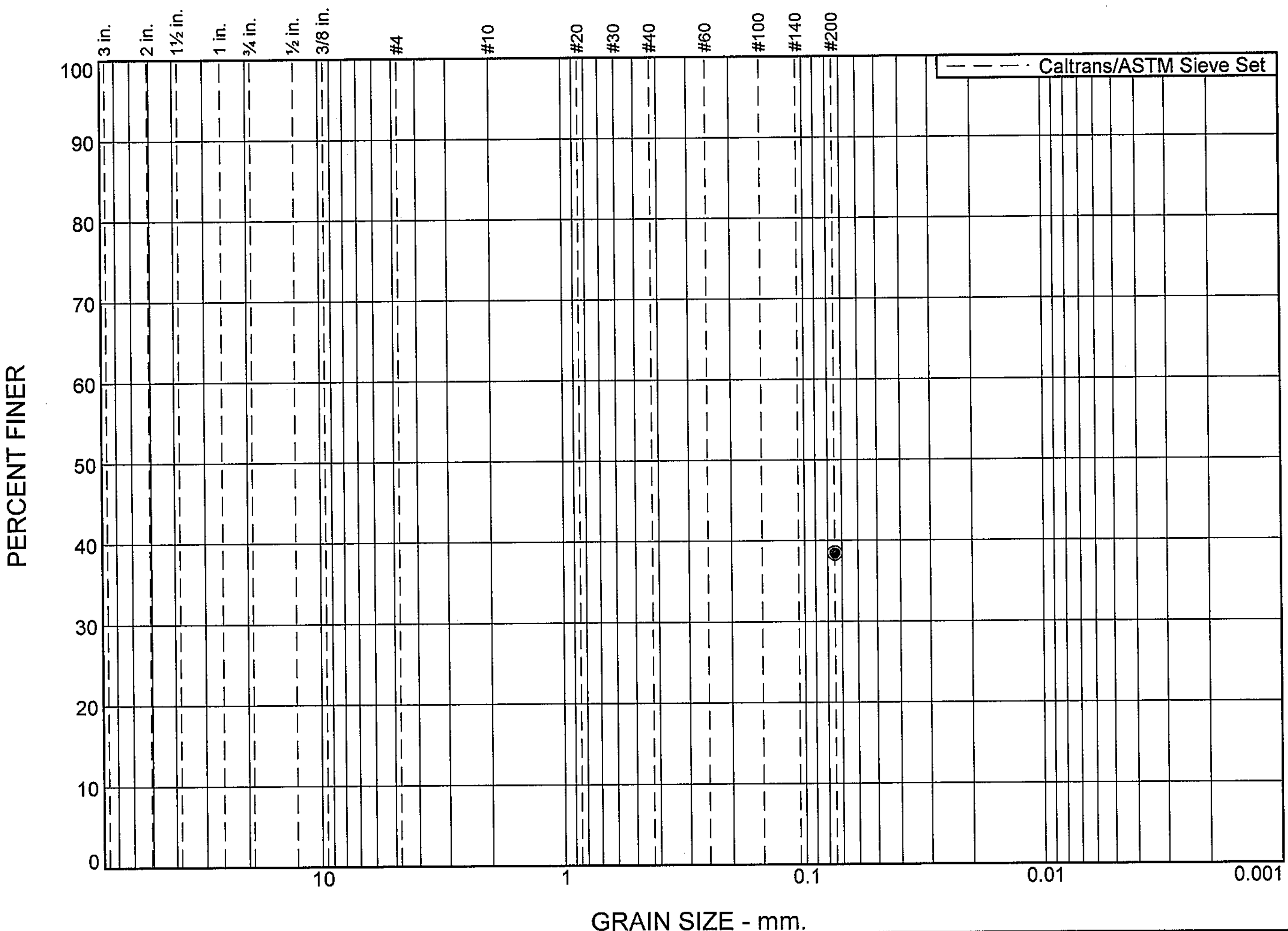
SOILS ENGINEERING, INC.

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165 **Figure** A-14

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							38	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		3'	SILTY SAND	SM

SOILS ENGINEERING, INC.

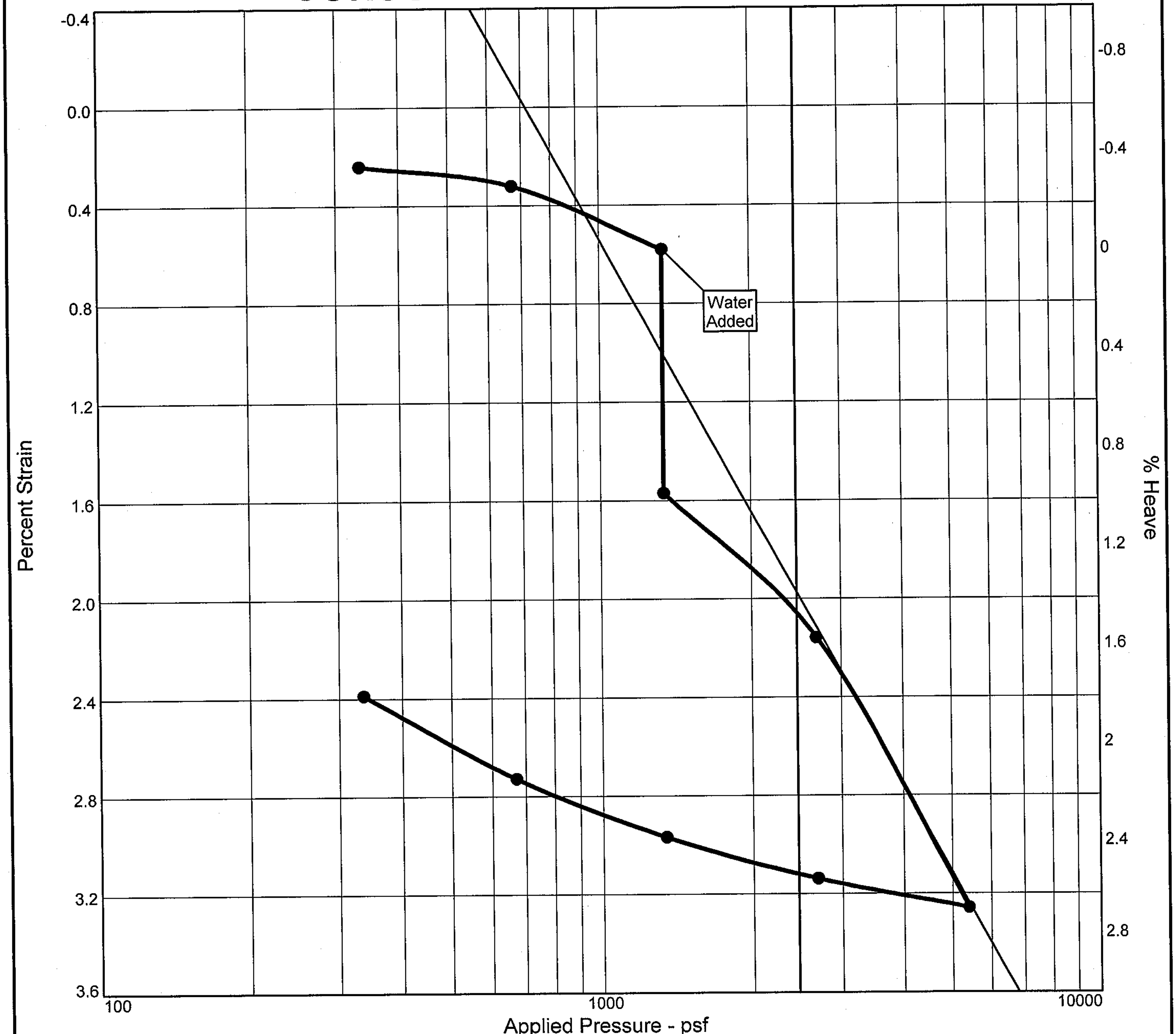
Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Project No.: 17165

Figure A-15

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
46.7 %	14.3 %	91.2	N/A	N/A	2.65	336	2658	0.07	0.01		-1.0	0.814

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-1 **Depth:** 3'

Remarks:
Sample No: 70533
Test Date: 07/11/19

SOILS ENGINEERING, INC.

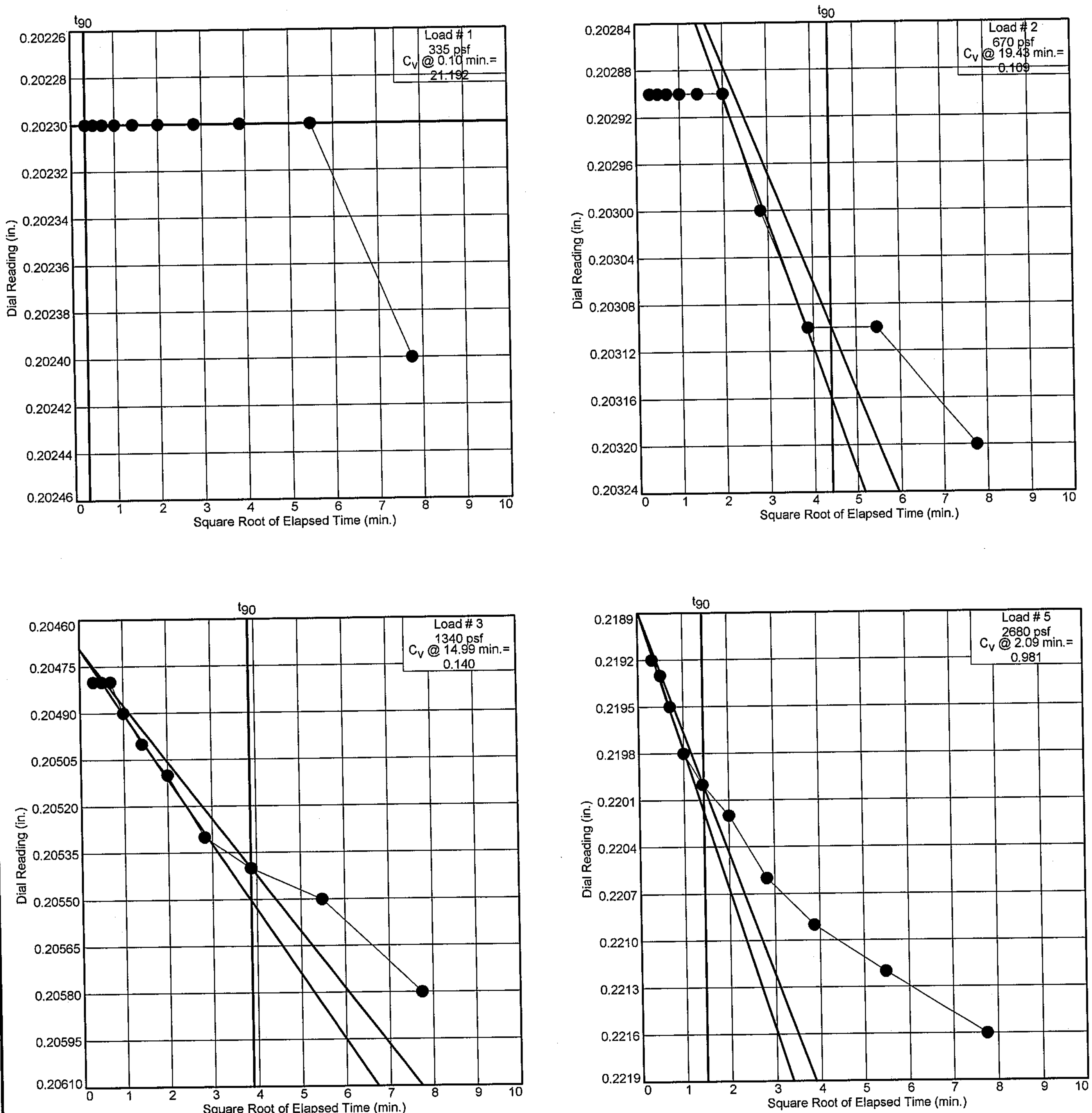
Figure B-1

Tested By: CF **Checked By:** AL

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-1 Depth: 3'



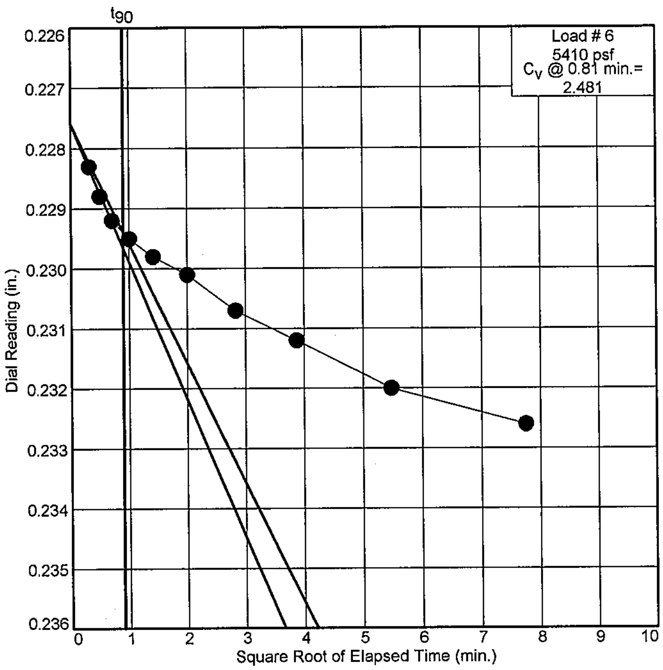
SOILS ENGINEERING, INC.

Figure B-1

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

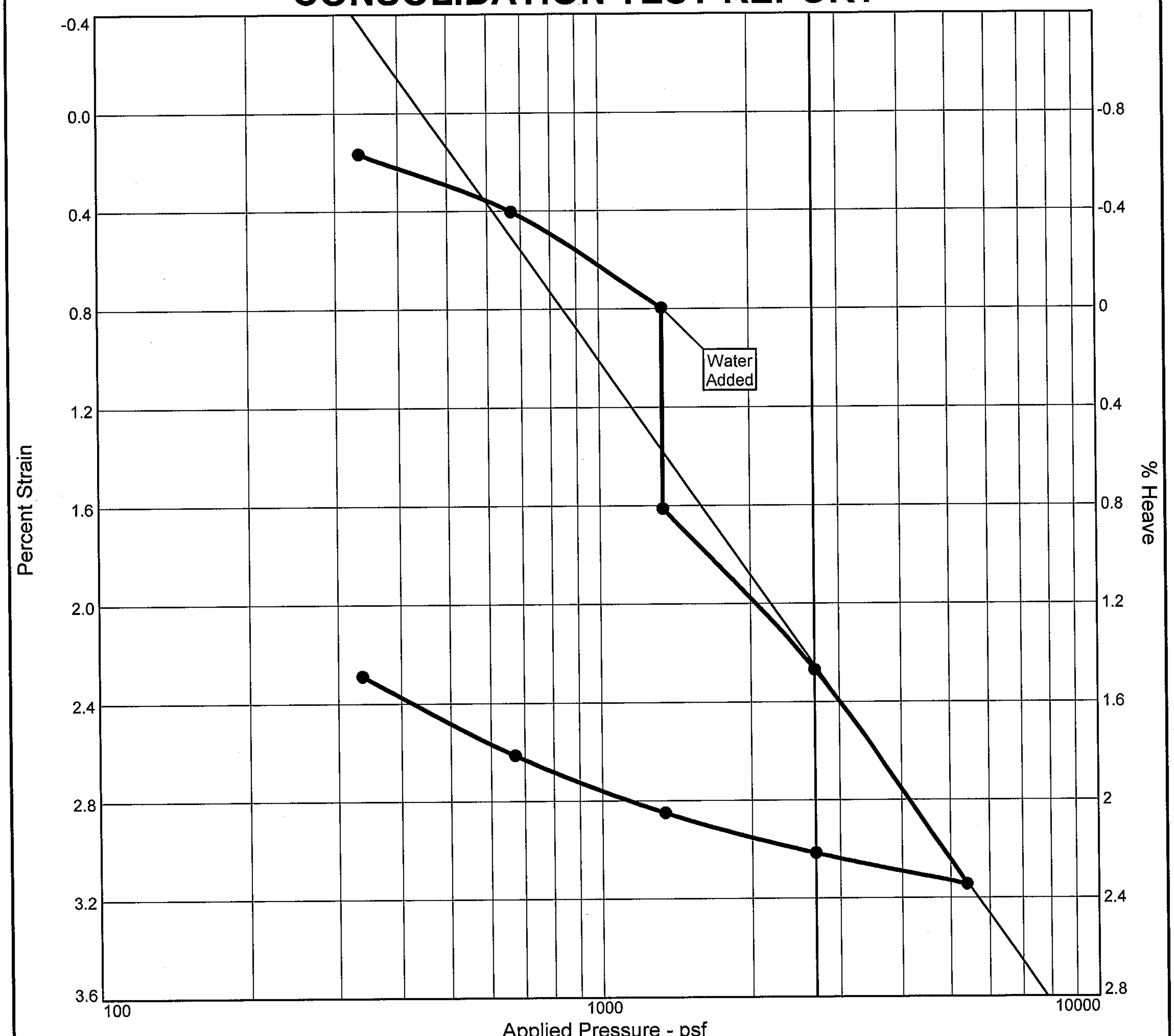
Source of Sample: B-1 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-1

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
41.0 %	11.2 %	96.1	N/A	N/A	2.65	336	2746	0.05	0.01		-0.8	0.721

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-2 **Depth:** 6'

Remarks:
Sample No: 70522
Test Date: 07/11/19

SOILS ENGINEERING, INC.

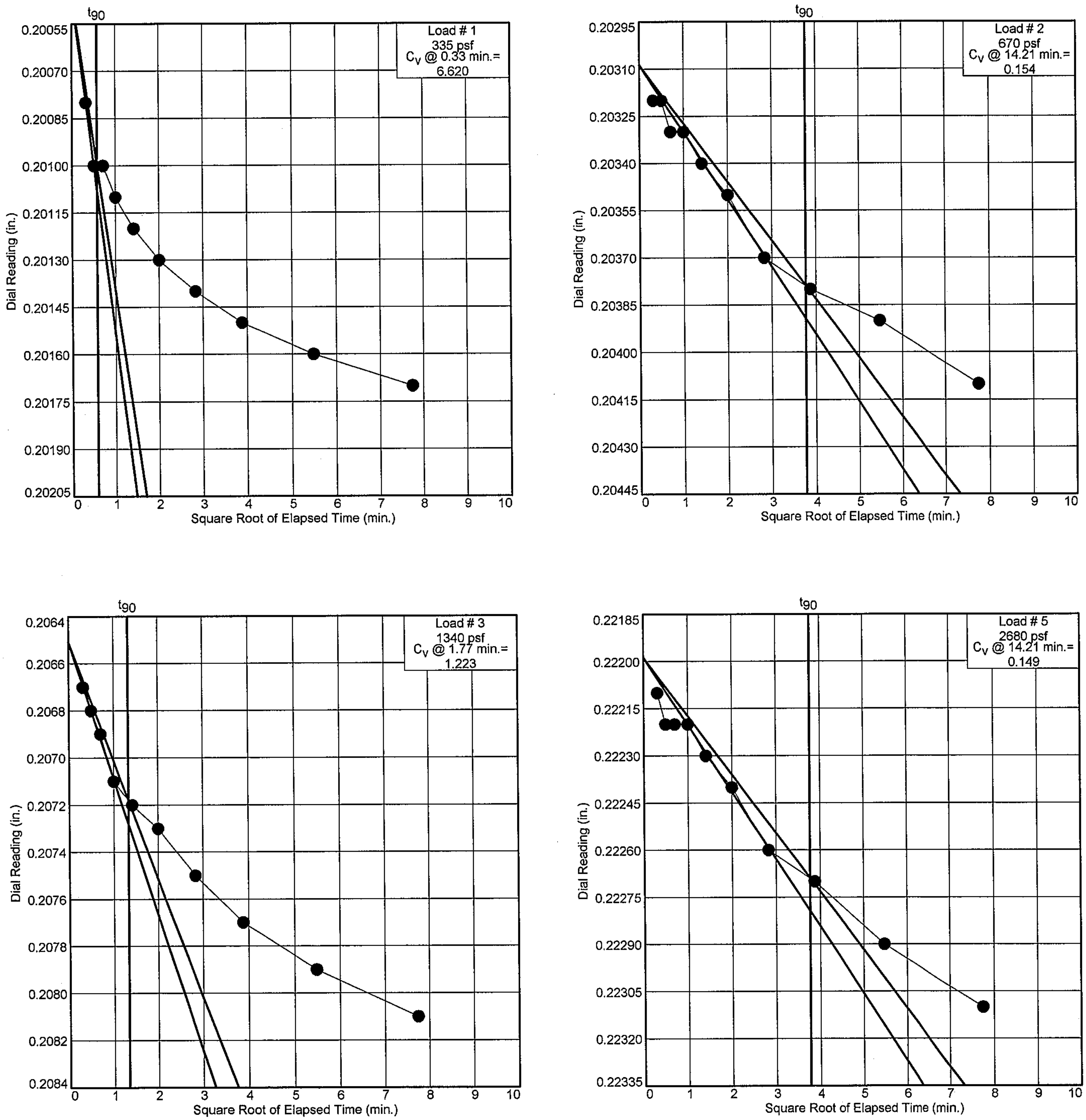
Figure B-2

Tested By: CF **Checked By:** AL

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-2 Depth: 6'



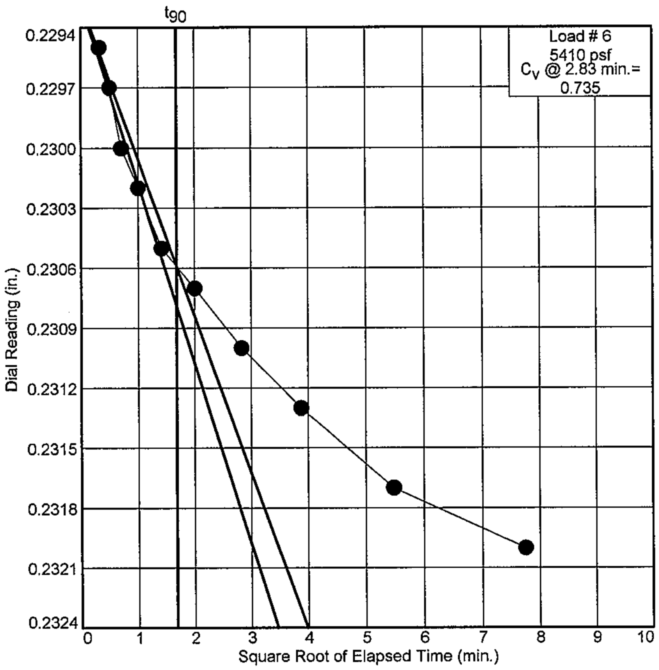
SOILS ENGINEERING, INC.

Figure B-2

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

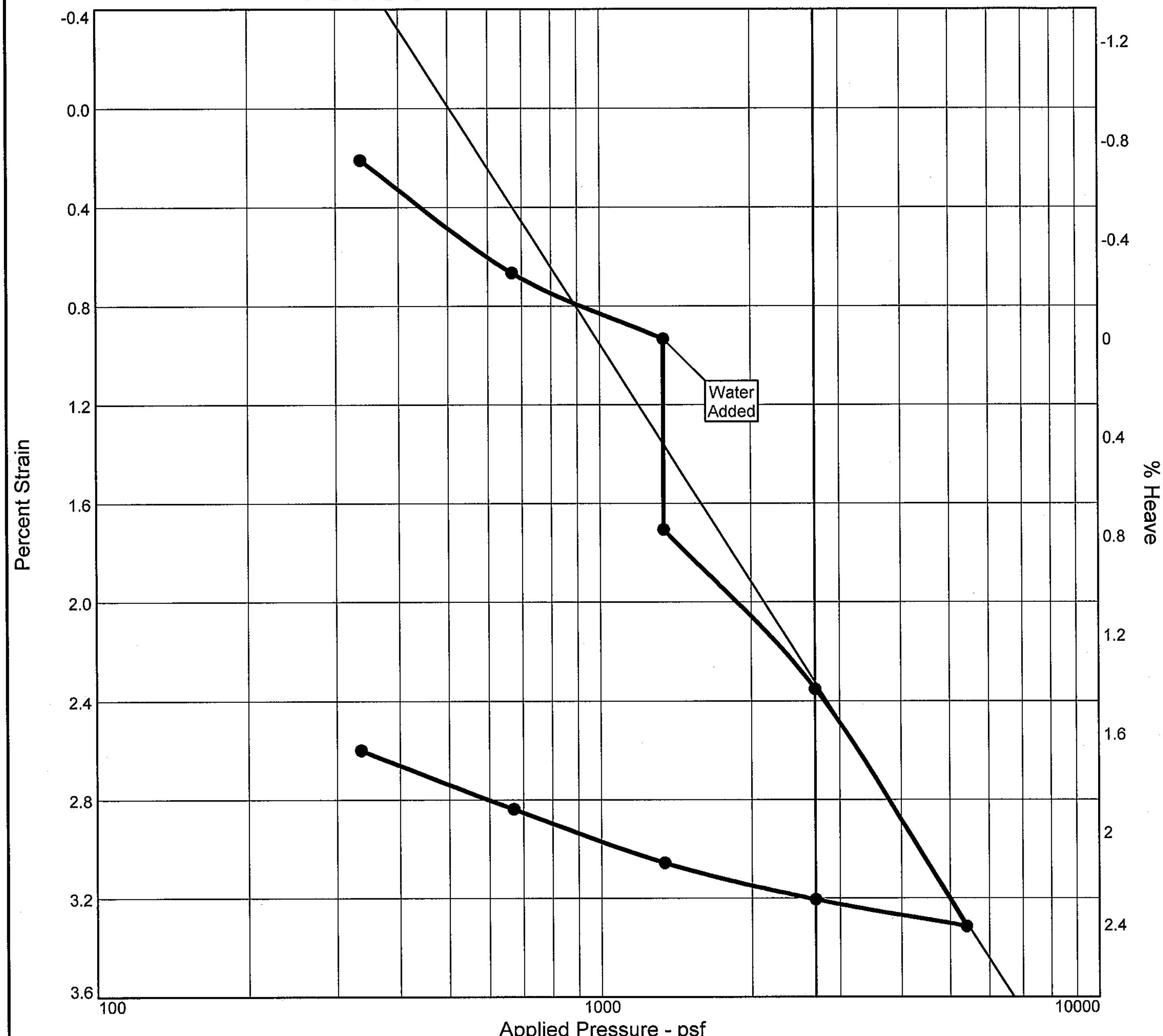
Source of Sample: B-2 Depth: 6'



SOILS ENGINEERING, INC.

Figure B-2

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
36.3 %	11.5 %	89.9	N/A	N/A	2.65	336	2767	0.06	0.01		-0.8	0.840

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-3 **Depth:** 3'

Remarks:
Sample No: 70562
Test Date: 07/11/19

SOILS ENGINEERING, INC.

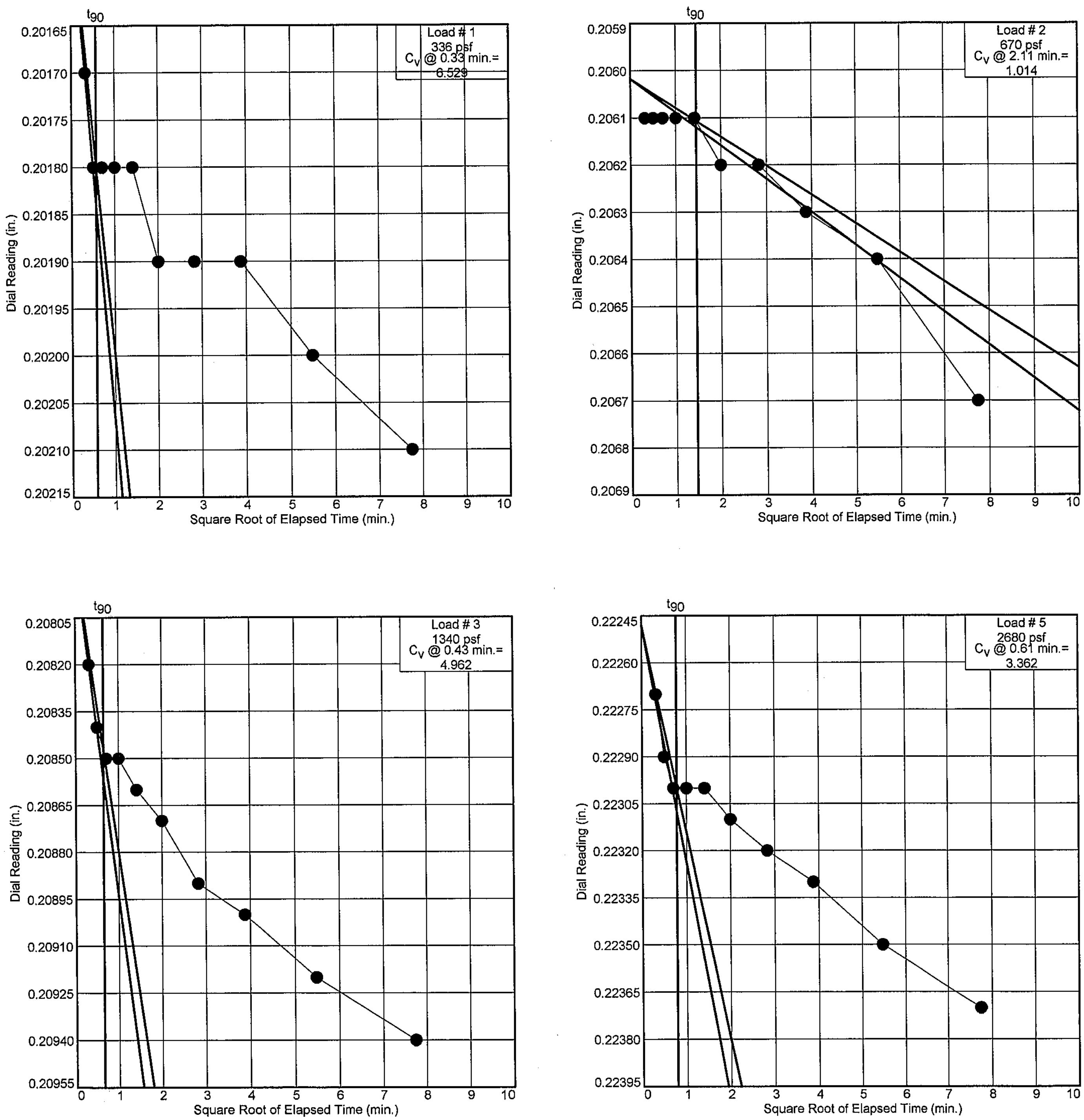
Figure B-3

Tested By: CE **Checked By:** AI

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-3 Depth: 3'



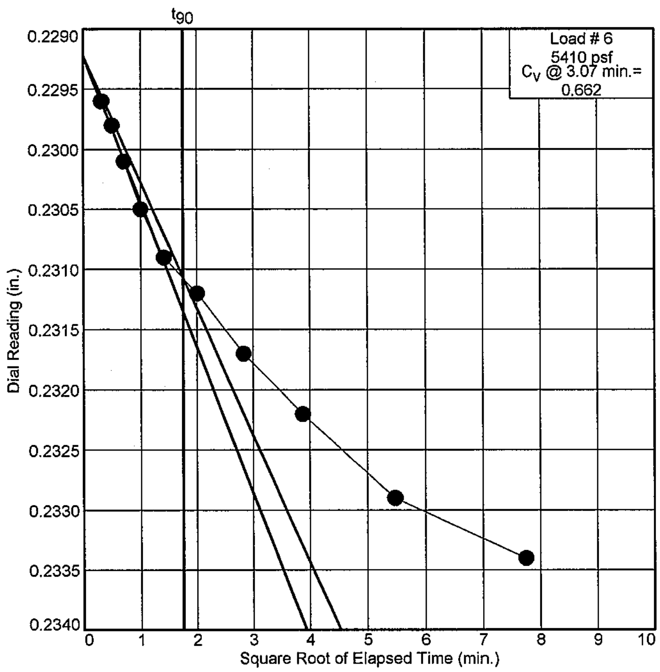
SOILS ENGINEERING, INC.

Figure B-3

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

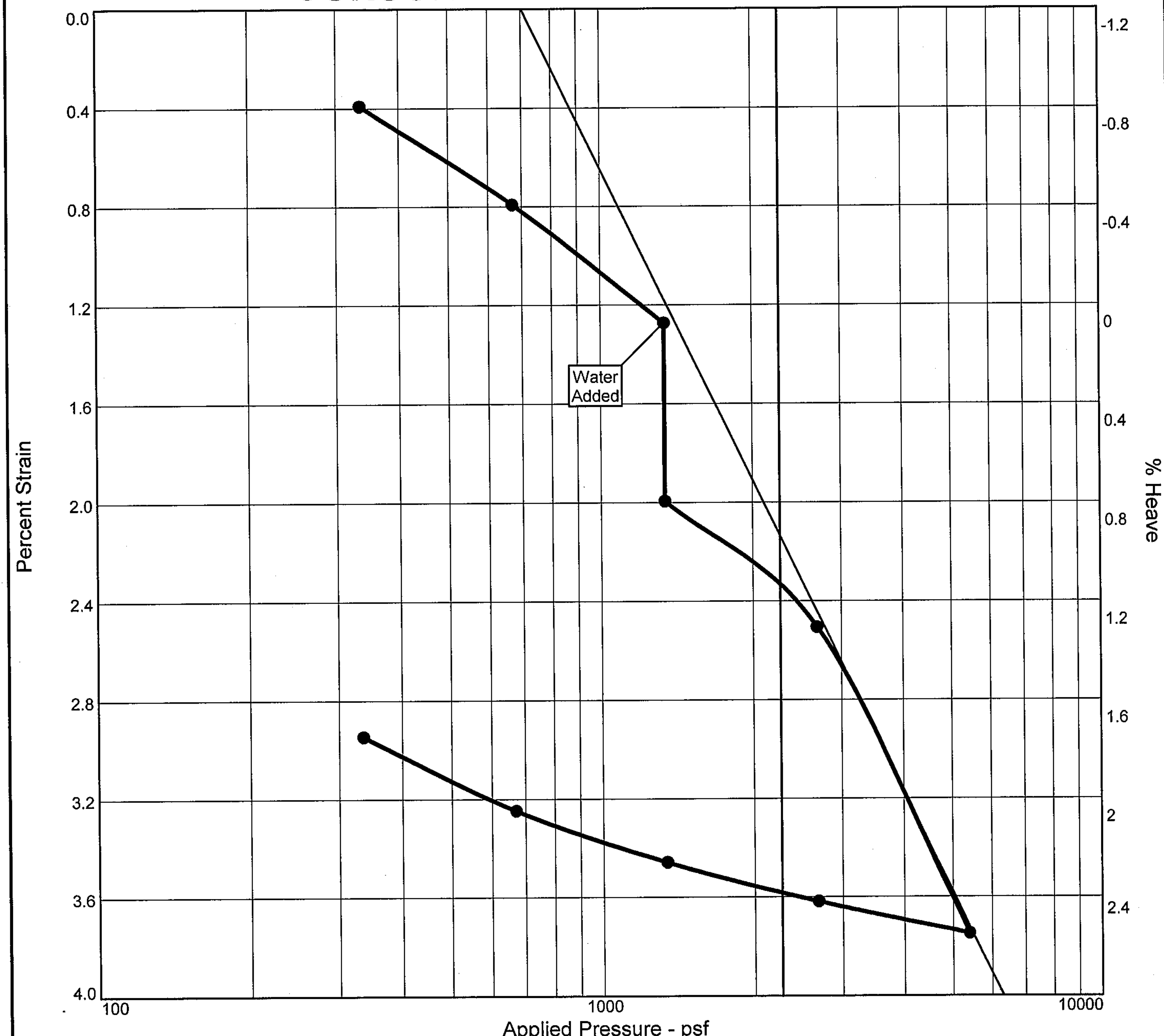
Source of Sample: B-3 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
46.6 %	16.3 %	85.8	N/A	N/A	2.65	336	2602	0.08	0.01		-0.7	0.927

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-4 **Depth:** 6'

Remarks:
Sample No: 70575
Test Date: 07/11/19

SOILS ENGINEERING, INC.

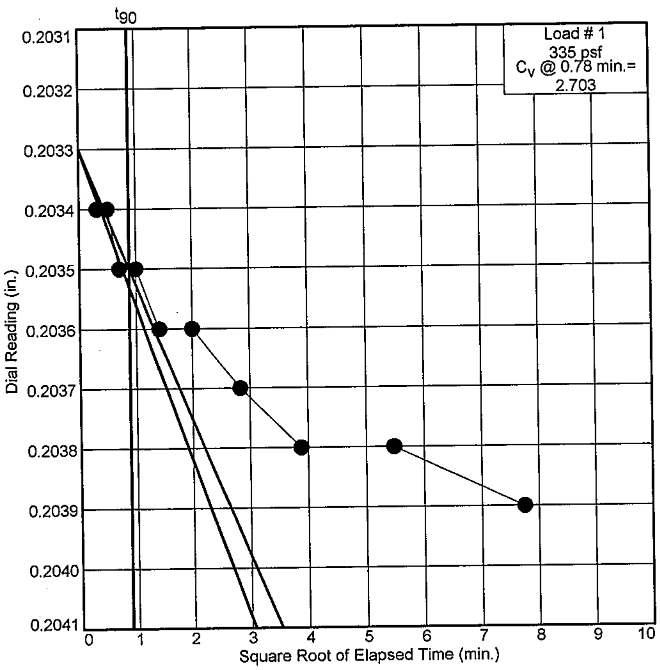
Figure B-4

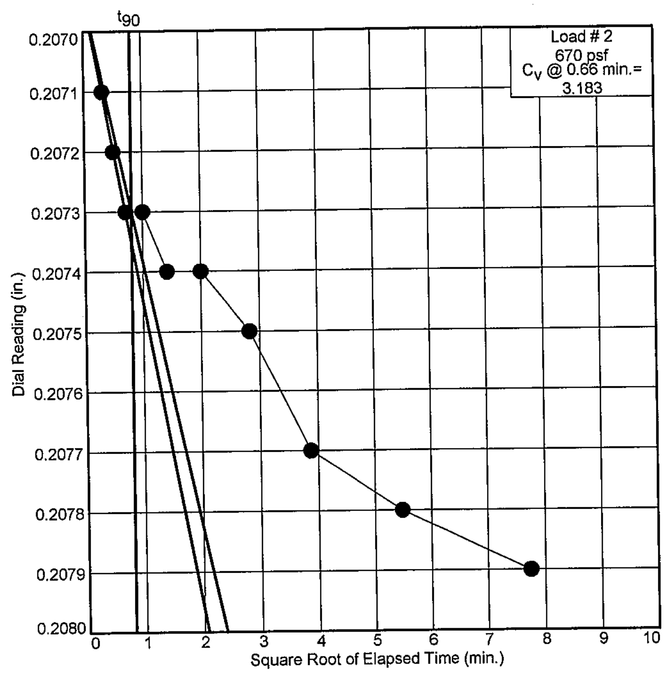
Tested By: CF **Checked By:** AI

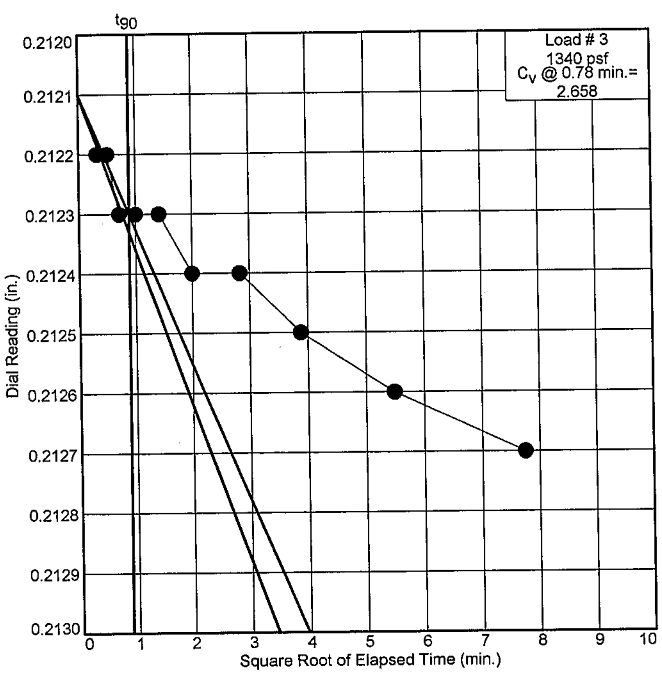
Dial Reading vs. Time

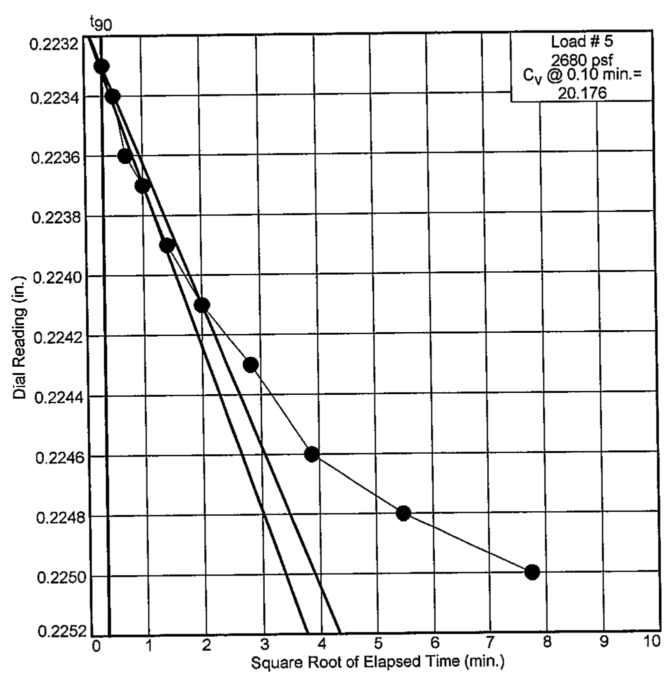
Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-4 Depth: 6'









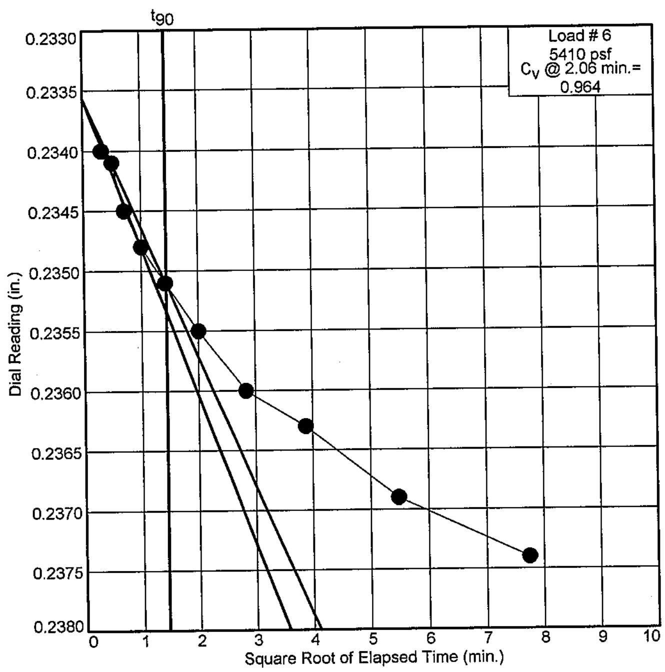
SOILS ENGINEERING, INC.

Figure B-4

Dial Reading vs. Time

Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

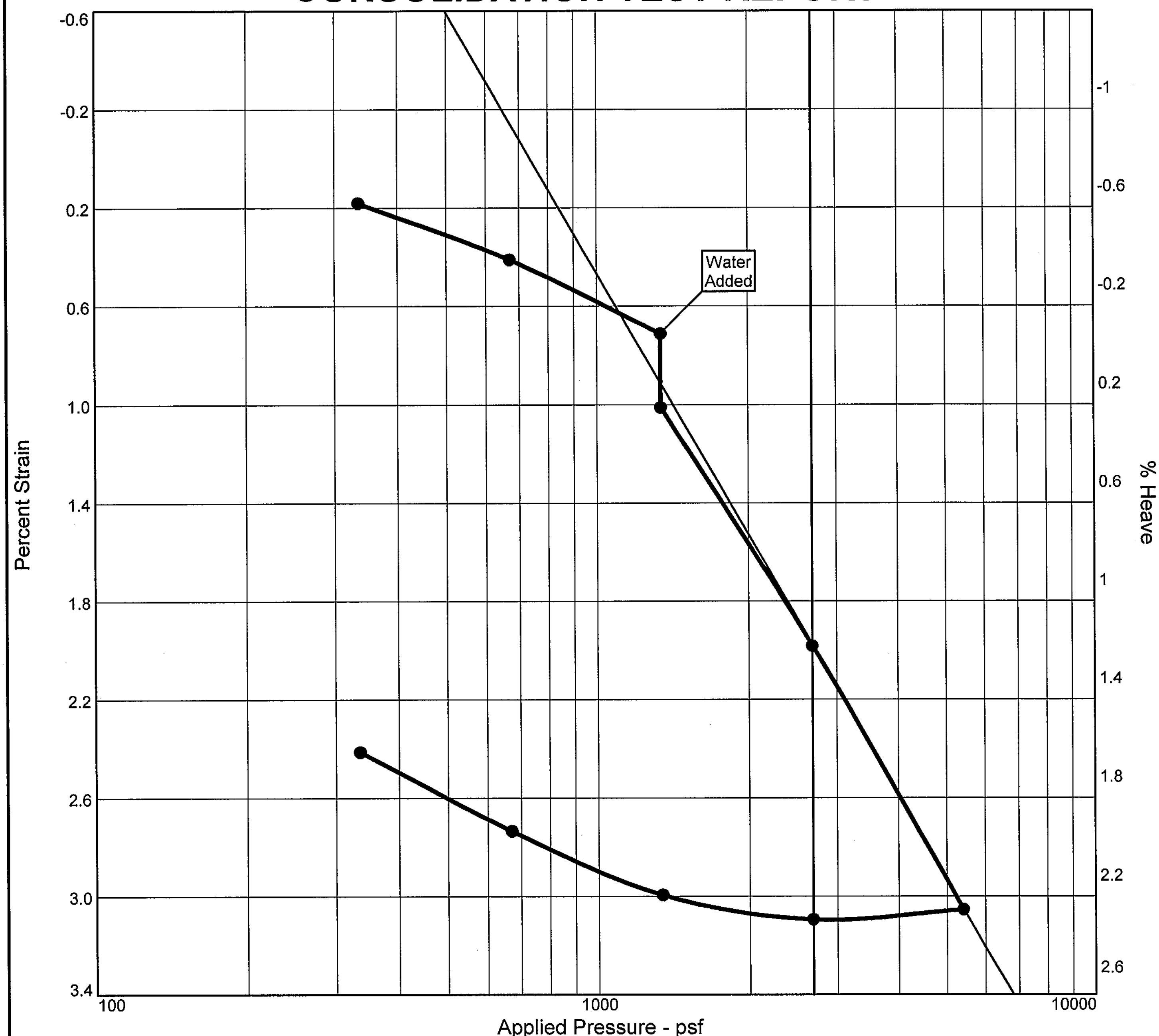
Source of Sample: B-4 Depth: 6'



SOILS ENGINEERING, INC.

Figure B-4

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
55.2 %	20.4 %	83.7	N/A	N/A	2.65	336	2706	0.07	0.01		-0.3	0.977

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-5 **Depth:** 3'

Remarks:
Sample No: 70587
Test Date: 07/11/19

SOILS ENGINEERING, INC.

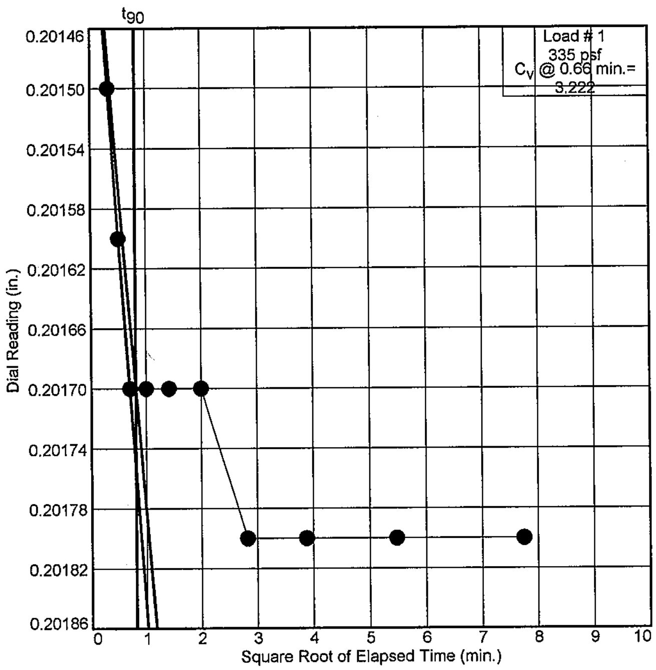
Figure B-5

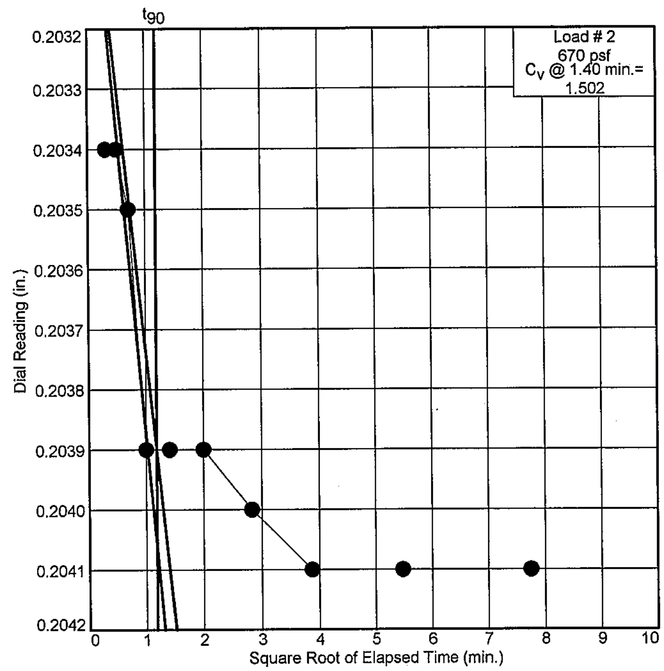
Tested By: CE **Checked By:** AL

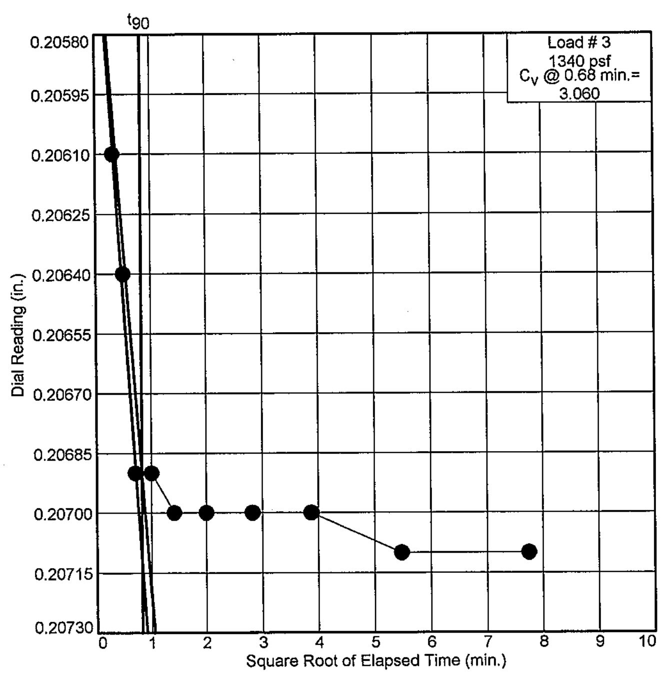
Dial Reading vs. Time

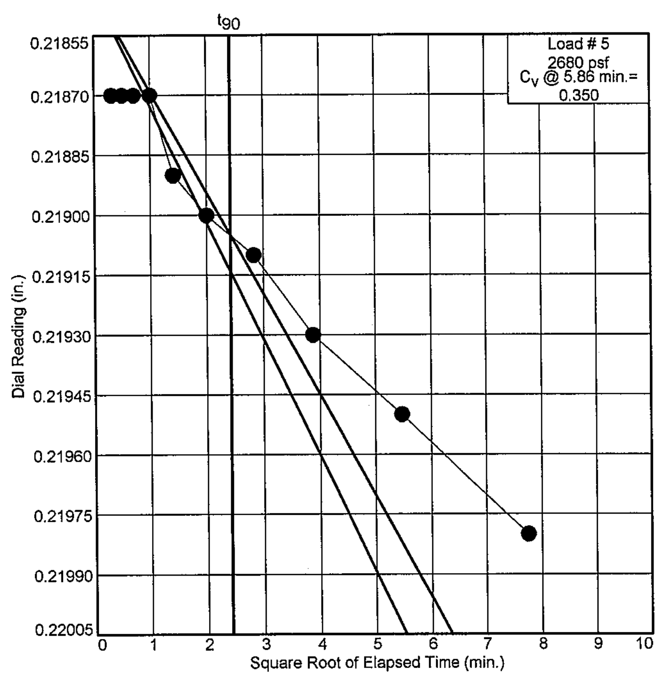
Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-5 Depth: 3'





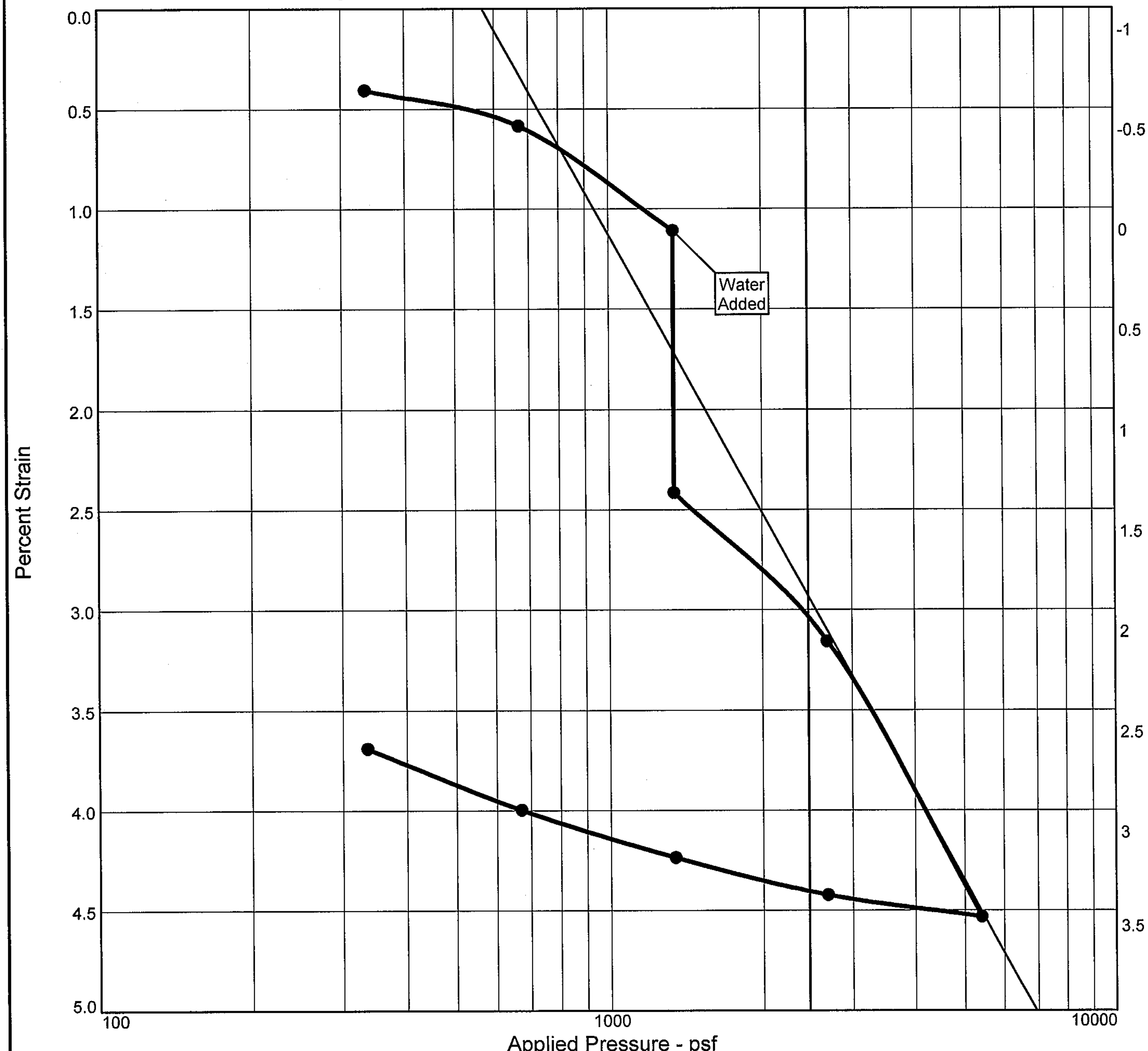




SOILS ENGINEERING, INC.

Figure B-5

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
24.0 %	7.9 %	88.4	N/A	N/A	2.65	336	2661	0.09	0.01		-1.3	0.872

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	N/A

Project No. 17165 **Client:** UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-6 **Depth:** 3'

Remarks:
Sample No: 70608
Test Date: 07/11/19

SOILS ENGINEERING, INC.

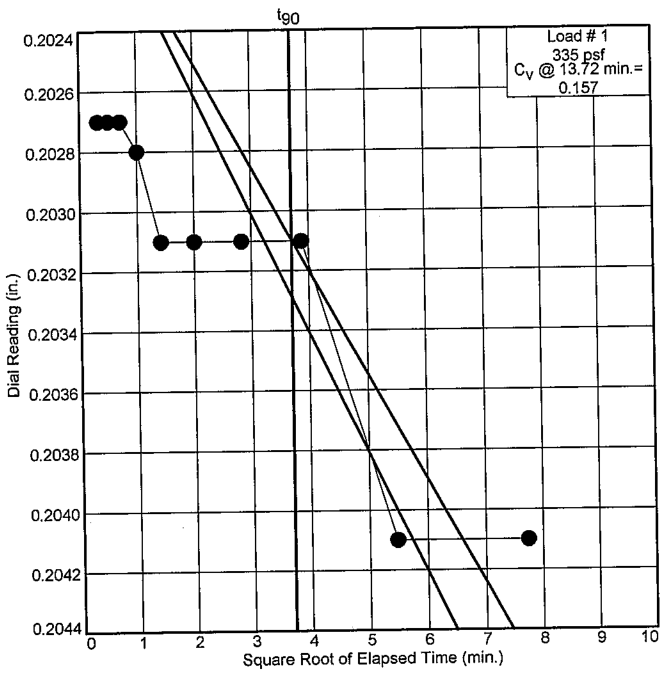
Figure B-6

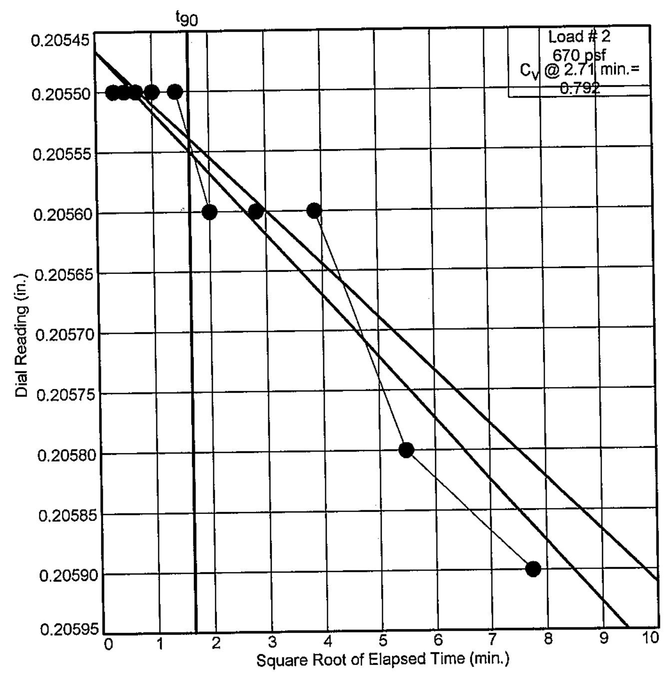
Tested By: CE Checked By: AI

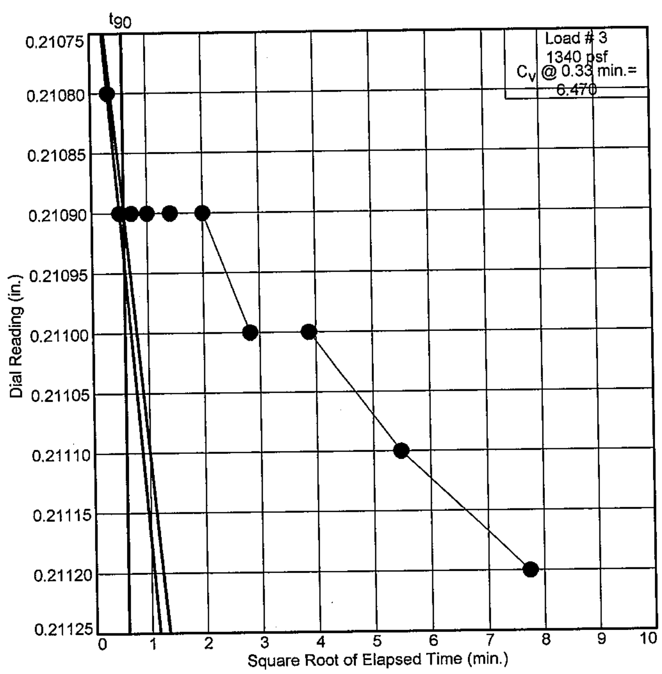
Dial Reading vs. Time

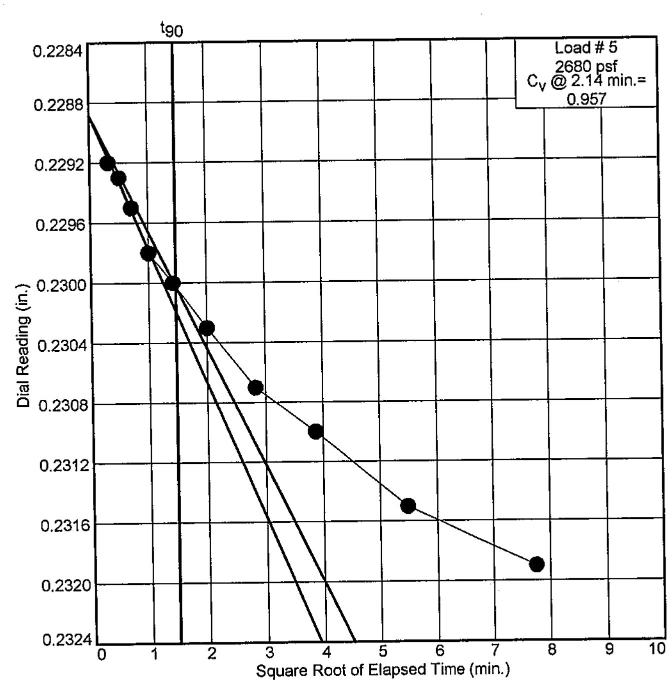
Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-6 Depth: 3'









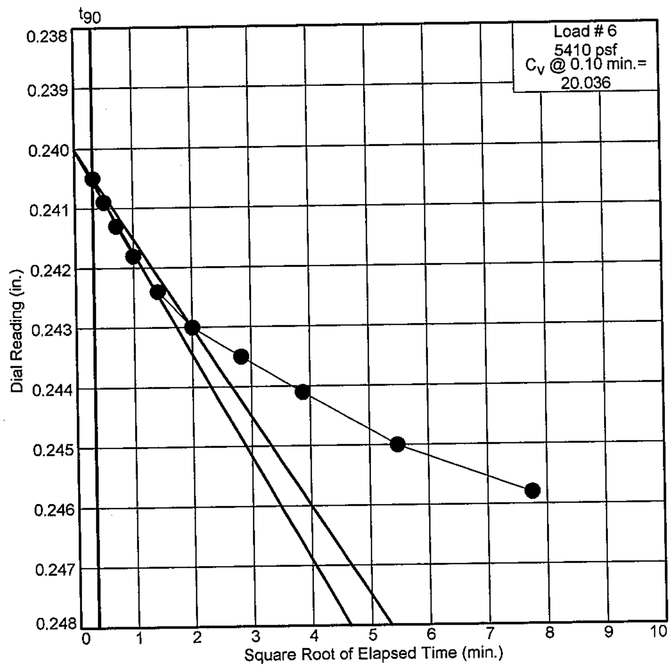
SOILS ENGINEERING, INC.

Figure B-6

Dial Reading vs. Time

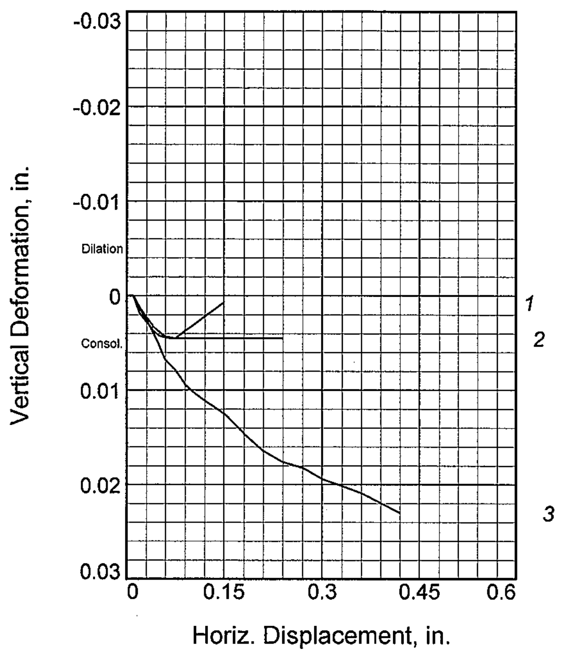
Project No.: 17165
Project: The Kings Area Rapid Transit (KART) Station

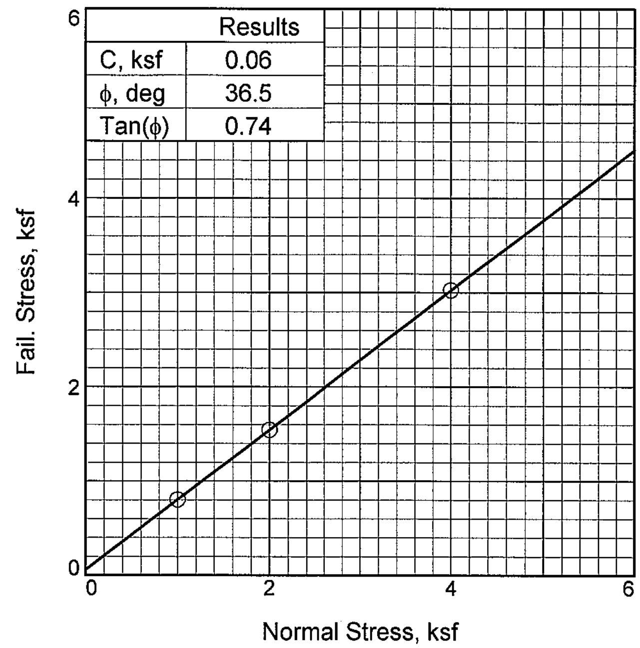
Source of Sample: B-6 Depth: 3'

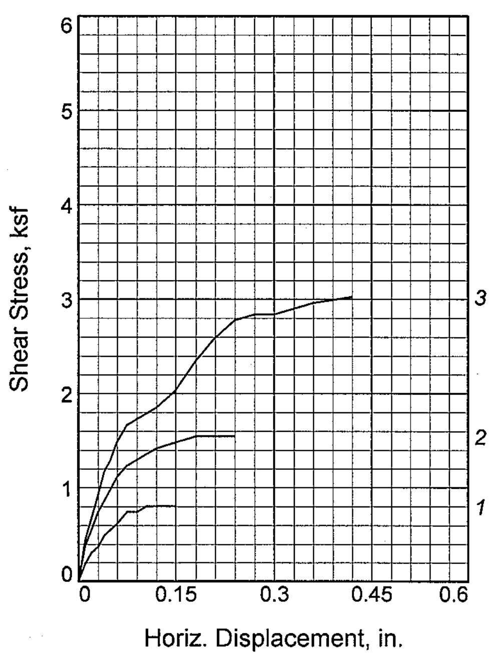


SOILS ENGINEERING, INC.

Figure B-6







	Sample No.	1	2	3
Initial	Water Content, %	10.3	10.6	10.7
	Dry Density, pcf	96.5	96.7	98.2
	Saturation, %	38.3	39.4	41.4
	Void Ratio	0.7146	0.7116	0.6846
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	24.1	21.9	20.4
	Dry Density, pcf	96.5	96.7	98.2
	Saturation, %	89.2	81.5	79.0
	Void Ratio	0.7146	0.7116	0.6846
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
	Normal Stress, ksf	1.00	2.00	4.00
	Fail. Stress, ksf	0.80	1.54	3.03
	Displacement, in.	0.11	0.18	0.42
	Ult. Stress, ksf			
	Displacement, in.			
	Strain rate, in./min.	N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE
Description: SILTY SAND; yellowish brown, damp, fine, cohesive, medium dense
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 07/12/19

Figure C-1

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

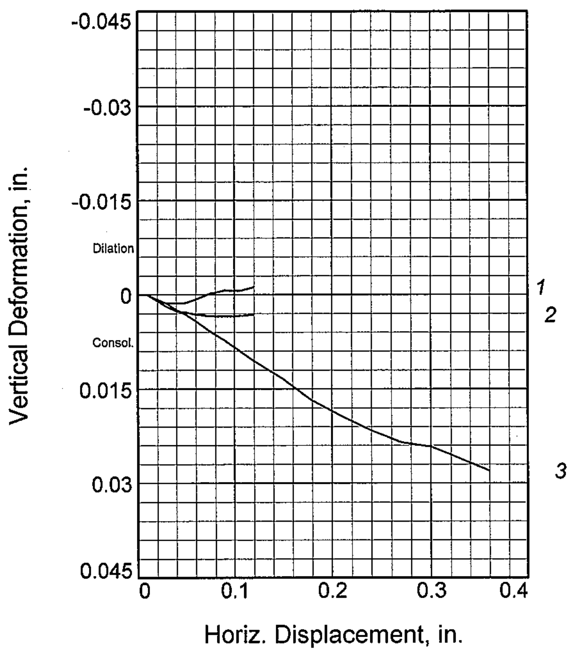
Source of Sample: B-1 **Depth:** 6'

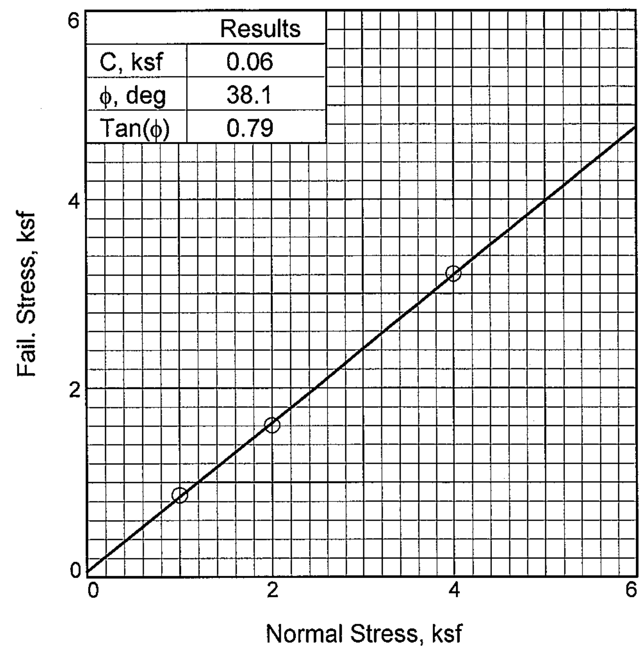
Proj. No.: 17165 **Date Sampled:** 06/25/19

DIRECTIVE SHEAR TEST REPORT

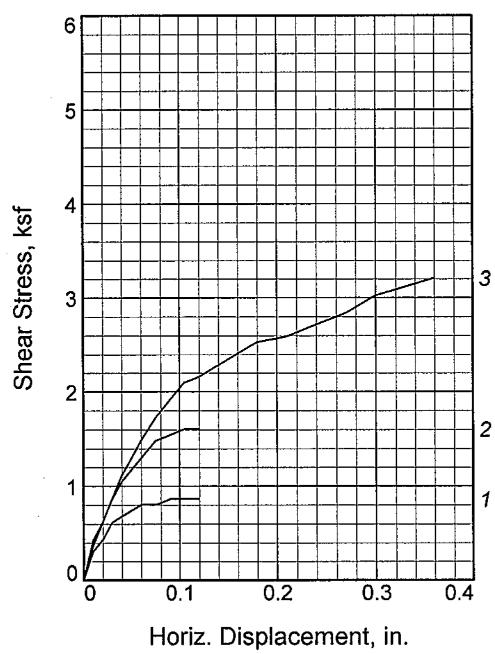
SOILS ENGINEERING, INC.

Tested By: CF Checked By: AI





Results	
C, ksf	0.06
ϕ, deg	38.1
Tan(ϕ)	0.79



	Sample No.	1	2	3
Initial	Water Content, %	16.4	21.9	23.8
	Dry Density, pcf	93.9	88.9	85.8
	Saturation, %	57.0	67.3	68.1
	Void Ratio	0.7617	0.8606	0.9277
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	26.9	28.0	30.3
	Dry Density, pcf	93.9	88.9	85.8
	Saturation, %	93.7	86.4	86.4
	Void Ratio	0.7617	0.8606	0.9277
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
	Normal Stress, ksf	1.00	2.00	4.00
	Fail. Stress, ksf	0.86	1.61	3.21
	Displacement, in.	0.09	0.11	0.36
	Ult. Stress, ksf			
	Displacement, in.			
	Strain rate, in./min.	N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE
Description: SILTY SAND; yellowish brown, damp, fine, low cohesion, loose, cohesive
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 07/15/19

Figure C-2

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

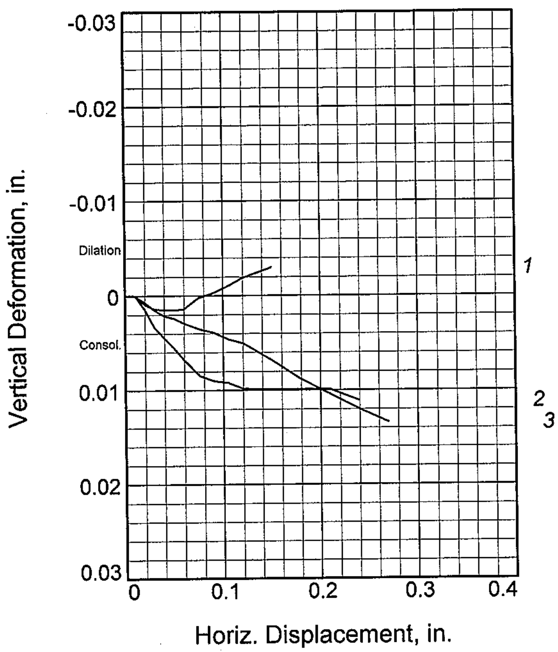
Source of Sample: B-4 **Depth:** 3'

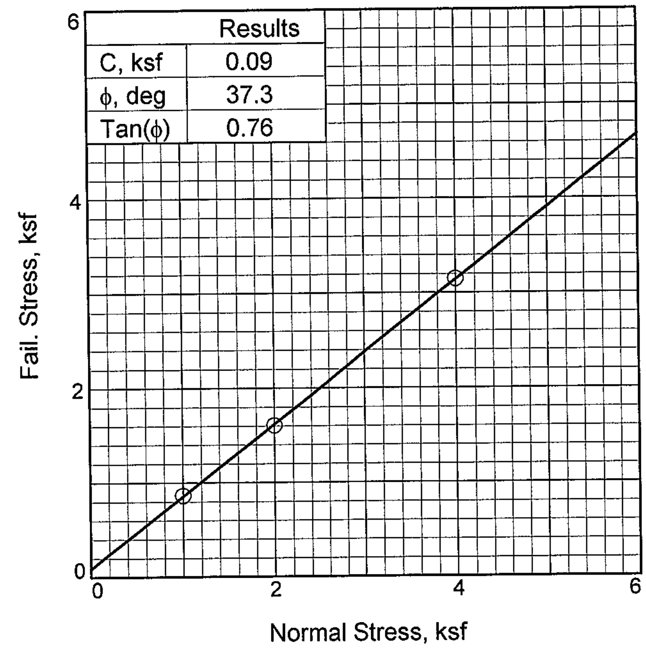
Proj. No.: 17165 **Date Sampled:** 06/26/19

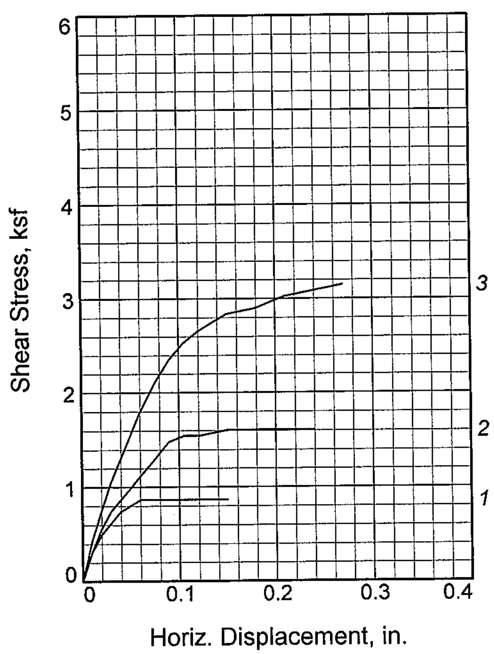
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: CE **Checked By:** AI







	Sample No.	1	2	3
Initial	Water Content, %	12.6	17.0	20.8
	Dry Density, pcf	90.4	87.6	82.5
	Saturation, %	40.1	50.7	54.7
	Void Ratio	0.8305	0.8879	1.0061
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	29.0	31.1	32.6
	Dry Density, pcf	90.4	87.6	82.5
	Saturation, %	92.6	92.8	86.0
	Void Ratio	0.8305	0.8879	1.0061
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
	Normal Stress, ksf	1.00	2.00	4.00
	Fail. Stress, ksf	0.86	1.61	3.15
	Displacement, in.	0.06	0.15	0.27
	Ult. Stress, ksf			
	Displacement, in.			
	Strain rate, in./min.	N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE
Description: SILTY SAND; yellowish brown, damp, fine
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 07/15/19

Figure C-3

Client: UltraSystems Environmental

Project: The Kings Area Rapid Transit (KART) Station

Source of Sample: B-6 **Depth:** 6'

Proj. No.: 17165 **Date Sampled:** 06/27/19

DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: CE **Checked By:** AL

APPENDIX D

SEISMIC INVESTIGATION

SEISMIC DESIGN INFORMATION
ASCE Design Map Summary and Detail Report

EQFAULT
Version 3.00

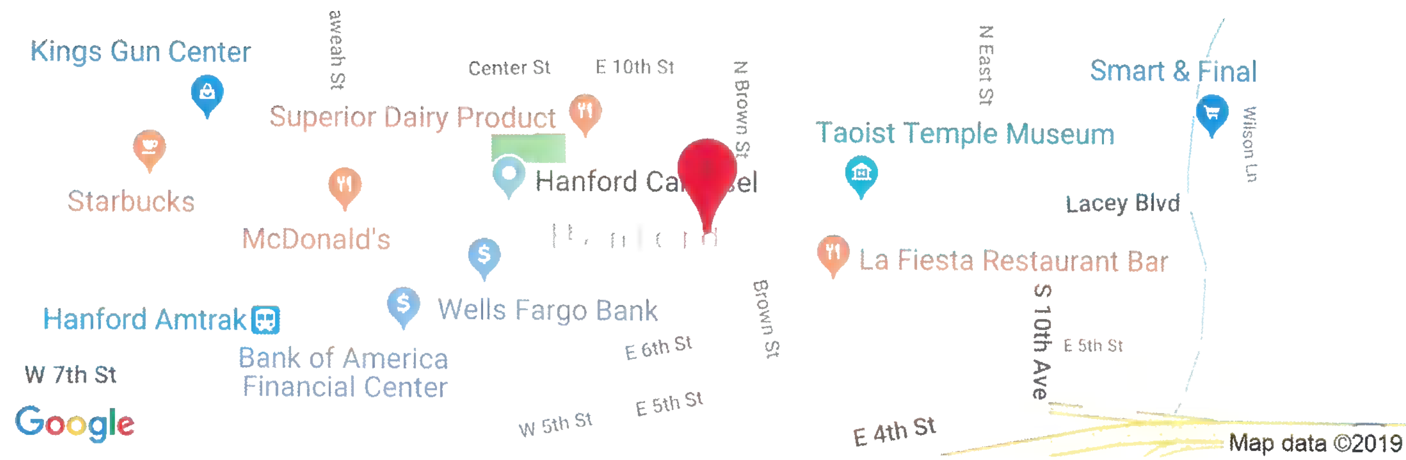
California Fault Map

LiquefyPro
Version 4.9b
Liquefaction Analysis Graphic Representation & Summary

OSHPD

17156 Hanford KART

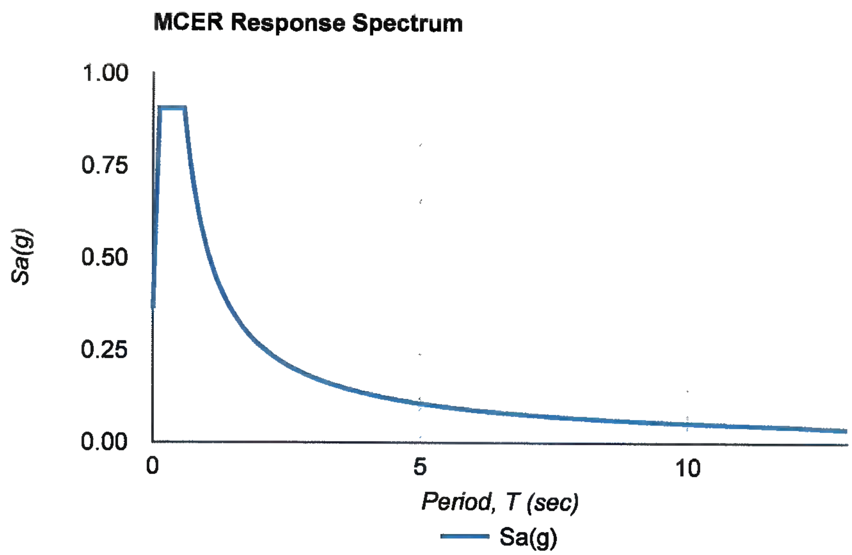
Latitude, Longitude: 36.3275, -119.6434

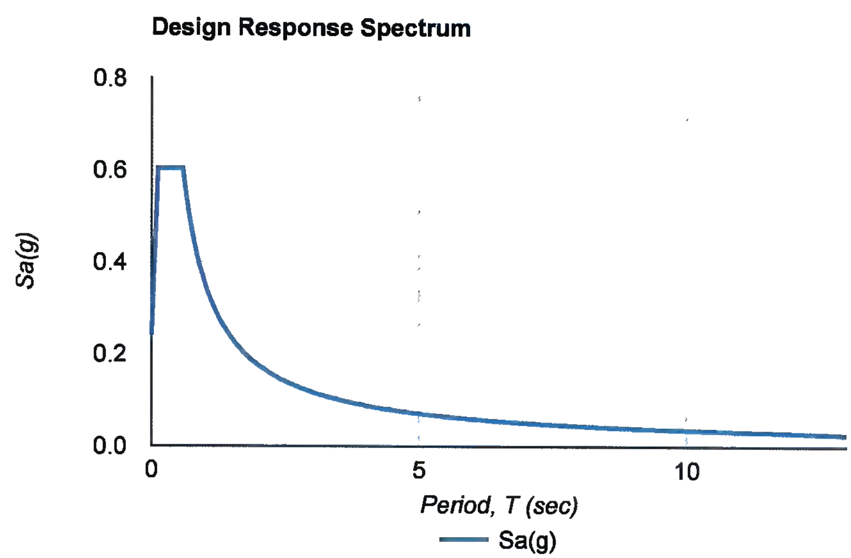


Date	7/10/2019, 2:11:03 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.756	MCE_R ground motion. (for 0.2 second period)
S_1	0.293	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.905	Site-modified spectral acceleration value
S_{M1}	0.531	Site-modified spectral acceleration value
S_{DS}	0.604	Numeric seismic design value at 0.2 second SA
S_{D1}	0.354	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.198	Site amplification factor at 0.2 second
F_v	1.815	Site amplification factor at 1.0 second
PGA	0.287	MCE_G peak ground acceleration
F_{PGA}	1.226	Site amplification factor at PGA
PGA_M	0.352	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.756	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.744	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.293	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.277	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.016	Mapped value of the risk coefficient at short periods
C_{R1}	1.056	Mapped value of the risk coefficient at a period of 1 s





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*                    *
*    E Q F A U L T   *
*                    *
*    Version 3.00    *
*                    *
**********************
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 17156

DATE: 07-09-2019

JOB NAME: 17156 Hanford Kings Area Rapid Transit

CALCULATION NAME: 17156 Hanford Kings Area Rapid Transit

FAULT-DATA-FILE NAME: CGSFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 36.3275
SITE LONGITUDE: 119.6434

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
GREAT VALLEY 14	28.7(46.2)	6.4	0.105	VII
GREAT VALLEY 13	31.3(50.4)	6.5	0.103	VII
GREAT VALLEY 12	39.3(63.2)	6.3	0.078	VII
Kern Front	43.0(69.2)	6.3	0.073	VII
GREAT VALLEY 11	46.2(74.4)	6.4	0.073	VII
SAN ANDREAS - Parkfield	53.6(86.2)	6.5	0.056	VI
SAN ANDREAS - 1857 Rupture M-2a	54.0(86.9)	7.8	0.111	VII
SAN ANDREAS - Cholame M-1c-1	54.0(86.9)	7.3	0.085	VII
SAN ANDREAS - Whole M-1a	54.0(86.9)	8.0	0.123	VII
SAN ANDREAS - Cho-Moj M-1b-1	54.0(86.9)	7.8	0.111	VII
SAN ANDREAS (Creeping)	55.8(89.8)	6.2	0.046	VI
SAN JUAN	57.6(92.7)	7.1	0.073	VII
GREAT VALLEY 10	59.5(95.8)	6.4	0.060	VI
FOOTHILLS FAULT SYSTEM 1	69.3(111.5)	6.5	0.056	VI
GREAT VALLEY 9	69.9(112.5)	6.6	0.059	VI
SAN ANDREAS - Carrizo M-1c-2	71.1(114.4)	7.4	0.072	VII
FOOTHILLS FAULT SYSTEM 2	71.9(115.7)	6.5	0.054	VI
ORTIGALITA	75.1(120.8)	7.1	0.059	VI
FOOTHILLS FAULT SYSTEM 3	75.3(121.2)	6.5	0.052	VI
RINCONADA	76.8(123.6)	7.5	0.072	VI
INDEPENDENCE	80.8(130.1)	7.1	0.068	VI
BIRCH CREEK	85.4(137.5)	6.4	0.045	VI
ROUND VALLEY	85.9(138.2)	7.0	0.062	VI
OWENS VALLEY	89.4(143.9)	7.6	0.067	VI
WHITE WOLF	91.0(146.4)	7.3	0.069	VI
GREAT VALLEY 8	91.7(147.6)	6.6	0.047	VI
SAN LUIS RANGE (S. Margin)	92.3(148.5)	7.2	0.065	VI
QUIEN SABE	92.3(148.6)	6.4	0.035	V
So. SIERRA NEVADA	92.7(149.2)	7.3	0.068	VI
HILTON CREEK	93.5(150.4)	6.7	0.049	VI
LOS OSOS	94.1(151.4)	7.0	0.057	VI
WHITE MOUNTAINS	95.2(153.2)	7.4	0.058	VI
FISH SLOUGH	96.5(155.3)	6.6	0.046	VI
PLEITO THRUST	97.0(156.1)	7.0	0.056	VI
HARTLEY SPRINGS	97.5(156.9)	6.6	0.045	VI
HOSGRI	98.3(158.2)	7.5	0.059	VI

****

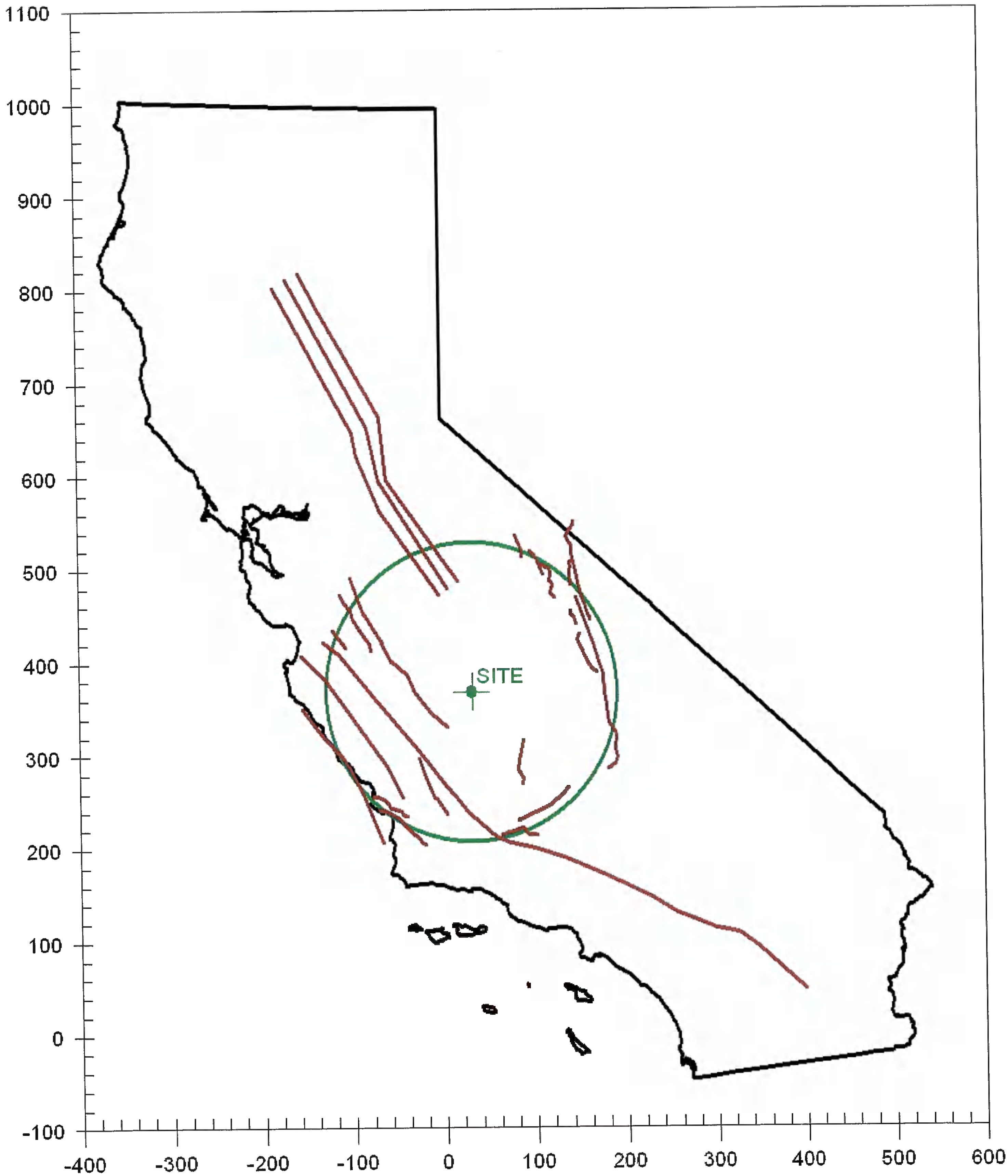
-END OF SEARCH-   36 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE GREAT VALLEY 14   FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 28.7 MILES (46.2 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.1229 g

CALIFORNIA FAULT MAP

17156 Hanford Kings Area Rapid Transit

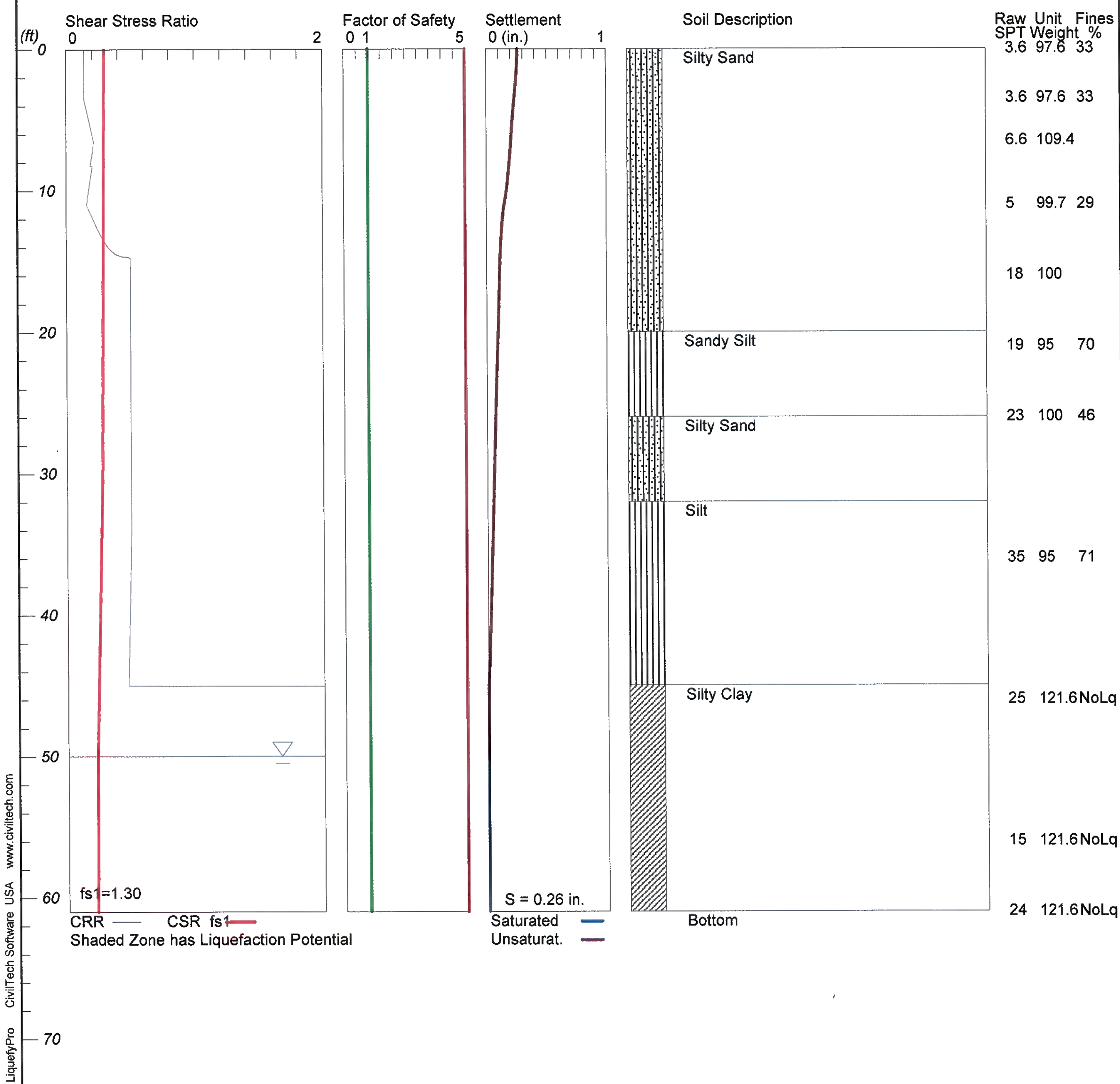


LIQUEFACTION ANALYSIS

Kart Hanford

Hole No.=B-1 Water Depth=50 ft

Magnitude=7.5
Acceleration=0.352g



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                             LIQUEFACTION ANALYSIS SUMMARY
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UltraSystems Environmantal, KART GEOTECH\OFFICE REPORTS\LiquefyPro
Files\17156 B-1 LiquefyPro.liq
      Title:  Kart Hanford
      Subtitle:  17156 Kart B-1

      Surface Elev.=
      Hole No.=B-1
      Depth of Hole= 61.00 ft
      Water Table during Earthquake= 50.00 ft
      Water Table during In-Situ Testing= 50.00 ft
      Max. Acceleration= 0.35 g
      Earthquake Magnitude= 7.50

 Input Data:
      Surface Elev.=
      Hole No.=B-1
      Depth of Hole=61.00 ft
      Water Table during Earthquake= 50.00 ft
      Water Table during In-Situ Testing= 50.00 ft
      Max. Acceleration=0.35 g
      Earthquake Magnitude=7.50
      No-Liquefiable Soils:   CL, OL are Non-Liq. Soil

      1. SPT or BPT Calculation.
      2. Settlement Analysis Method: Tokimatsu, M-correction
      3. Fines Correction for Liquefaction: Idriss/Seed
      4. Fine Correction for Settlement: During Liquefaction*
      5. Settlement Calculation in: All zones*
      6. Hammer Energy Ratio,                              Ce = 1.25
      7. Borehole Diameter,                                Cb= 1
      8. Sampling Method,                                  Cs= 1.2
      9. User request factor of safety (apply to CSR) ,   User= 1.3
         Plot one CSR curve (fs1=User)
      10. Use Curve Smoothing: Yes*
      * Recommended Options
```

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	3.60	97.60	33.00
3.50	3.60	97.60	33.00
6.50	6.60	109.40	33.00
11.00	5.00	99.70	29.00
16.00	18.00	100.00	29.00
21.00	19.00	95.00	70.00
26.00	23.00	100.00	46.00
36.00	35.00	95.00	71.00
46.00	25.00	121.60	NoLiq
56.00	15.00	121.60	NoLiq
61.00	24.00	121.60	NoLiq

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.26 in.
Total Settlement of Saturated and Unsaturated Sands=**0.26 in.**
Differential Settlement=**0.130** to 0.171 in.

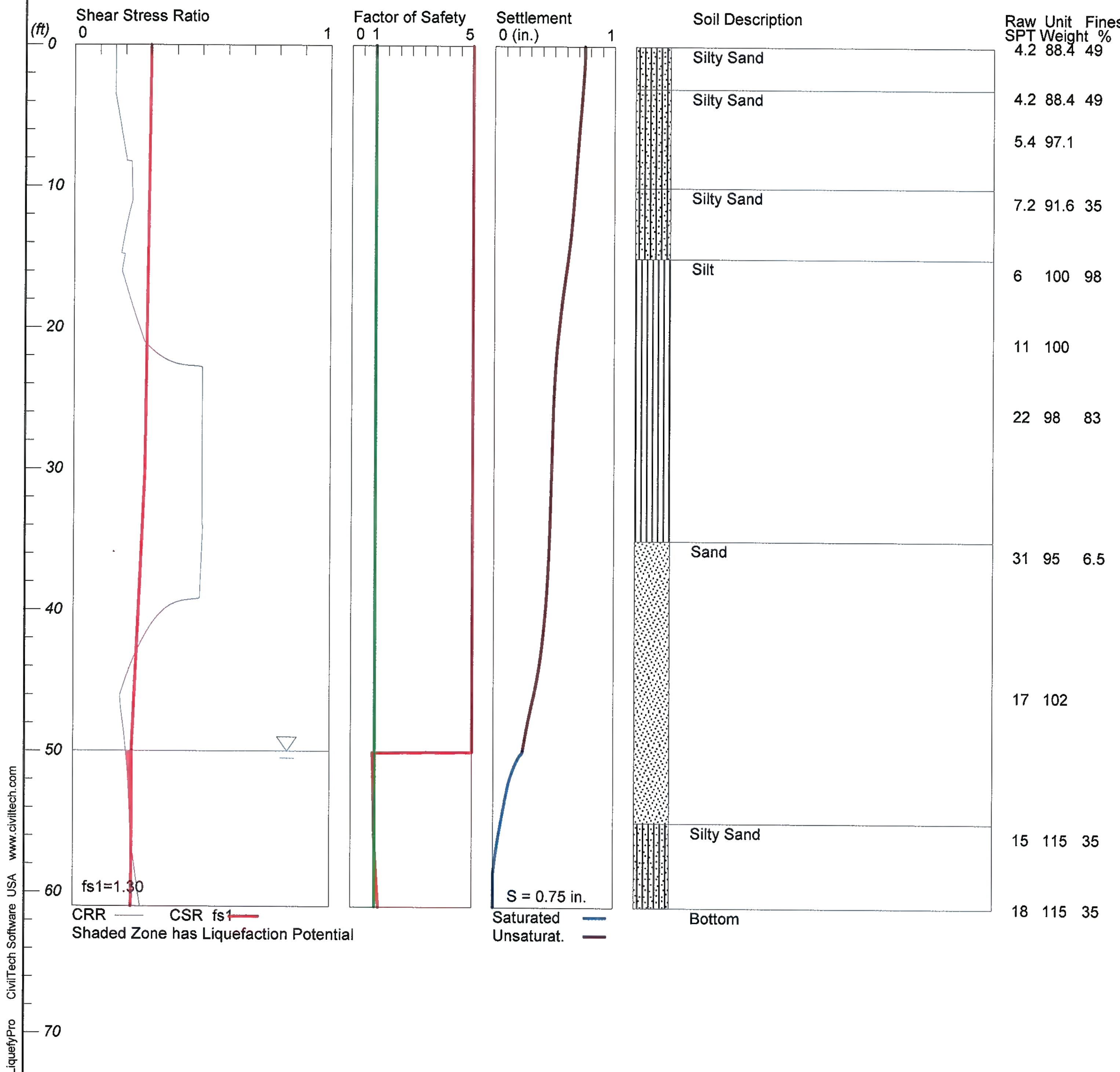
Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.14	0.30	5.00	0.00	0.26	0.26
0.05	0.14	0.30	5.00	0.00	0.26	0.26
0.10	0.14	0.30	5.00	0.00	0.26	0.26
0.15	0.14	0.30	5.00	0.00	0.26	0.26
0.20	0.14	0.30	5.00	0.00	0.26	0.26
0.25	0.14	0.30	5.00	0.00	0.26	0.26
0.30	0.14	0.30	5.00	0.00	0.26	0.26
0.35	0.14	0.30	5.00	0.00	0.26	0.26
0.40	0.14	0.30	5.00	0.00	0.26	0.26
0.45	0.14	0.30	5.00	0.00	0.26	0.26
0.50	0.14	0.30	5.00	0.00	0.26	0.26
0.55	0.14	0.30	5.00	0.00	0.26	0.26
0.60	0.14	0.30	5.00	0.00	0.26	0.26
0.65	0.14	0.30	5.00	0.00	0.26	0.26
0.70	0.14	0.30	5.00	0.00	0.26	0.26
0.75	0.14	0.30	5.00	0.00	0.26	0.26
0.80	0.14	0.30	5.00	0.00	0.26	0.26
0.85	0.14	0.30	5.00	0.00	0.26	0.26
0.90	0.14	0.30	5.00	0.00	0.26	0.26
0.95	0.14	0.30	5.00	0.00	0.26	0.26
1.00	0.14	0.30	5.00	0.00	0.26	0.26
1.05	0.14	0.30	5.00	0.00	0.26	0.26
1.10	0.14	0.30	5.00	0.00	0.26	0.26
1.15	0.14	0.30	5.00	0.00	0.26	0.26
1.20	0.14	0.30	5.00	0.00	0.25	0.25
1.25	0.14	0.30	5.00	0.00	0.25	0.25
1.30	0.14	0.30	5.00	0.00	0.25	0.25
1.35	0.14	0.30	5.00	0.00	0.25	0.25
1.40	0.14	0.30	5.00	0.00	0.25	0.25
1.45	0.14	0.30	5.00	0.00	0.25	0.25
1.50	0.14	0.30	5.00	0.00	0.25	0.25
1.55	0.14	0.30	5.00	0.00	0.25	0.25
1.60	0.14	0.30	5.00	0.00	0.25	0.25

LIQUEFACTION ANALYSIS

Kart Hanford

Hole No.=B-5   Water Depth=50 ft

Magnitude=7.5
Acceleration=0.352g



CivilTech Corporation   17156 Kart B-5   Plate A-1

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Files\17156 B-5 LiquefyPro.liq
      Title:  Kart Hanford
      Subtitle:  17156 Kart B-5

      Surface Elev.=
      Hole No.=B-5
      Depth of Hole= 61.00 ft
      Water Table during Earthquake= 50.00 ft
      Water Table during In-Situ Testing= 50.00 ft
      Max. Acceleration= 0.35 g
      Earthquake Magnitude= 7.50

 Input Data:
      Surface Elev.=
      Hole No.=B-5
      Depth of Hole=61.00 ft
      Water Table during Earthquake= 50.00 ft
      Water Table during In-Situ Testing= 50.00 ft
      Max. Acceleration=0.35 g
      Earthquake Magnitude=7.50
      No-Liquefiable Soils:   CL, OL are Non-Liq. Soil

      1. SPT or BPT Calculation.
      2. Settlement Analysis Method: Tokimatsu, M-correction
      3. Fines Correction for Liquefaction: Idriss/Seed
      4. Fine Correction for Settlement: During Liquefaction*
      5. Settlement Calculation in: All zones*
      6. Hammer Energy Ratio,                                   Ce = 1.25
      7. Borehole Diameter,                                     Cb= 1
      8. Sampling Method,                                       Cs= 1.2
      9. User request factor of safety (apply to CSR) ,   User= 1.3
         Plot one CSR curve (fs1=User)
      10. Use Curve Smoothing: Yes*
      * Recommended Options
```

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	4.20	88.40	49.00
3.50	4.20	88.40	49.00
6.50	5.40	97.10	49.00
11.00	7.20	91.60	35.00
16.00	6.00	100.00	98.00
21.00	11.00	100.00	98.00
26.00	22.00	98.00	83.00
36.00	31.00	95.00	6.50
46.00	17.00	102.00	6.50
56.00	15.00	115.00	35.00
61.00	18.00	115.00	35.00

Output Results:

Settlement of Saturated Sands=0.24 in.
Settlement of Unsaturated Sands=0.51 in.
Total Settlement of Saturated and Unsaturated Sands=**0.75 in.**
Differential Settlement=**0.375** to 0.495 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.16	0.30	5.00	0.24	0.51	0.75
0.05	0.16	0.30	5.00	0.24	0.51	0.75
0.10	0.16	0.30	5.00	0.24	0.51	0.75
0.15	0.16	0.30	5.00	0.24	0.51	0.75
0.20	0.16	0.30	5.00	0.24	0.51	0.75
0.25	0.16	0.30	5.00	0.24	0.51	0.75
0.30	0.16	0.30	5.00	0.24	0.51	0.75
0.35	0.16	0.30	5.00	0.24	0.51	0.75
0.40	0.16	0.30	5.00	0.24	0.51	0.75
0.45	0.16	0.30	5.00	0.24	0.51	0.75
0.50	0.16	0.30	5.00	0.24	0.51	0.75
0.55	0.16	0.30	5.00	0.24	0.51	0.75
0.60	0.16	0.30	5.00	0.24	0.51	0.75
0.65	0.16	0.30	5.00	0.24	0.51	0.75
0.70	0.16	0.30	5.00	0.24	0.51	0.75
0.75	0.16	0.30	5.00	0.24	0.51	0.75
0.80	0.16	0.30	5.00	0.24	0.51	0.75
0.85	0.16	0.30	5.00	0.24	0.51	0.75
0.90	0.16	0.30	5.00	0.24	0.51	0.75
0.95	0.16	0.30	5.00	0.24	0.51	0.75
1.00	0.16	0.30	5.00	0.24	0.51	0.75
1.05	0.16	0.30	5.00	0.24	0.51	0.75
1.10	0.16	0.30	5.00	0.24	0.51	0.75
1.15	0.16	0.30	5.00	0.24	0.51	0.75
1.20	0.16	0.30	5.00	0.24	0.51	0.75
1.25	0.16	0.30	5.00	0.24	0.51	0.75
1.30	0.16	0.30	5.00	0.24	0.51	0.75
1.35	0.16	0.30	5.00	0.24	0.51	0.75
1.40	0.16	0.30	5.00	0.24	0.51	0.75
1.45	0.16	0.30	5.00	0.24	0.51	0.75
1.50	0.16	0.30	5.00	0.24	0.51	0.75
1.55	0.16	0.30	5.00	0.24	0.51	0.74
1.60	0.16	0.30	5.00	0.24	0.50	0.74