GEOTECHNICAL ENGINEERING REPORT

CRRA South Meadows Generating Station
Jet Fuel Storage Tank No. 6 – Replacement
Hartford, Connecticut

Prepared by

TRC Engineers, Inc.
16000 Commerce Parkway
Suite B
Mount Laurel, New Jersey 08054

~~**August 22, 2009**~~ April 22,2010
TRC Project No. 153306

Submitted to

Carl Stopper
TRC Environmental Corporation
21 Griffin Road North
Windsor, CT 06095

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April 22, 2010

TRC Environmental Corporation
21 Griffin Road North
Windsor, CT 06095
Attn: Mr. Carl N. Stopper, V.P., P.E.

Re: Geotechnical Engineering Services
Geotechnical Report
CRRA South Meadows Generating Station
Jet Fuel Storage Tank No. 6 – Replacement
Hartford, CT
TRC Project No.: 153306

Dear Mr. Stopper,

TRC Engineers, Inc. (TRC) is pleased to present our geotechnical report for this project. This report contains a summary of the results of our field investigation, our subsequent analysis and geotechnical recommendations. We initiated and conducted our work in general accordance with our proposal dated February 1, 2010, after receipt of your notice to proceed.

We trust that this report contains the information required and we thank you for the opportunity to assist you on this project. If you have any questions regarding the contents of this report, please call our office.

Sincerely,

TRC Engineers, Inc.

Thomas M. Caruso
Geotechnical Engineer

Frederick A. Brinker
Manager, Geotechnical Services

Contents

Attachments

1.0 Proposed Work and Objectives

The project site is located at the Connecticut Resource Recovery Authority (CRRA) South Meadows Generating Station, just northeast of the intersection of Reserve Road with Maxim Road in Hartford, CT. The proposed work consists of the replacement of the existing 5.5 million gallon jet engine fuel tank with a new 500,000 gallon fuel tank at a new location. The new tank is a proposed 50 ft diameter welded steel above ground storage tank. The maximum fuel height will be 40 ft with an approximate 10 ft freeboard height (total tank height of 50 ft). The tank will be constructed with an outer containment wall which will be 60 ft in diameter. Based on information provided by CRRA, we understand that the proposed tank and containment walls will be founded on concrete ring wall foundations with the base of the tank founded on compacted aggregate layer. Specific loading conditions were not provided to us at the time of this report; however, we expect loading conditions to by typical for this type of construction.

The objectives of our work were to determine subsurface conditions at the project site, evaluate these conditions with respect to the proposed construction, and make preliminary recommendations with respect to:

- Tank and containment wall foundation support recommendations.
- Stability and estimated settlements.
- Lateral earth pressure parameters.
- Seismic considerations.
- Ground water conditions and management.
- Temporary construction considerations and issues.
- Soil material and compaction requirements for support of the tank and containment wall.
- Reusability of on-site soils in compacted fills.
- Frost penetration depth and effect.

2.0 Field and Laboratory Testing

The field investigation included advancing four (4) test borings to depths ranging from 37 to 72 ft below the ground surface. Test boring drilling was completed by SITE, LLC on March 1st and 2nd, 2010. Test Borings GTB-1, GTB-3 and GTB-4 were advanced using a model CME 300/45 track mounted drill rig with a CME automatic hammer. Test Boring GTB-2 was advanced using a model CME 75 truck mounted drill rig with an automatic hammer. All drilling and sampling was performed in general accordance with ASTM D1586 and D1587. Continuous split spoon sampling was performed at boring B-2 to a depth of 10 ft below the ground surface (bgs) and at 5 ft intervals thereafter. Sampling was performed at 5 ft intervals from the ground surface to the boring termination depth at the remainder of the test borings. TRC is Geotechnical Engineer, Mr. Thomas M. Caruso, was onsite to log the test borings. The test boring logs are attached.

Upon completion of the test borings, soil samples were delivered to our ASTM/ AASHTO accredited soil mechanics laboratory. Laboratory testing was performed on selected samples in order to determine soil index properties (soil moisture contents, particle gradations, soil plasticity); soil consolidation parameters; and soil shear strength parameters (UU and CU triaxial testing, and unconfined compressive strength testing on undisturbed Shelby tube samples). Laboratory chemical testing was also performed for this project. Chemical testing performed consisted of determination of soil pH, sulfates and chlorides content, as well as soil resistivity. Soil resistivity testing was performed by TRC using the soil box resistivity method (ASTM G 187-05). Chemical testing was performed by our subcontracted laboratory Accutest, Inc. Laboratory test results are summarized in Section 3.0 below, and are also attached.

3.0 Site Geology and Subsurface Conditions

3.1 Site Geology

Available geologic information prepared by the United States Geological Survey indicates that the site is located near the contact of two surficial geologic deposits, alluvium and till. The alluvial deposits consist of sand, silt, clay, gravel and organic matter. The silt and clay alluvium may occur within or beneath more permeable surficial deposits. According to geologic information, the till deposits overlie the chiefly red sandstone and shale with conglomerate bedrock. This information is generally consistent with the test boring observations where apparent glacial till was encountered in the basal portion of test boring GTB-2 underlying upper alluvium. This information is also generally consistent with data from historic test borings advanced at the project site by others.

3.2 Subsurface Conditions

Underlying a surficial 0.3 to 0.5 ft thick topsoil layer, the test borings encountered four (4) distinct strata based on their physical and engineering properties. The following presents a summary of each stratum encountered. It should be noted that a strong hydrocarbon odor was observed below groundwater levels in each of the borings. The odor was observed to depths of approximately 20 ft.

Stratum 1 – Uncontrolled Fill

This stratum was encountered in each of the test borings underlying a 0.3 to 0.5 in. thick topsoil layer extending to a depths ranging from 3 to 10 ft below the existing ground surface. This stratum generally consists of dark brown, red brown and black sand, silt, gravel and debris in variable combinations. The debris consists of brick, glass and ash. Standard Penetration Test (SPT) N-values generally indicate this stratum to range from “very loose” to “medium dense” in relative density. Laboratory index test results indicate this stratum to have a moisture content of approximately 20 percent. The results of chemical and resistivity testing are presented in Section 4.8.

Stratum 2 – Gray SILT and SAND

This stratum was encountered in each of the test borings underlying the uncontrolled fill of Stratum 1, extending to depths ranging from approximately 34 to 35 ft bgs. This stratum generally consists of SILT with fine sand which grades to fine SAND with silt and fine gravel in the lower approximately 8 to 15 ft. Trace quantities of organic matter consisting of wood were encountered sporadically within this stratum. The presence of organic matter is a depositional characteristic typical of relatively recent river outwash/alluvium. Laboratory index test results indicate this stratum to have a moisture content ranging from 19 to 35 percent and to be non-plastic. An organic content test performed on Sample S-6 obtained from GTB-2 indicates the sample to have an organic content of approximately 1.7 percent. Laboratory consolidation testing performed on Shelby tube sample U-1 from GTB-2 indicates this stratum to be normally consolidated and moderately to highly compressible, having a Compression Index of approximately 0.17 at a void ratio of approximately 1.1.

Stratum 3 – Silty CLAY

This stratum was encountered in each of the test borings underlying Stratum 2. Test borings GTB-1, GTB-3 and GTB-4 were each terminated within this stratum at depths ranging from 37 to 42 ft. In boring GTB-2, this stratum extended to a depth of 69 ft. This stratum generally consists of reddish brown silty CLAY with frequent, very thin (1 mm) silt and sand varves. SPT N-values indicate this stratum to be "very soft" to "soft" in consistency. Laboratory index test results indicate this stratum has a plasticity index ranging from 18 to 22 percent, a liquid limit ranging from 29 to 52 percent, and a moisture content ranging from approximately 33 to 57 percent. Laboratory consolidation test results and subsequent interpretation indicate this stratum to be slightly overconsolidated with a Recompression Index ranging from approximately 0.1 to 0.2, a Compression Index ranging from approximately 0.5 to 1.3 and an *insitu* void ratio ranging from approximately 1.5 to 1.8. Laboratory unconsolidated undrained triaxial testing and unconfined compressive strength testing indicate this stratum to have an undrained shear strength ranging from approximately 800 to 1400 psf.

Stratum 4 – Glacial TILL

This stratum was encountered underlying Stratum 3 in boring GTB-2. GTB-2 was terminated approximately 3 ft into this stratum at a depth of 72 ft bgs. Based on classification of the soil sample obtained, this stratum generally consists of a combination of sand, silt and gravel sized rock fragments. SPT N-values indicate this stratum to be medium dense. We expect that the density of this stratum will increase with increased depth. This stratum has been classified as TILL and appears to be the result of glacial deposition.

3.3 Groundwater

Groundwater readings were obtained during and shortly after the completion of drilling in each of the test borings. According to the test boring data, groundwater was encountered at a depth of approximately 5 ft bgs. These observations are only for the times and dates noted on the boring logs. Groundwater will fluctuate during the year based on seasonal fluctuations, as well as fluctuations in the nearby Connecticut River. As stated above, a strong hydrocarbon odor was observed below groundwater levels in each of the borings. The odor was observed to depths of approximately 20 ft.

4.0 Geotechnical Recommendations

Based on the results of the field investigation, laboratory testing performed on this project, and our subsequent analysis, the new tank can be supported at the currently proposed location. However, anticipated contact pressures from the proposed tank will induce potentially large to moderate amounts of settlement of the upper "very soft" to "very loose" SILT soils if the proposed tank is supported on-grade with no remedial actions. Therefore, subgrade remediation of the upper SILT will be required in order to limit settlements and provide sufficient bearing capacity to support the tank. Settlements of the lower varved silty CLAY are expected to be relatively small and uniform, and are not expected to significantly affect structural performance of the tank.

4.1 Subsurface Remediation

As stated above, subgrade remediation will be required in order to limit overall tank settlements and provide sufficient bearing capacity. In the absence of subgrade remediation, we estimate that settlements of the Stratum 2 SILT may approach 2 ft. In addition, the factor of safety against bearing capacity failure of the soils supporting the tank is below the acceptable value. Two subgrade remediation alternatives were considered for this project: 1) the installation of Rammed Aggregate Piers (RAP); and 2) subgrade preloading (surcharging) in combination with the use of wick-drains. These two alternative remediation schemes are discussed in detail, below.

For both schemes, we recommend that approximately 3.5 ft of the existing fill materials be removed from an area that extends at least 5 ft horizontally past the outside edges of the proposed tank and containment wall footprint. A high strength, non-woven geotextile fabric, meeting the strength requirements of a Class 1 geotextile as per AASHTO M288, should be placed over the exposed subgrades followed by placement of a 6 in. thick layer of crushed or broken stone, meeting the Grading "B" requirements of Section M.02 CTDOT "Standard Specifications for Roads, Bridges and Incidental Construction Form 815 Metric". The excavated area should then be backfilled with a compacted, load bearing structural fill, meeting the Grading "A" requirements of Section M.02 CTDOT "Standard Specifications for Roads, Bridges and Incidental Construction Form 815 Metric" or AASHTO No. 57 Stone, to create a well compacted working platform. The upper 6 to 12 in. of fill placed below the tank bottom should also meet the gradation and corrosivity requirements for tank bedding material specified in Section 5.3.2.1 of API 651. If AASHTO No. 57 Stone is used to construct the working platform then a geotextile separation fabric will be necessary to prevent the migration of finer grained particles from the tank bedding material downward into the No. 57 Stone. In the event that the recommended preloading alternative is selected for use on this project, the thickness of the aggregate layer underlying the ringwalls may need to be increased, as discussed below.

Rammed Aggregate Piers – The proposed tank and containment wall foundation can be supported on Impact® Rammed Aggregate Piers (RAP), a proprietary system developed, designed and installed by Geopier, Inc., and their licensed subsidiaries. RAP elements are vertical columns of aggregate, placed in lifts and mechanically tamped in augered, temporarily cased holes. These aggregate inclusions serve to stiffen and reinforce the composite soil matrix as well as reduce settlements. In the case of this project, RAP would be installed through the upper SILT soils into the more granular soils just above the varved silty CLAY. We have been in communication with a Geopier design and installation contractor, Design/ Build Geotechnical, LLC (DBG). Based on the proposed tank details, the subsurface conditions, and the contractor's experience using the RAP system on similar projects in areas nearby, a RAP system is suitable for this project. We do not expect vibrations to be a concern at the site during RAP installation.

We recommend installing ungrouted, displacement-type Impact® Rammed Aggregate Piers (RAP) to completely penetrate the upper Stratum 1 fill and "soft" to "loose" silt portions of Stratum 2. A pier spacing of 4.5 ft on-center should be to support tank and containment wall foundations and base support. Minimum pier installation depths of 27 ft should be used in order to fully penetrate the "soft" to "loose" silts of Stratum 2 and distribute tank loads throughout the upper soil layer to minimize total settlements.

RAP should be constructed of clean aggregate, similar to AASHTO No. 57 Aggregate, in order to proivde rapid drainage and dissipation of pore water pressure and to minimize tip stresses distributed to Stratum 3. A construction pattern using a 4 ft mandrel up-stroke and a 3 ft down stroke should be utilized to construct 22 to 24 inch diameter elements.

Based on the anticipated tank contact pressures, we estimate that the total magnitude of settlements under the weight of the full tank could approach 4 in. Based on the relatively consistent subsurface conditions encountered in the borings, as well as consideration for the recommended tank pad preparation, we expect that settlements will be uniform in nature with differential settlements estimated to be on the order of 1 to 2 in. If RAP elements are used on this project, we recommend that a modulus test be performed on a RAP element in order verify the elastic modulus of the pier used in the design. We also recommend that the proposed tank be hydrotested by filling the tank with water prior to filling the tank with fuel product as well as prior to construction of the surrounding containment area (if possible). The purpose of hydrotesting would be to induce settlements of the subgrade soils before connections for piping networks are made, and prior to construction of the containment area. We expect that the majority of total settlements would occur within 15 to 30 days after the tank is fully loaded with water. We recommend that the hydrotesting be performed in four stages by filling the tank to 25 percent of the total fill height and allowing the tank to settle over a minimum 5 day period prior to additional stage filling. A minimum total of four points on the periphery of the tank should be monitored on a weekly basis during staged filling and up to 30 days after the tank has been filled with water.

It should be noted that small, secondary consolidation type settlements of the upper silt and lower clay will occur throughout the life of the tank due to creep, decay of organic material, etc. These settlements are estimated to be less than 1 in. Tank pipe networks and utilities should be fitted with flexible connections to allow for such future movement.

As previously stated, we recommend removal of the upper 3.5 ft of fill over an area that extends 5 ft beyond the tank footprint, followed by placement of a geotextile fabric and a

6 in. stone layer. The overexcavation should then be replaced with compacted load bearing structural fill. According to DGB, a minimum 2.5 ft of compacted granular crushed or broken stone, meeting the CTDOT Section M.02 Grading “A” or AASHTO No. 57 Aggregate, will be required between the top of the piers and tank floor to provide load transfer to the RAP elements. In addition, ringwall and containment wall foundations will need to bear directly on RAP elements. As such, we recommend that the RAP elements should be installed prior to removing the upper fill. The tops of RAP elements could then be excavated out prior to placing the compacted granular pad.

Based on these evaluations, DGB has developed a budget for the design and construction of the RAP ground support system. Based on information provided by DGB, the cost for preparing an engineering design submittal and shop drawings, mobilization to the site, completing a full scale modulus load test and subsequently constructing RAP elements to a depth of 27 ft and tank settlement monitoring during hydrotesting will be on the order of $180,000. According to DGB, this budget should be considered an estimate and is based on the assumption that the work may be completed paying Open Shop wages, that unanticipated subsurface obstructions that may not be penetrated by their Impact equipment will be removed by others and that the pier locations will be laid out in the field by others prior to their arrival on site. This estimate does not include treatment/ disposal of contaminated soils.

Preloading and Wick-Drains - The site can be surcharged prior to construction of the replacement tank to limit post construction settlements and improve shear strength of the soils. Surcharging would consist of placement fill soils over and beyond the tank and containment wall footprint area such that the loads induced from surcharge fills would be greater than the weight of the proposed tank filled with jet fuel to the maximum proposed height of 40 ft. We estimate that surcharge fill heights would need to be on the order of 25 ft in order for the surcharge alternative to be effective. Maximum side-slopes angles of 2H: 1V are required in order to assure stability of the surcharge embankment against deep seeded global stability failure. In order to expedite the amount of time required for settlements of the upper silts to occur, we recommend that surcharging be performed in conjunction with installation of wick-drains. Wick-drains are prefabricated vertical drains that are used to accelerate settlement of soft, saturated, compressible soil layers by decreasing the pore water drainage path, thus decreasing settlement time and accelerating the rate of strength gain of the soil layer. The prefabricated drains typically consist of a prefabricated PVC core wrapped with a geotextile fabric having an apparent opening size (AOS) of no greater than 0.15 mm. A sand or aggregate “drainage blanket” is usually placed at the surface in order to promote discharge of water from the drains. We estimate that for wick-drains installed at center-to-center spacing of 5 ft through the upper silt on a square grid pattern to depths of 30 ft bgs will be effective in decreasing the time for total settlements to occur to between 1.5 to 3 months.

Surcharge fills should be monitored for settlements and pore pressures using settlement plates and vibrating wire piezometers in order to most accurately determine when the majority of settlements have occurred. Settlement platforms and vibrating wire piezometers would be installed prior to surcharge fill placement. We recommend that four settlement platforms be placed at the approximate test boring locations, with three vibrating wire piezometers installed on a equally spaced, triangular pattern within the tank footprint area.

The recommended 3.5 ft removal and replacement scheme should be implemented upon removal of surcharge fills in order to assure a well compacted uniform base. Additional foundation subgrades (tank ringwall and foundation wall) should be overexcavated to a depth of 2 ft below proposed foundation bearing elevations and replaced with AASHTO No. 57 Stone. The geotextile and stone working pad could then be constructed below the tank.

We estimate that the total cost for this remediation scheme could approach $400,000. This price range includes the cost of wick drain installation; purchase, placement, removal and disposal of surcharge fills; settlement monitoring during fill placement and an estimated 3 month settlement period; piezometer installation and monitoring and subsequent settlement data interpretation. It is important to note that some groundwater that will be discharged to the surface from the vertical wick-drains will likely contain hydrocarbon contaminants. Groundwater collection and treatment, or disposal of contaminants was not considered in the cost estimate.

It is worth noting that we did consider the option of constructing the tank and containment area at the currently proposed location using the tank as a surcharge in lieu of a soil surcharge. This would include the installation of wick drains. For this option, the weight of the filled tank itself would serve as the surcharge to induce the anticipated minimum 2 ft of settlement prior to installing tank connections. However, the greater the magnitude of total settlements, the harder it becomes to predict the relative uniformity of settlements. That is, if the tank is allowed to settle without site remediation, there exists the risk that large differential settlements could occur. Large differential settlements could ultimately lead to:

- distortion and structural damage to the body of the tank requiring repair;
- cracking and damage to the tank ringwall foundation requiring repair and/or replacement;
- required “jacking” and repositioning of the tank to the required plumbness.

In addition to the risks associated with settlement, there is also a risk of complete shear failure of bearing soils underlying the tank even with staged filling.

When considering the cost associated with any of the aforementioned risks, it is the opinion of TRC that this approach should be eliminated from further consideration as such risks will be mitigated through site remediation, as discussed above. We also note that this approach does not address remediation of soils underlying the containment area and wall, which would have to be dealt with separately and at additional costs. tank movements, foundation settlement criteria, etc. This work, which is outside of our current scope of work for this project, can be done at your request.

Conclusion - Based on the substantial cost benefits that are realized with the use of RAP over the preload and wick drain option, as well as the reduced time required for implementation of this remediation scheme, RAP elements are preferred for use on this project.

4.2 Foundation Considerations

The proposed ringwall and containment wall foundations should be founded directly over the recommended geotextile layer at a depth of 3.5 ft bgs, as required for frost protection and by DGB's requirement that foundations be constructed directly over RAP elements. The ringwalls foundation should be designed for a maximum bearing pressure of 2,500 psf. The foundation design will also need to consider the anticipated total, differential and secondary settlements expected from tank loads.

Ringwalls should have a maximum width of 18 in. In the event that ringwall contact pressures exceed the maximum recommended bearing pressure of 2,500 psf, consideration could be given to construction of spread footings underlying ringwall foundations in order to distribute the load, as discussed in API 650, Appendix B, Section B.4.2.3(f). The bottom of spread footings would need to be founded at a depth of 3.5 ft below exposed finished grades.

4.3 Earthwork

The existing on-site soils are not suitable for reuse as load bearing structural fill or backfill for this project. Therefore, imported fills will be required on this project. All imported fill material should be selected from suitable sources and be approved by the geotechnical engineer well in advance of fill construction. As stated above, imported crushed or broken stone fills used on this project should meet the Grading "A" or "B" material requirements of Section M.02 CTDOT "Standard Specifications for Roads, Bridges and Incidental Construction Form 815 Metric" or AASHTO No. 57 Aggregate. In addition to the structural fill gradation requirements provided above, the upper 6 to 12 in. of structural fill placed below the bottom of the proposed tank should meet the gradation and corrosivity requirements specified in Section 5.3.2.1 of API 651. All structural fills should be free of deleterious materials, including organics.

All fills should be placed in layers not exceeding 6 to 8-in. loose measure. This criterion may be modified in the field depending on the conditions present at the time of construction and on the compaction equipment used. All fills should be compacted to not less than 98% of maximum standard dry density (ASTM D1557). Once a subgrade has been prepared, construction traffic should be controlled in such a fashion as to minimize subgrade disturbance.

Existing utilities should be removed and relocated outside the tank area. Abandoned utilities should be removed and the excavations filled with structural compacted fill or lean concrete. In addition, we expect that the existing utility lines above the proposed tank area will interfere with the proposed construction and will need to be relocated/ rerouted. This needs to be identified prior to construction.

Based on review of the site plan developed by TRC, it appears that construction of the proposed containment wall on the north side of the proposed tank will infringe upon the existing roadway embankment. In order to assure stability, the embankment slope will need to be re-graded during construction in order to maintain grades at the existing 2H:1V. If re-grading is not feasible, the existing embankment slope can be stabilized using an earth retention system.

4.4 Lateral Earth Pressure Parameters

Imported fills should be similar in gradation to USCS SW-GW well graded soil aggregate. The soil parameters indicated in the table below may be used to estimate lateral earth pressures on below grade structures. It is important to note that the parameters listed for Imported Structural Fill are assumed values for typical well graded crushed stone aggregates. These values should be verified once the material has been selected and may be altered based on the gradation of the actual material to be used for construction.

At-rest earth pressures (K_o) and the active earth pressure (K_a) should be used in the design of non-yielding and yielding walls, respectively. Backfill behind below grade walls should be placed with light equipment and the soils should not be over-compacted. Heavy compaction equipment and compactive effort may lead to overstress of the below grade walls.

Earth Pressure Parameters		
Parameter	Existing FILL Soils	Imported Structural Fill
γ_t (pcf)	125	130
ϕ	28^o	34^o
C (psf)	0	0
c_a (psf)	0	0
δ (concrete)	17^o	25^o
K_p	2.77	3.53
K_o	0.48	0.44
K_a	0.36	0.28

4.5 Groundwater Management

Based on the groundwater levels encountered in the borings, we expect that groundwater will be encountered in excavations that extend 5 ft below existing grades. If excavations required for construction extend below the water level, temporary dewatering systems will be necessary to maintain dry working conditions. In conjunction with the aggregate working platform, we expect that numerous sumps and pumps should be sufficient in maintaining dry excavation conditions. Design of temporary dewatering systems will be the responsibility of the contractor and based on conditions at the time of construction.

4.6 Temporary Excavation Conditions

The on-site soils are considered Type C soils per OSHA excavation regulations. The sidewalls of confined excavations above groundwater levels and deeper than 4 ft must be sloped, benched or adequately shored per OSHA 29 CFR 1926 regulations. Open excavations in the on-site soils should not be steeper than H 1 ½ : 1V.

4.7 Seismic Considerations

According to the American Petroleum Institute (API), the site class is within "Site Class E" based on the soil profiles. According to ASCE 7, the maximum considered earthquake ground motions in this area for 0.2 sec. and 1.0 sec. spectral responses are approximately 23.9 % g and 6.4 % g, respectively. Site coefficients Fa and Fv for Site Class E and the mapped spectral responses are equal to 2.5 and 3.5 respectively.

Liquefaction is the phenomena whereby loose, saturated granular soils (typically poorly graded sands) subjected to earthquake induced ground motion experience a rapid increase in pore water pressures. When poor water pressures exceed effective overburden pressures, these soils can lose partial to full load carrying capability resulting in foundation failure, lateral spread, settlement, etc. The existing loose sandy soil underlying the upper silt is susceptible to liquefaction. However, according to a liquefaction evaluation performed using methodologies developed by Tokimatsu and Seed, 1987, as presented in Geotechnical Earthquake Engineering (Kramer, 2005), the cyclic strain induced during a seismic event with moment magnitude of 7.5 will produce settlements of the sand layer that are estimated to be less than 1 in. In an ASCE publication titled *Liquefaction-Induced Ground-Surface Disruption*, 1995, Youd investigate ground disruption due to seismic induced liquefaction of soils that lie beneath non-liquefiable soils. Based on the results of this study, we do not anticipate that compression of the existing sand will be reflected at the surface. Therefore, special design considerations due to liquefaction do not appear to be warranted for this project.

4.8 Corrosion Potential

According to chemical test results performed on surficial soil samples obtained from just below the topsoil layer, the soils tested have sulfate and chloride contents that are below the reporting limits of 22 and 110 kg/mg, respectively. Soil pH values range from 7.7 to 10.1, indicating lightly to moderately caustic soils. Soil box resistivity test results indicate resistivity values ranging from approximately 37,000 to 47,000 ohm-cm. Based on the results of chemical and resistivity testing, the site soils are not considered corrosive to buried concrete or steel.

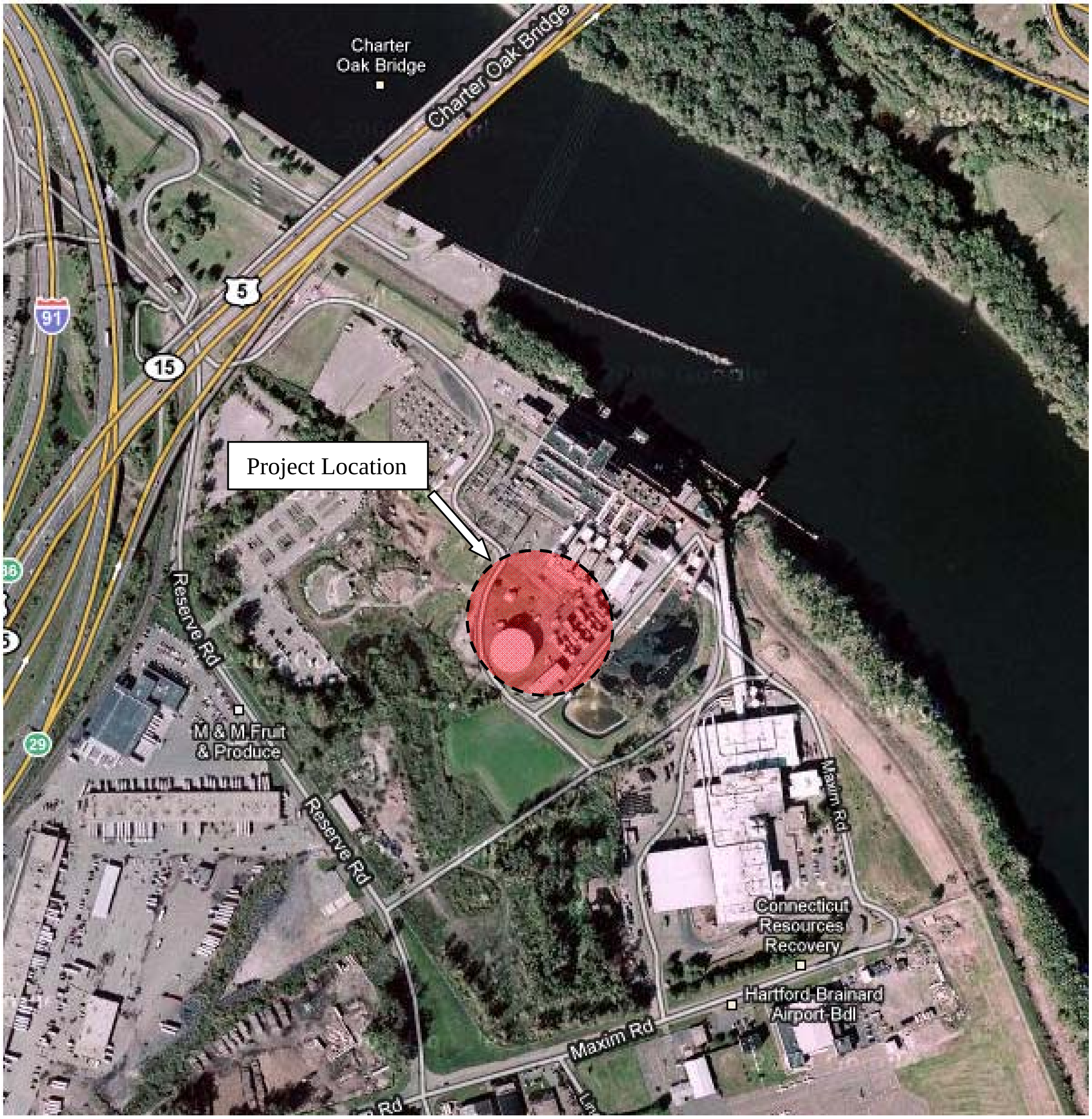
5.0 Recommendations for Additional Services

We recommend that TRC provide engineering consultation and field inspection services during construction operations to determine if soils, other materials, and ground water conditions encountered during construction are similar to those encountered in the borings, and that they have comparable engineering properties and influences on the design of the structures. TRC should review specifications for earthwork and foundation construction when they are prepared. TRC can also provide installation and monitoring settlement plates and vibrating wire piezometers in the event that this alternative is chosen for this project; or survey monitoring of storage tank movement during hydrotesting for the RAP alternative. We would be pleased to provide these additional services, which are not included in our present scope of work.

6.0 Limitations

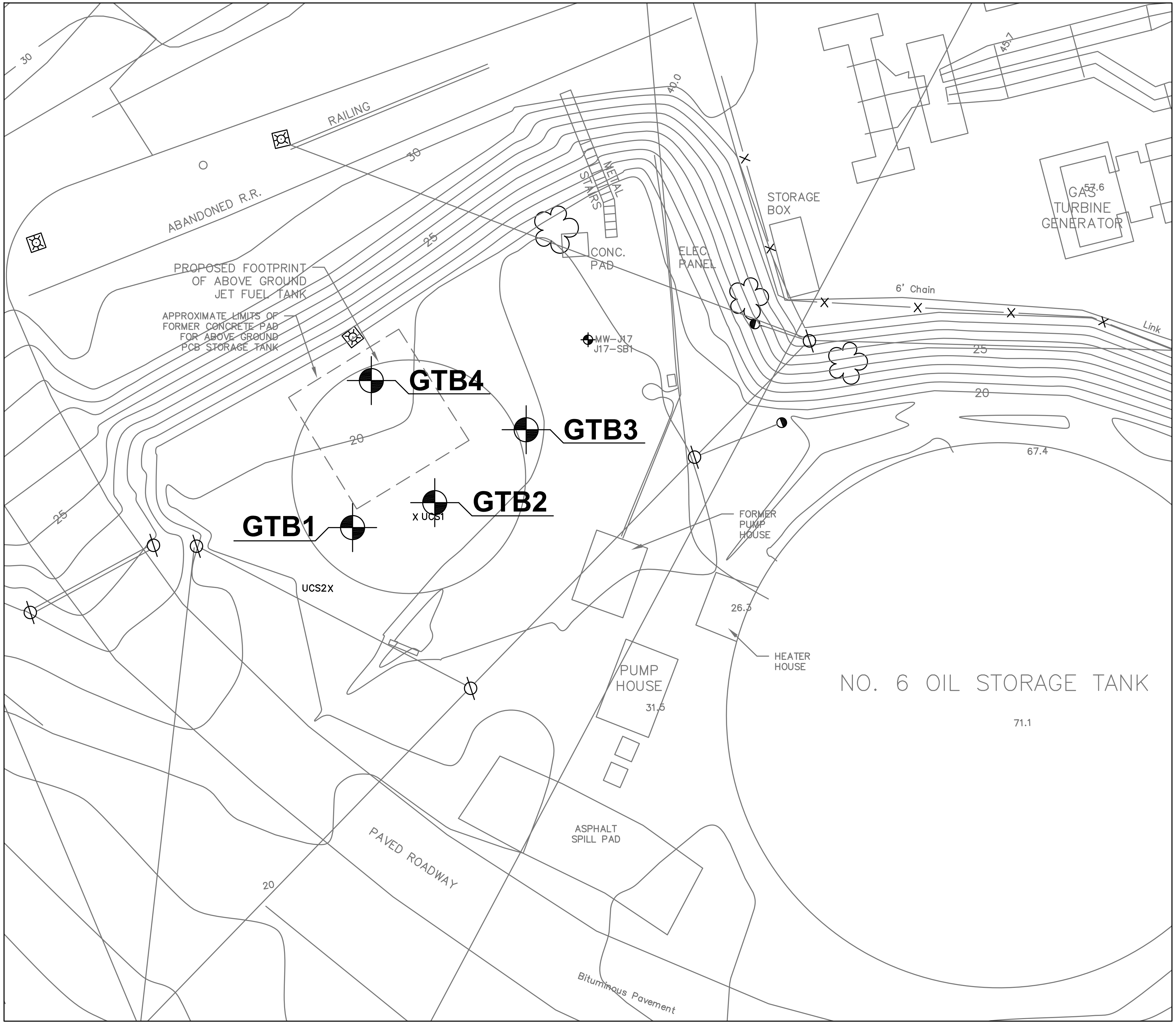
This work has been done in accordance with our authorized scope of work and in accordance with generally accepted practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this investigation. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project discussed herein and any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review the relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problem, which may arise, from the misunderstanding or misinterpretation of this report or failure to comply with our recommendations.

SITE LOCATION MAP



Project	Date	Our Project No.
CRRA Tank No. 6 Replacement Hartford, CT	March 23, 2010	153306
	For CRRA South Meadows Generating Station	

Drawing No. 1



LEGEND:

GTB1 APPROXIMATE TEST BORING LOCATION

NOTES:

1) TEST BORINGS LOCATIONS STAKED OUT IN THE FIELD BY TRC ENVIRONMENTAL CORPORATION

2) TEST BORINGS ADVANCED BY SITE, LLC

3) BASE PLAN PROVIDED BY TRC ENVIRONMENTAL CORPORATION

4) THE SUBSURFACE CONDITIONS REVEALED BY THIS INVESTIGATION REPRESENT THE CURRENT CONDITIONS AT THE SPECIFIC HOLE LOCATIONS ONLY AND MAY NOT BE INDICATIVE OF CONDITIONS AT OTHER LOCATIONS OR TIMES

DRAWING TITLE

TEST BORING LOCATION PLAN

PROJECT

CRRA GENERATING STATION
CRRA TANK NO. 6 REPLACEMENT
HARTFORD, CT

FOR

TRC ENGINEERING, INC.
21 GRIFFIN ROAD NORTH
WINDSOR, CT 06095

TRC
16000 COMMERCE PARKWAY – SUITE B
MOUNT LAUREL, N.J. 08054-2291
PH: (856) 273-1224
FAX: (856) 273-9244
CERTIFICATE OF AUTHORIZATION NO. GA276857

SCALE: Not to Scale		
DRAWN: CAB	CHECKED: TMC	REVIEWED
DATE: 3/23/2010		
DRAWING: 1 OF 1		REVISION: 0
OUR FILE: 153306		

TEST BORING LOG

BORING	GTB-01
G.S. ELEV.	
FILE	153306
SHEET	1 OF 2

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

GROUNDWATER DATA

FIRST ENCOUNTERED 5.0 '

DEPTH	HOUR	DATE	ELAPSED TIME
4.5'	NR	3/1	0 HR

METHOD OF ADVANCING BOREHOLE

d	FROM	0.0 '	TO	37.0 '

DRILLER JOHN A. DEANGELIS, JR
HELPER JOHN A. DEANGELIS, III
INSPECTOR T. CARUSO
DATE STARTED 03/01/2010
DATE COMPLETED 03/01/2010

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
			0.5	***TOPSOIL***		
	S-1	4 10 7 6		***DARK BROWN AND RED-BROWN M/C SAND AND C/GRAVEL, TR TO SM SILT, TR BRICK DEBRIS (FILL)***		CME 300/45 C AUTO HAMMER
5			5.0			
	S-2	1 2 2 4		***DARK BROWN, BROWN AND BLACK SILTY SAND TO SANDY SILT AND GRAVEL (FILL)***		STRONG HYDROCARBON ODOR FROM 5 TO 21.5 FT
10			10.0			
	S-3	1/1' 1 1				
15						
	S-4	WH 1/1' 1		***GRAY VERY FINE SANDY SILT***		
20						
			21.5			
	S-5	2 3 4 5		***LIGHT GRAY TO GRAY M/C SAND, TR TO SM F/GRAVEL***		
25			25.0			
	S-6	1 1 2 2		***LIGHT GRAY TO GRAY M/C SAND, TR TO SM F/GRAVEL, TR ORGANICS (TIMBER)***		
			27.0			
30						
	S-7	3 6 7 7		***LIGHT GRAY TO GRAY M/C SAND, TR TO SM F/GRAVEL***		
35			35.0			

WH - WEIGHT OF HAMMER ; WR - WEIGHT OF ROD

DRN. CAB
CKD. TMC

TEST BORING LOG

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

BORING	**GTB-01**
G.S. ELEV.	
FILE	153306
SHEET	2 OF 2

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-8	1/1' 1 1	37.0	***BROWN CLAY, TR TO SM SILT, HIGH PLASTICITY, FREQUENT SILT VARVES***		
				END OF BORING AT 37'		
40						
45						
50						
55						
60						
65						
70						
75						

TEST BORING LOG

TRC

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

BORING	GTB-02
G.S. ELEV.	
FILE	153306
SHEET	1 OF 2

GROUNDWATER DATA

FIRST ENCOUNTERED 5.0 '

DEPTH	HOUR	DATE	ELAPSED TIME
4.3'	NR	3/2	0 HR

METHOD OF ADVANCING BOREHOLE

a	FROM	0.0 '	TO	8.0 '
d	FROM	8.0 '	TO	72.0 '

DRILLER JOHN A. DEANGELIS, JR
HELPER JOHN A. DEANGELIS, III
INSPECTOR T. CARUSO
DATE STARTED 03/02/2010
DATE COMPLETED 03/02/2010

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
			0.3	***TOPSOIL***		
	S-1	2 7 6 16	3.0	***BROWN, RED-BROWN AND DARK BROWN, SILTY SAND AND C/GRAVEL, TR BRICK DEBRIS (FILL)***		CME 75 AUTO HAMMER
	S-2	10 7 6 5	4.0	***GRAY F/SANDY SILT***		
5	S-3	1 1 1 1				
	U-1	P U S H	10.0	***GRAY SILT, TR TO SM F/SAND***		
10	S-4	WH/1.5' 1	15.0	***GRAY F/SANDY SILT TO SILTY F/SAND, WET***		STRONG HYDROCARBON ODOR FROM 10 TO 15 FT
15	S-5	WR WH 1 1	20.0	***GRAY F/SAND, SM SILT***		
20	S-6	1 2 4 5	25.0	***GRAY F/M SAND, TR TO SM SILT, TR ORGANICS (TIMBER)***		
25	S-7	1 2 2 3	30.0	***GRAY M/C/F SAND, TR TO SM F/GRAVEL, TR SILT, TR ORGANICS (TIMBER)***		
30	S-8	2 4 4 5	35.0	***GRAY M/C SAND, SM F/GRAVEL***		
35						

WH - WEIGHT OF HAMMER ; WR - WEIGHT OF ROD

DRN. CAB
CKD. TMC

TEST BORING LOG

TRC

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

BORING	**GTB-02**
G.S. ELEV.	
FILE	153306
SHEET	2 OF 2

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-9	1 1 1 1				
40	U-2	P U S H				
45	S-10	WH/1.5' 2		***BROWN CLAY, TR TO SM SILT, HIGH PLASTICITY, FREQUENT SILT VARVES***		
50	S-11	WH/1.5' 1	51.5			
			55.0	***BROWN TO RED-BROWN SILTY CLAY TO CLAYEY SILT, MODERATE PLASTICITY***		
55	U-3	P U S H				
60	S-12	WH 1 1 2		***SILTY CLAY, MODERATE PLASTICITY, FREQUENT SILT VARVES***		
65	S-13	WH/1.5' 2	69.0			
70	S-14	6 5 5 9	72.0	***RED-BROWN SANDY SILT TO SILTY SAND AND F/GRAVEL SIZED ROCK FRAGMENTS***		S-14: TIP OF SPLIT SPOON CONTAINED SANDY CLAY
75				***END OF BORING AT 72'***		

TEST BORING LOG

BORING	GTB-03
G.S. ELEV.	
FILE	153306
SHEET	1 OF 2

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

GROUNDWATER DATA			
FIRST ENCOUNTERED 5.0 '			
DEPTH	HOUR	DATE	ELAPSED TIME
5.5'	10:30	3/1	0 HR

METHOD OF ADVANCING BOREHOLE				
d	FROM	0.0 '	TO	42.0 '

DRILLER JOHN A. DEANGELIS, JR
HELPER JOHN A. DEANGELIS, III
INSPECTOR T. CARUSO
DATE STARTED 03/01/2010
DATE COMPLETED 03/01/2010

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
			0.5	***DARK BROWN SILT, TR ROOTS AND GRASS (TOPSOIL)***		
	S-1	1 4 7 7		***DARK BROWN SILTY F/SAND, TR TO SM GRAVEL AND BRICK DEBRIS, TR HAIR ROOTS (FILL)***		CME 300/45 C AUTO HAMMER
5			5.0			
	S-2	1 0 1 1		***GRAY SILT, TR TO SM CLAY, TR F/SAND***		STRONG HYDROCARBON ODOR FROM 5 TO 20 FT
	U-1	P U S H				
10			10.0			
	S-3	WH		***GRAY SILT, TR TO SM F/SAND***		NO RECOVERY IN SHELBY TUBE SAMPLES U-1 AND U-2
	U-2	P U S H				
15			15.0			
	S-4	WH 1 1 1		***GRAY F/SAND, SM SILT***		
20			20.0			
	S-5	1/1' 1 2		***GRAY M/F SAND, TR TO SM SILT, TR TO SM F/GRAVEL***		S-5: ORGANIC SEAM 2" THICK AT BOTTOM OF SPOON - LARGE ROOT/WOOD PIECES
25			25.0			
	S-6	3 4 5 6		***LIGHT GRAY M/C/F SAND, TR TO SM F/GRAVEL, TR WOOD ORGANICS***		
30						
	S-7	3 2 3 4				
			34.0			
35						

WH - WEIGHT OF HAMMER ; WR - WEIGHT OF ROD

DRN. CAB
CKD. TMC

TEST BORING LOG

BORING	GTB-03
G.S. ELEV.	
FILE	153306
SHEET	2 OF 2

PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-8	1 1 1 2				
40				***BROWN CLAY, SM SILT, HIGH PLASTICITY, FREQUENT SILT VARVES***		
	S-9	1/1' 1/1'		42.0		
				END OF BORING AT 42'		
45						
50						
55						
60						
65						
70						
75						

TEST BORING LOG

TRC

BORING	GTB-04
G.S. ELEV.	
FILE	153306
SHEET	1 OF 2

PROJECT: CRRA TANK NO. 6 REPLACEMENT

LOCATION: HARTFORD, CT

GROUNDWATER DATA

FIRST ENCOUNTERED 5.0 '

DEPTH	HOUR	DATE	ELAPSED TIME
4.2'	NR	3/1	0 HR

METHOD OF ADVANCING BOREHOLE

d	FROM	0.0 '	TO	37.0 '

DRILLER	JOHN A. DEANGELIS, JR
HELPER	JOHN A. DEANGELIS, III
INSPECTOR	T. CARUSO
DATE STARTED	03/01/2010
DATE COMPLETED	03/01/2010

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
			0.5	***DARK BROWN SILT, TR TO SM F/SAND, TR ORGANICS (HAIR ROOTS, GRASS) (TOPSOIL)***		
	S-1	2 5 5 14		***DARK BROWN TO BROWN SILTY SAND AND CRUSHED STONE/BRICK DEBRIS (FILL)***		CME 300/45 C AUTO HAMMER
5			5.0			
	S-2	1 1 1 2		***DARK BROWN TO BLACK SILT (POSSIBLE ASH), SM F/SAND, TR F/GRAVEL, WET (FILL)***		STRONG HYDROCARBON ODOR FROM 5 TO 10 FT
10			10.0			
	S-3	WH 1/1.5'		***LIGHT GRAY SILT, TR TO SM F/SAND***		
15			15.0			
	S-4	WH 1/1' 1		***LIGHT GRAY F/SANDY SILT TO SILT SAND***		
20			20.0	***LIGHT GRAY F/SANDY SILT TO SILT SAND, TR ORGANICS (WOOD)***		
	S-5	1/1' 5 4	21.8	***LIGHT GRAY M/C SAND, TR F/GRAVEL, TR SILT, TR ORGANICS (WOOD)***		
25			25.0			
	S-6	2 8 3 3		***LIGHT GRAY M/C/F SAND, SM F/GRAVEL, TR ORGANICS***		
30			30.0			
	S-7	2 3 4 7		***LIGHT GRAY M/F SAND, TR F/GRAVEL***		
35			35.0			

WH - WEIGHT OF HAMMER ; WR - WEIGHT OF ROD

DRN. CAB

CKD. TMC

TEST BORING LOG

BORING	GTB-04
G.S. ELEV.	
FILE	153306
SHEET	2 OF 2

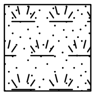
PROJECT: CRRA TANK NO. 6 REPLACEMENT
LOCATION: HARTFORD, CT

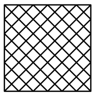
DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-8	2 2 1 1	37.0	***BROWN CLAY, TR TO SM SILT, FREQUENT SILT VARVES***		
				END OF BORING AT 37'		
40						
45						
50						
55						
60						
65						
70						
75						

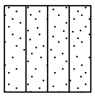
KEY TO SYMBOLS

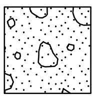
Symbol Description

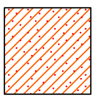
<u>Strata symbols</u>

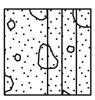

Topsoil

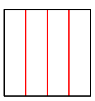

Fill (made ground)

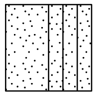

USCS Sandy Silt

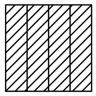

USCS Poorly-graded Gravelly Sand

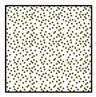

Silty Clay

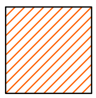

Poorly-graded Gravelly Sand with Silt


Silt with Low Plasticity


Poorly-graded Sand with Silt


Brown Clayey Silt / Silty Clay


Poorly-graded Sand


Clay with Low Plasticity

Symbol Description

<u>Misc. Symbols</u>

Water table first encountered

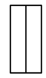
Water table first reading after drilling

Water table second reading after drilling

Water table third reading after drilling

NR Not Recorded

<u>Soil Samplers</u>


Split Barrel


Undisturbed Sample

<u>Lab Symbols</u>

FINES = Fines %

LL = Liquid Limit %

PI = Plasticity Index %

U_c = Unconfined Compressive Strength

<u>Notes:</u>

COLUMN A) Soil sample number.

COLUMN B) FOR SOIL SAMPLE (ASTM D 1586): indicates number of blows obtained for each 6 ins. penetration of the standard split-barrel sampler. FOR ROCK CORING (ASTM D2113): indicates percent recovery (REC) per run and rock quality designation (RQD). RQD is the % of rock pieces that are 4 ins. or greater in length in a core run.

COLUMN C) Strata symbol as assigned by the geotechnical engineer.

DESCRIPTION) Description including color, texture and classification of subsurface material as applicable (see Descriptive Terms). Estimated depths to bottom of strata as interpolated from the borings are also shown.

DESCRIPTIVE TERMS: F = fine M = medium C = coarse

RELATIVE PROPORTIONS:

-Descriptive Term-	-Symbol-	-Est. Percentages-
Trace	TR	1-10
Trace to Some	TR to SM	10-15
Some	SM	15-30
Silty, Sandy, Clayey, Gravelly	-	30-40
And	and	40-50

REMARKS) Special conditions or test data as noted during investigation. Note that W.O.P. indicates water observation pipes.

* Free water level as noted may not be indicative of daily, seasonal, tidal, flood, and/or long term fluctuations.

METHODS AND TOOLS FOR ADVANCING BOREHOLES

- a - Continuous Sampling
- b - Finger type rotary cutter head 6 in. diameter (open hole)
- d - Drilled in casing 3 3/8 in. ID; 8 in. OD (hollow-stem auger)
- e - Drilled in casing 2 1/2 in. ID; 6 1/4 in. OD (hollow-stem auger)
- f - Driven flush joint casing (BW) - 2 3/8 in. ID; 2 7/8 in. OD (300 lb. hammer, 18 in. drop)
- g - Driven flush joint casing (NW) - 3 in. ID; 3 1/2 in. OD (300 lb. hammer, 18 in. drop)
- h - Tricone Roller Bit - 2 3/8 in. or 2 7/8 in.
- i - Drilling Mud (Slurry Method)
- c_1 - Double tube diamond core barrel (BX) : core size: 1.6 in.
hole size: 2.36 in.
- c_2 - Double tube diamond core barrel (NX) : core size: 2.0 in.
hole size: 2.98 in.
- c_3 - 4 in. thin walled diamond bit
- c_4 - 6 in. thin walled diamond bit

METHODS AND TOOLS FOR **TESTING AND SAMPLING SOILS AND/OR ROCKS**

Penetration test and split-barrel sampling of soils, ASTM D1586

140 lb. hammer, 30 in. drop. recording number of blows obtained for each 6 in. penetration usually for a total of 18 in. penetration of the standard 2 in. O.D. and 1 3/8 in. I.D. split-barrel sampler. Penetration resistance (N) is the total number of blows required for the second and third 6 in. penetration.

Thin walled tube sampling, ASTM D1587

Samples are obtained by pressing thin-walled steel, brass or aluminum tubes into soil. Standard thin-walled steel tubes:

O.D. in.	2	3
I.D. in.	1.94	2.87

Diamond core drilling, ASTM D2113

Diamond core drilling is used to recover intact samples of rock and some hard soils generally with the use of a:

BWM double tube core barrel
NWM double tube core barrel

SUMMARY OF LABORATORY TEST DATA

SAMPLE IDENTIFICATION					GRAIN SIZE DISTRIBUTION				PLASTICITY						VOLUMETRIC PROPERTIES			COMPACTION CHARACTERISTICS							
BORING NUMBER	SAMPLE NUMBER	DEPTH (FT)	ELEVATION (FT)	SOIL GROUP (USCS SYSTEM)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY COLLOIDS (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	SPECIFIC GRAVITY (*Indicates Assumed Value)	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (+ Indicates Remolded Sample)	VOID RATIO	DEGREE OF SATURATION (%)	TYPE OF TEST	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)	RESITIVITY (ohm-meter)	pH	ORGANIC CONTENT (%)	SULFATE (mg/kg)	CHLORIDE (mg/kg)
GTB-1	S-2	5-4			31	42	27							20.5											
	S-3	10-12					49		NV	NP	NP			28.6											
	S-4	15-17												30.3											
	S-6	25-27			3	92	5							30.4											
	S-7	30-32												19.1											
	S-8	35-37							49	29	20	1.2		53.7											
GTB-2	S-3	4-6												34.6											
	S-4	10-12												33.2											
	S-5	15-17					45							31.3											
	S-6	20-22												26.6									1.7		
	S-10	45-47							52	30	22	1.1		53.6											
	S-13	65-67							43	25	18	1.0		43.6											
	S-14	70-70.5			24	42	34							12.7											
	U-1	6-8			0	5	95		25	26	NP		2.75	33.3											
	U-2	40-42		MH	0	0	24	76	52	31	21	0.9	2.79	50.3											
	U-3	55-57		CL	0	0	26	74	41	26	15	1.2	2.83	44.7											
GTB-3	S-3	10-12					60		NV	NP	NP														
	S-4	15-17					41							28.7											
	S-5	20-22					18							32.6											
	S-6	25-27		SW	4	93	3							19.4											
	S-7	30-30.5																							
	S-8	35-37							29	47	18	1.3		52.2											
GTB-4	S-2	5-7			1	40	59							28.5											
	S-3	10-12					66							33.5											
	S-4	15-17			0	50	50							30.5											
	S-9	35-37							51	30	21	1.3		57.2											
GTB-1	S-1	0-2																				10.1		<110	<22
GTB-2	S-1	0-2																				8.0		<120	<23
GTB-3	S-1	0-2																				7.7		<110	<22
GTB-4	S-1	0-2																				8.7		<120	<23
GTB-1	ENVIRO	0.5-1																			371.1				
GTB-2	S-2	2-4																			365.8				
GTB-3	ENVIRO	0.5-1.5																			378.7				
GTB-4	ENVIRO	0.5-1.5																			>476.5				

TRC

Drawn By: TBT Date: 04/02/10
Checked: TC Date: 04/02/10

Project Name: CRRA TANK NO. 6 REPLACEMENT
Client: CONN. RESOURCES RECOVERY AUTHORITY

File No. 153306.039
Table No. 1

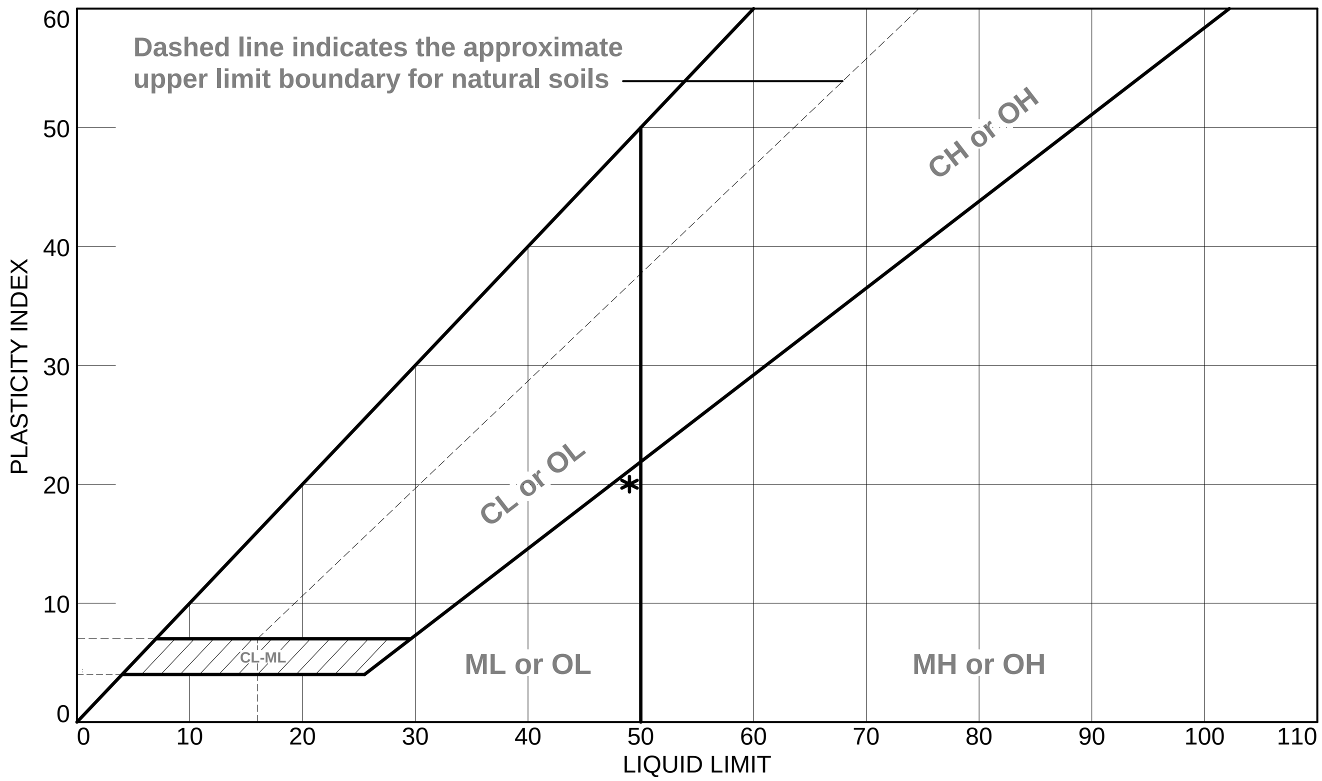
SUMMARY OF LABORATORY TEST DATA

SAMPLE IDENTIFICATION					VOLUMETRIC PROPERTIES			SHEAR STRENGTH PROPERTIES								CONSOLIDATION PROPERTIES				
BORING NUMBER	SAMPLE NUMBER	DEPTH (FT)	SPECIFIC GRAVITY (*INDICATES ASSUMED VALUE)	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (PCF) (+INDICATES REMOLDED SAMPLE)	VOID RATIO	DEGREE OF SATURATION (%)	TYPE OF TEST	TOTAL MINOR PRINCIPAL OR NORMAL STRESS (TSF)	DEVIATOR OR MAXIMUM SHEAR STRESS (TSF)	EFFECTIVE MINOR PRINCIPAL STRESS (TSF)	STRAIN (%)	ANGLE OF INTERNAL FRICTION (DEGREES)	COHESION (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)	OVERBURDEN PRESSURE (TSF)	PRECONSOLIDATION PRESSURE (TSF)	COMPRESSION INDEX	SWELLING INDEX	COEFFICIENTR OF PERMEABILITY (CM/SEC)
GTB-2	U-1	6-8	2.75	25.0	85.6	1.01	68.3	CU W/PP	0.50	1.19	0.52	0.05	26.5	0.11						
	U-1	6-8	2.75	31.7	85.5	1.01	86.7	CU W/PP	1.00	1.91	0.97	0.05								
	U-1	6-8	2.75	33.8	84.0	1.11	83.5													
	U-2	40-42	2.79	54.6	76.6	1.27	119.5	UU	0.71	0.70	0.71	0.05	0.00	0.35						
	U-2	40-42	2.79	53.9	68.5	1.54	97.5													
	U-3	55-57	2.83	48.4	74.4	1.38	99.6								0.452					
	U-3	55-57	2.83	44.7	72.5	1.81	69.9													
	U-3	55-57	2.83	50.4	72.4	1.44	99.1	UU	1.50	0.40	1.50	0.05	0.00	0.20						

TRC

Date Drawn: TBT	Date: 04/02/10	Project: CRRA TANK NO. 6 REPLACEMENT	File No.:	153306.039
Checked By: TC	Date: 04/02/10	Client: CONN. RESOURCES RECOVERY AUTHORITY	Table No.:	2

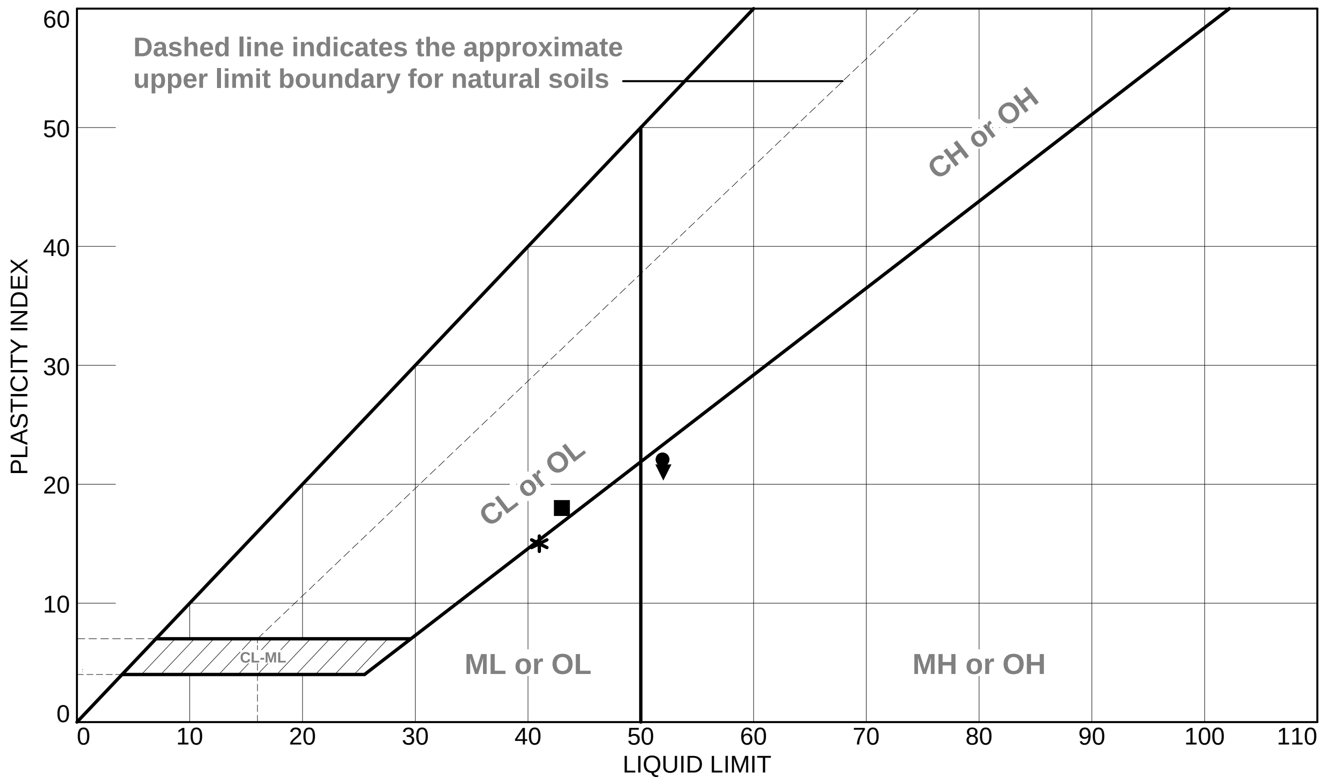
Atterberg Limits and Moisture Content Report



	SOIL DATA							
	SOURCE	**SAMPLE NO.**	**DEPTH**	**NATURAL WATER CONTENT (%)**	**PLASTIC LIMIT (%)**	**LIQUID LIMIT (%)**	**PLASTICITY INDEX (%)**	**USCS**
●	GTB-1	S-2	5-7'	20.5				
■	GTB-1	S-3	10-12'	28.6	NP	NP	NP	
▲	GTB-1	S-4	15-17'	30.3				
◆	GTB-1	S-6	25-27'	30.4				
▼	GTB-1	S-7	30-32'	19.1				
✱	GTB-1	S-8	35-37'	53.7	29	49	20	
⊕	GTB-2	S-3	4-6'	34.6				
⊞	GTB-2	S-4	10-12'	33.2				
⊗	GTB-2	S-5	15-17'	31.3				
⊠	GTB-2	S-6	20-22'	26.6				

TRC Engineers, Inc. Mt. Laurel, NJ	**Client:** CONNECTICUT RESOURCES RECOVERY AUTHORITY **Project:** CRRA TANK NO. 6 REPLACEMENT **Project No.:** 153306.039 **Figure** 1

Atterberg Limits and Moisture Content Report



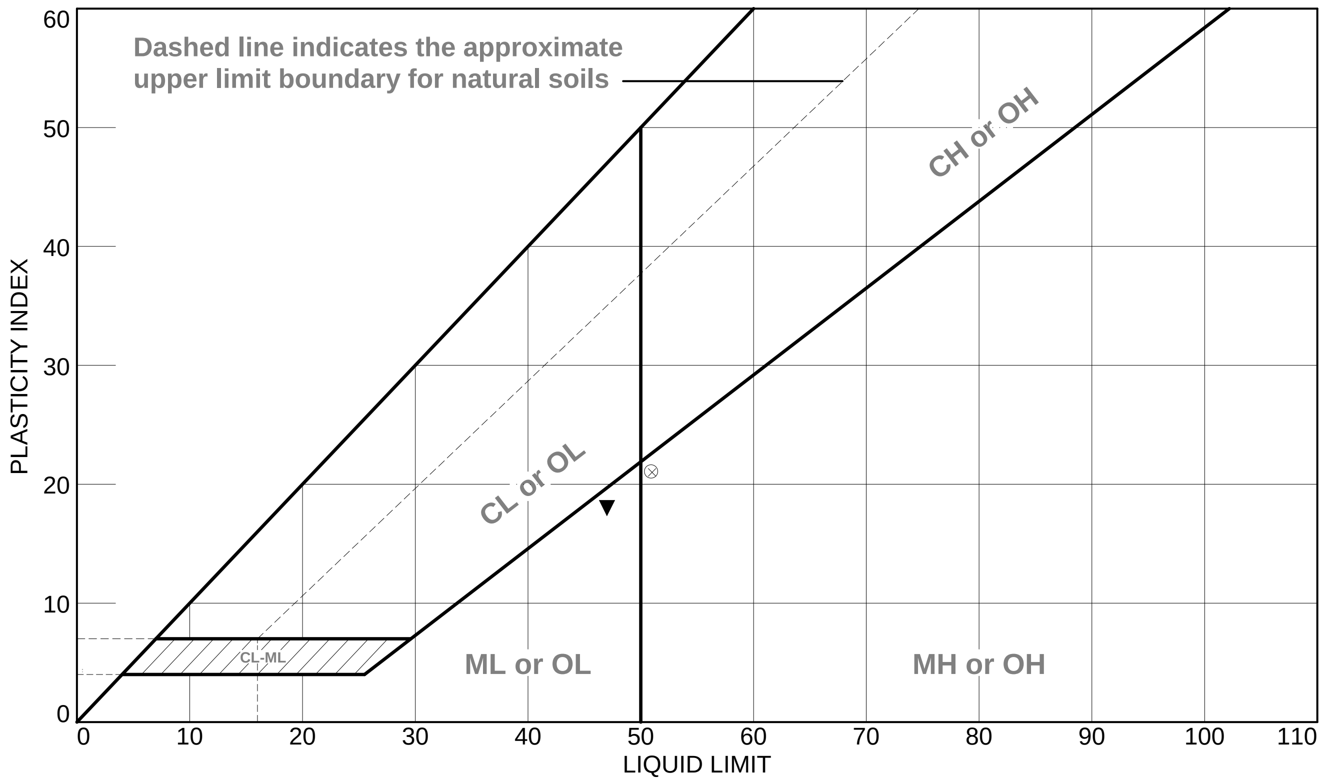
	SOIL DATA							
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	GTB-2	S-10	45-47'	53.6	30	52	22	
■	GTB-2	S-13	65-67'	43.6	25	43	18	
▲	GTB-2	S-14	70-70.5'	12.7				
◆	GTB-2	U-1	6-8'	33.3	26	25	NP	
▼	GTB-2	U-2	40-42'	50.3	31	52	21	MH
✱	GTB-2	U-3	55-57'	44.7	26	41	15	CL

TRC Engineers, Inc.
Mt. Laurel, NJ

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY
Project: CRRA TANK NO. 6 REPLACEMENT

Project No.: 153306.039 **Figure** 2

Atterberg Limits and Moisture Content Report



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	GTB-3	S-3	10-12'	31.0	NP	NP	NP	
■	GTB-3	S-4	15-17'	28.7				
▲	GTB-3	S-5	20-22'	32.6				
◆	GTB-3	S-6 & S-7	25-27' & 30-30.5'	19.4				SW
▼	GTB-3	S-8	35-37'	52.2	29	47	18	
✱	GTB-4	S-2	5-7'	28.5				
⊕	GTB-4	S-3	10-12'	33.5				
⊞	GTB-4	S-4	15-17'	30.5				
⊗	GTB-4	s-9	35-37'	57.2	30	51	21	

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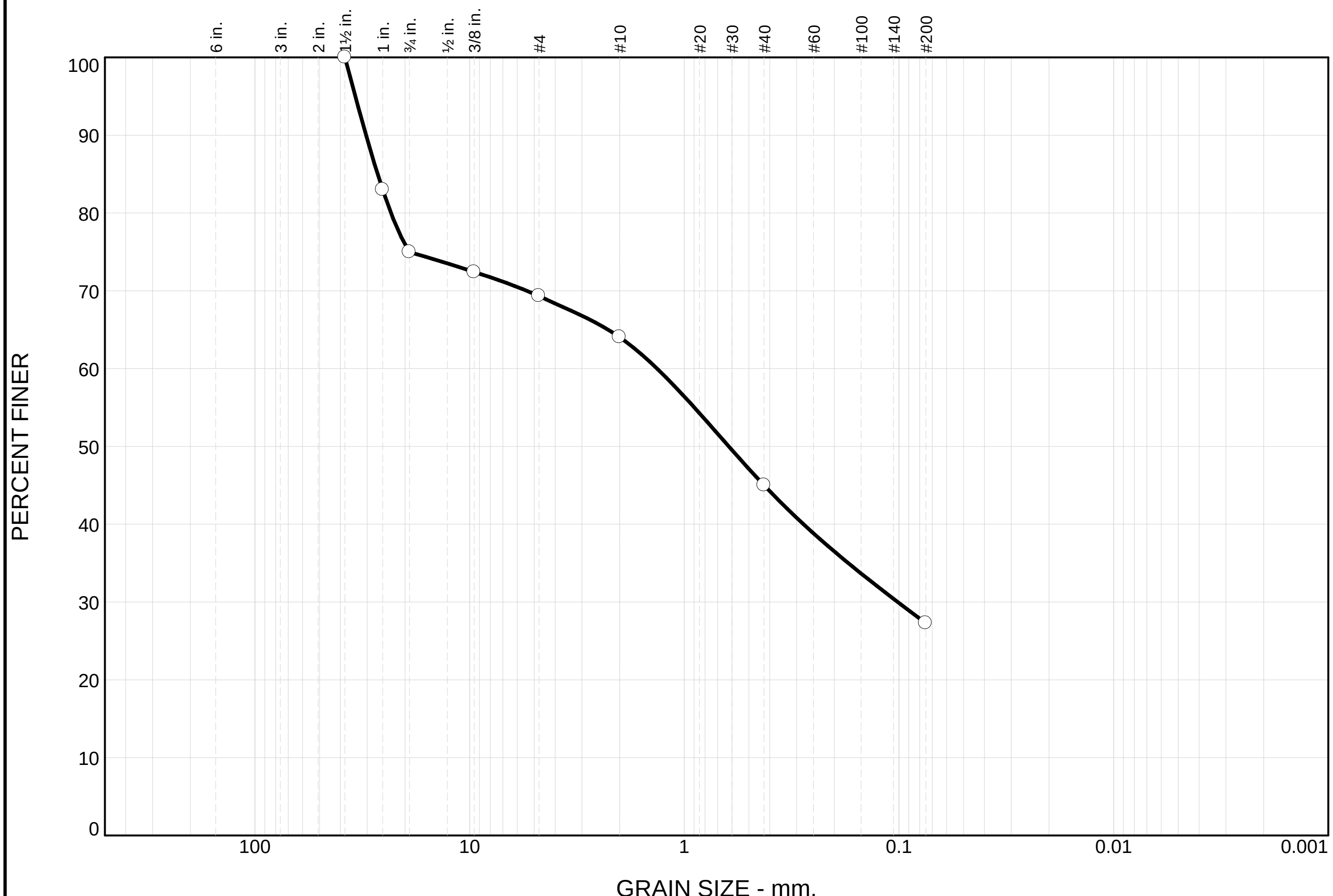
Engineers, Inc.
Mt. Laurel, NJ

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY
Project: CRRA TANK NO. 6 REPLACEMENT

Project No.: 153306.039 **Figure** 3

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	25.0	5.7	5.3	19.0	17.7	27.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			26.8121	1.3394	0.6203	0.1013				

Material Description	USCS	AASHTO
○ DARK BROWN GRAVELLY M/F/C SAND, SM SILT		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-1 **Depth:** 5-7' **Sample Number:** S-2

Remarks:

○Material contains a high percentage of coal. Strong Gas/ Petro Odor

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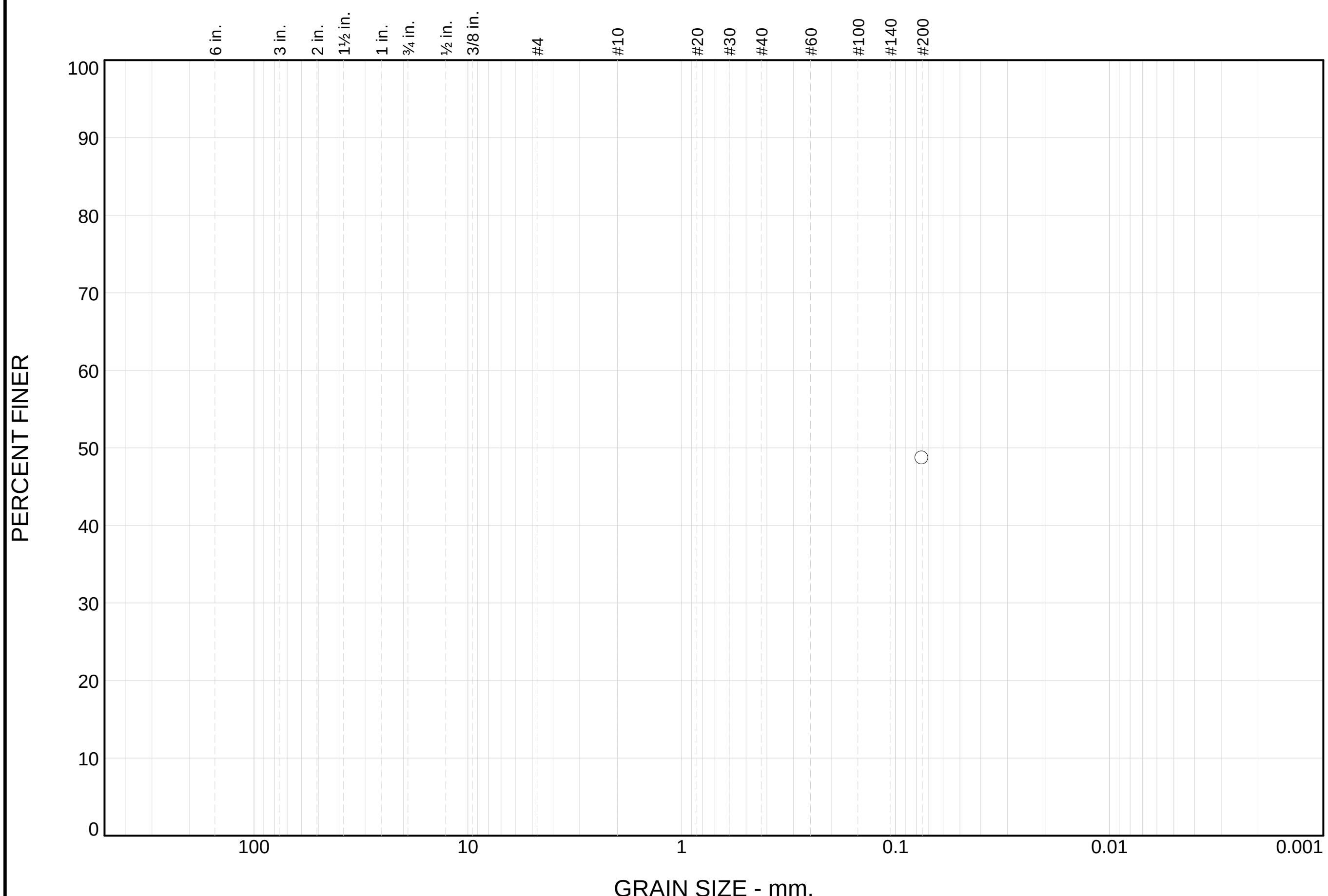
Figure 4

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							48.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ GRAY MICACEOUS SANDY SILT		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY
Project: CRRA TANK NO. 6 REPLACEMENT

○ **Sample Source:** GTB-1 **Depth:** 10-12' & 15-17' **Sample No.:** S-3 & S-4

Remarks:

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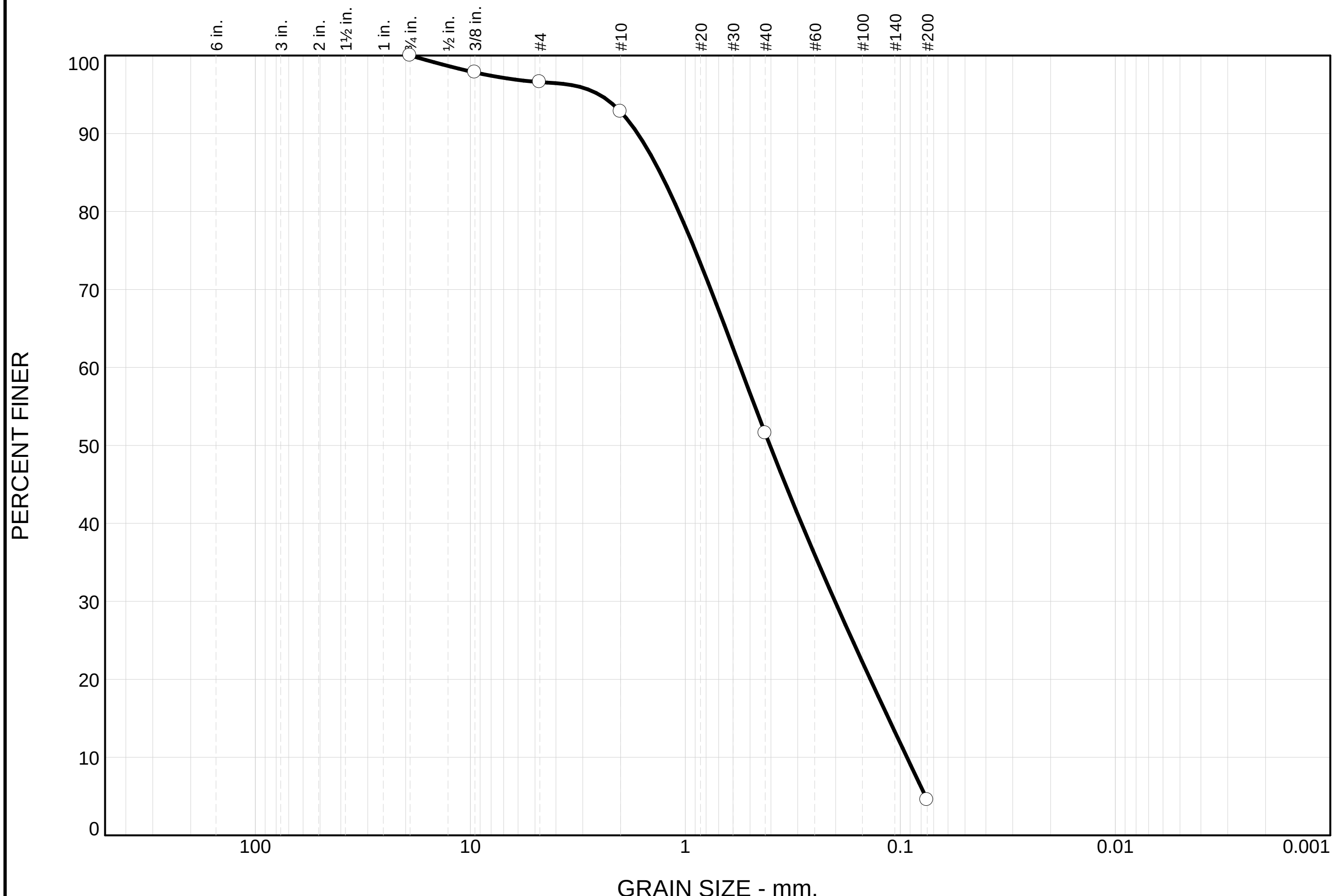
Figure 5

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.4	3.8	41.2	47.0	4.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3091	0.5551	0.4040	0.2012	0.1134	0.0931	0.78	5.96

	Material Description	USCS	AASHTO
○	GRAY F/M/C SAND, TR SILT, TR F/ GRAVEL	SP	

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Sample Source:** GTB-1 **Depth:** 25-27' & 30-32' **Sample No.:** S-6 & S-7

Remarks:

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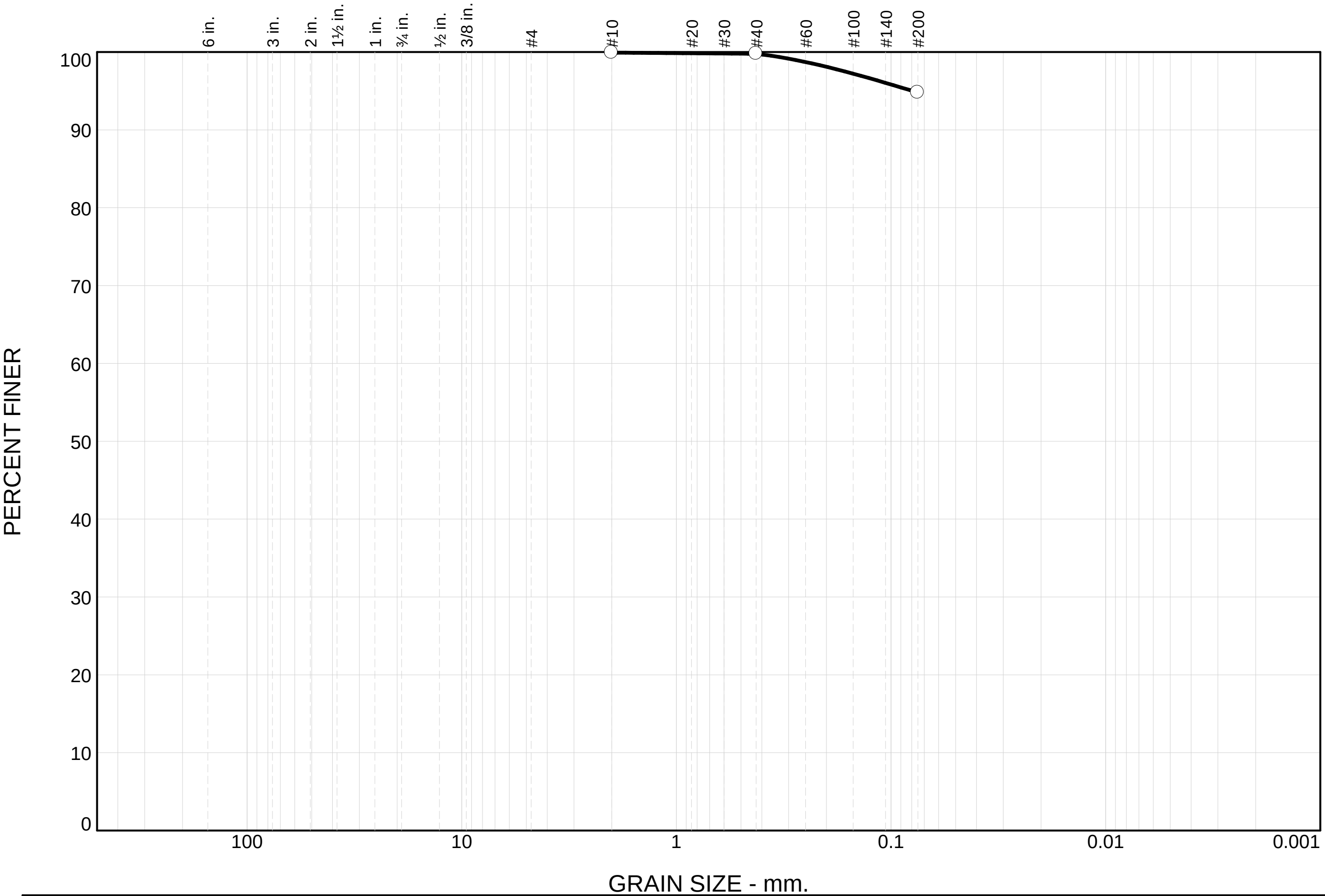
Figure 6

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					0.1	5.0	94.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25	26								

Material Description	USCS	AASHTO
○ GRAY MICACEOUS SILT, TR F/ SAND		A-4(0)

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-2 **Depth:** 6-8' **Sample Number:** U-1

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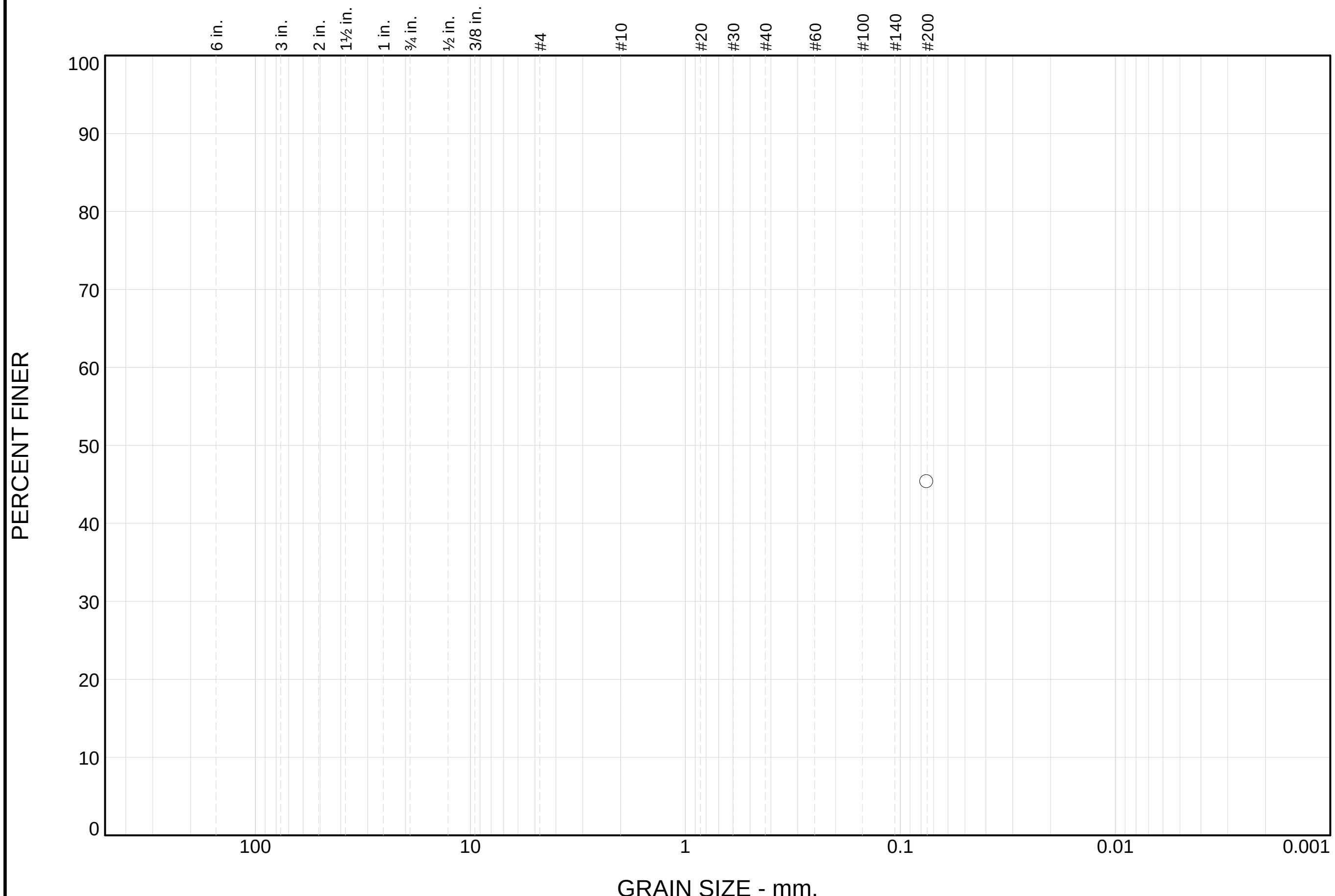
Remarks:

Figure 7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							45.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ DARK GRAY SILTY F/M SAND		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY
Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-2 **Depth:** 15-17' **Sample Number:** S-5

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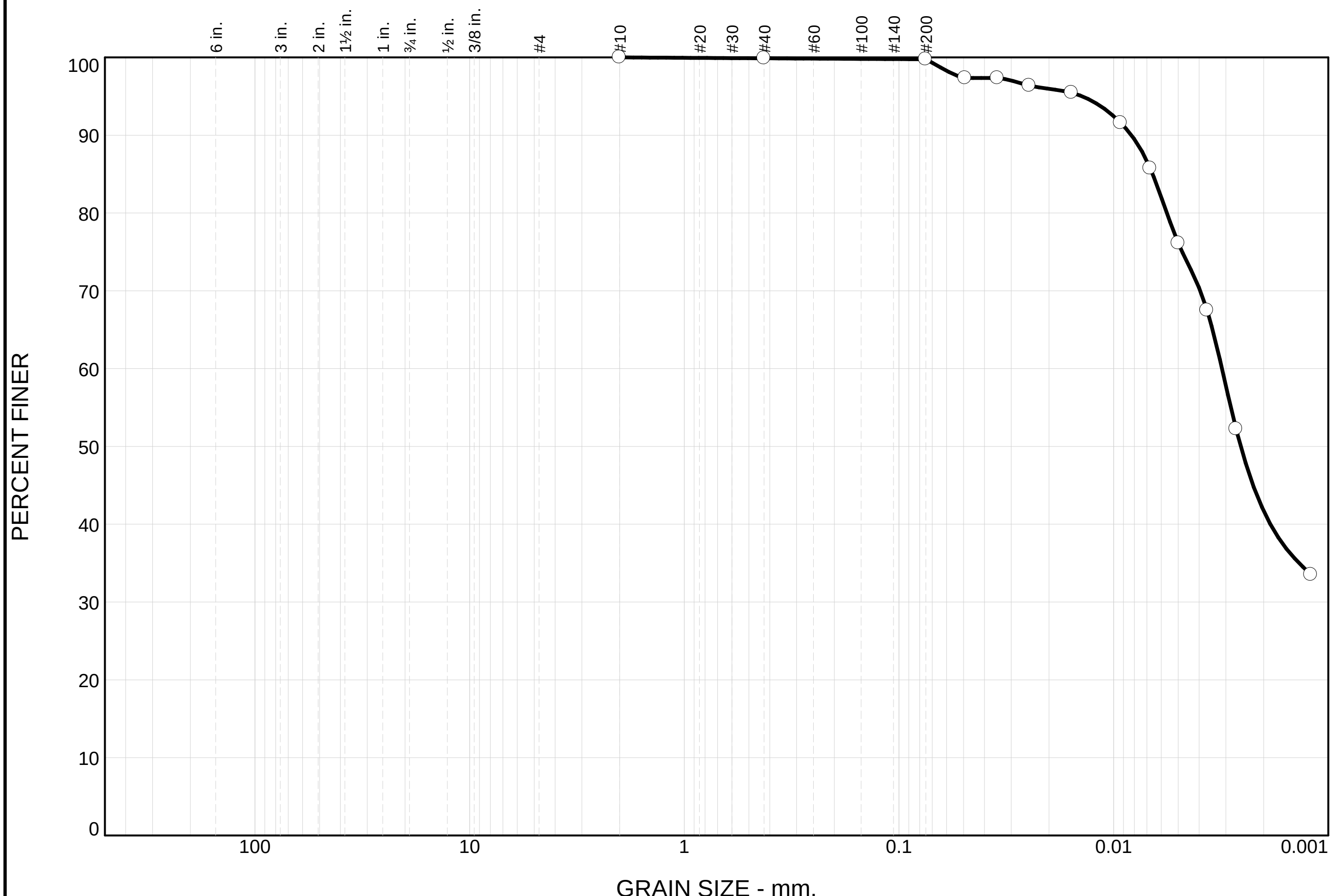
Remarks:
○Slight Gas/Petro Odor. Material contains a high percentage of Mica.

Figure 8

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.1	23.7	76.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	52	31			0.0026					

Material Description	USCS	AASHTO
○ BROWN CLAY, SM SILT	MH	A-7-5(26)

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-2 **Depth:** 40-42' **Sample Number:** U-2

Remarks:

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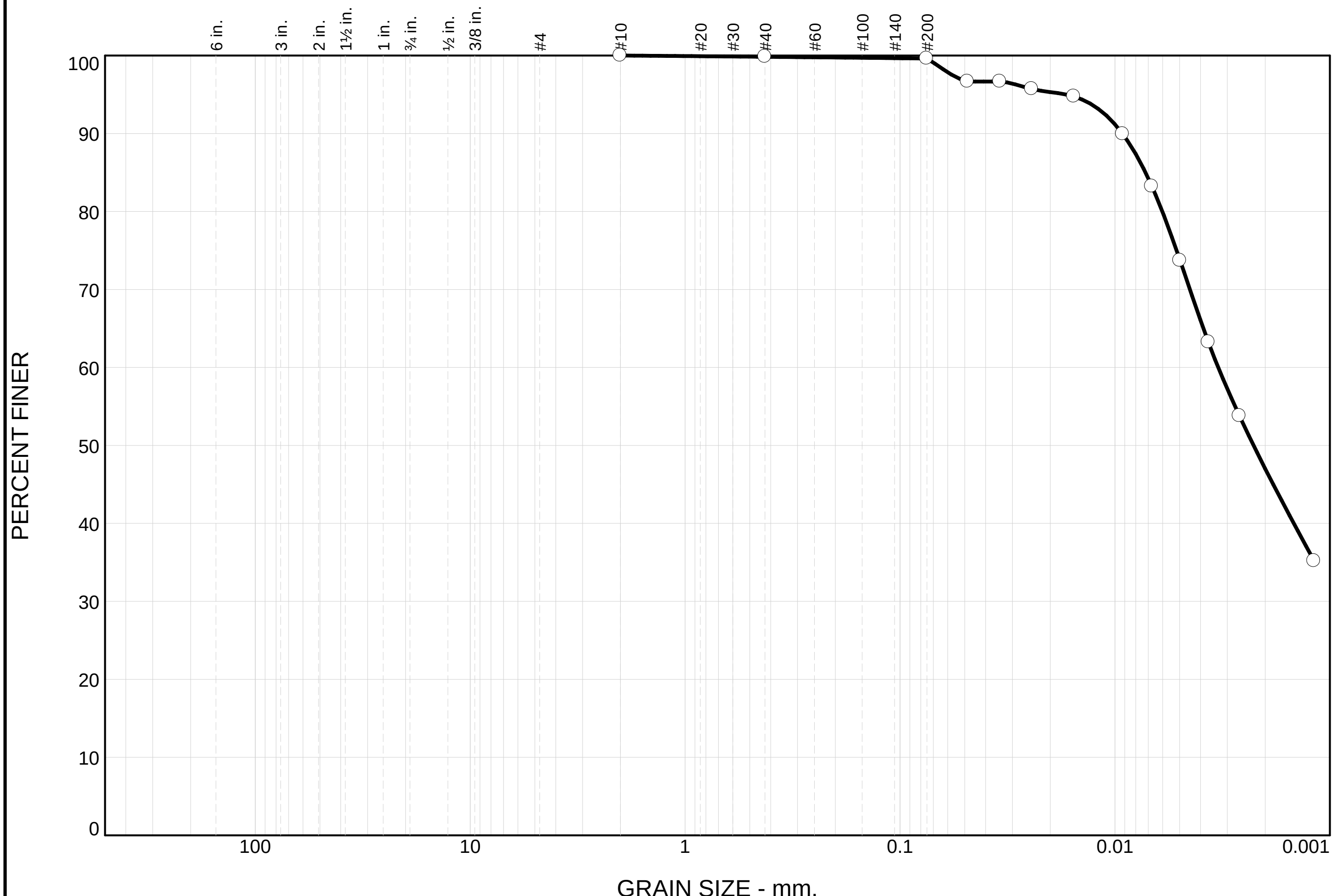
Figure 9

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	0.2	25.7	73.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	41	26			0.0023					

Material Description	USCS	AASHTO
○ BROWN CLAY, SM SILT	CL	A-7-6(18

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-2 **Depth:** 55-57' **Sample Number:** U-3

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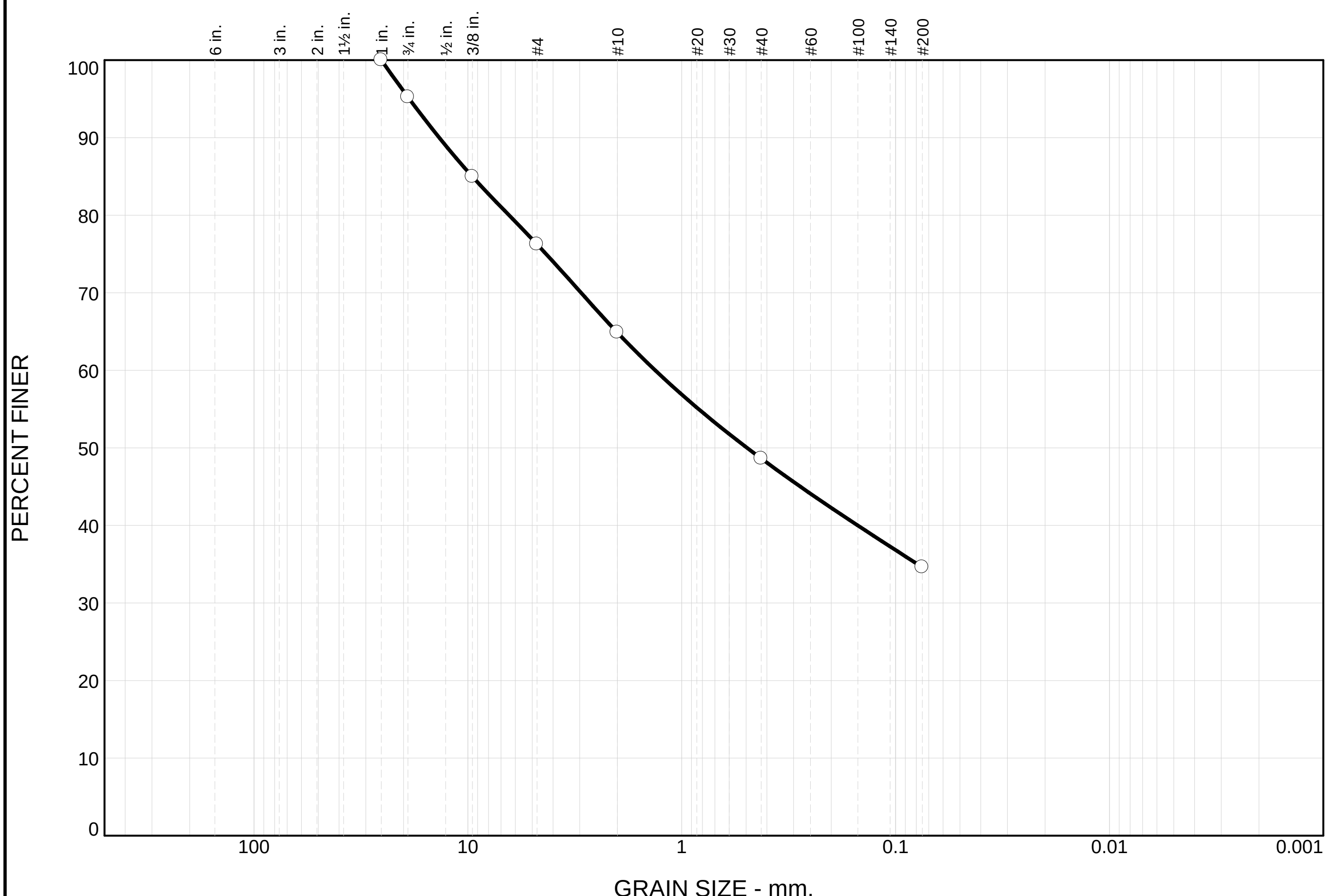
Remarks:

Figure 10

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.8	18.9	11.4	16.3	14.0	34.6	

╳	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			9.5402	1.3299	0.4948					

Material Description	USCS	AASHTO
○ BROWN SILTY M/F/C SAND, SM F/C GRAVEL		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-2 **Depth:** 70-70.5' **Sample Number:** S-14

Remarks:

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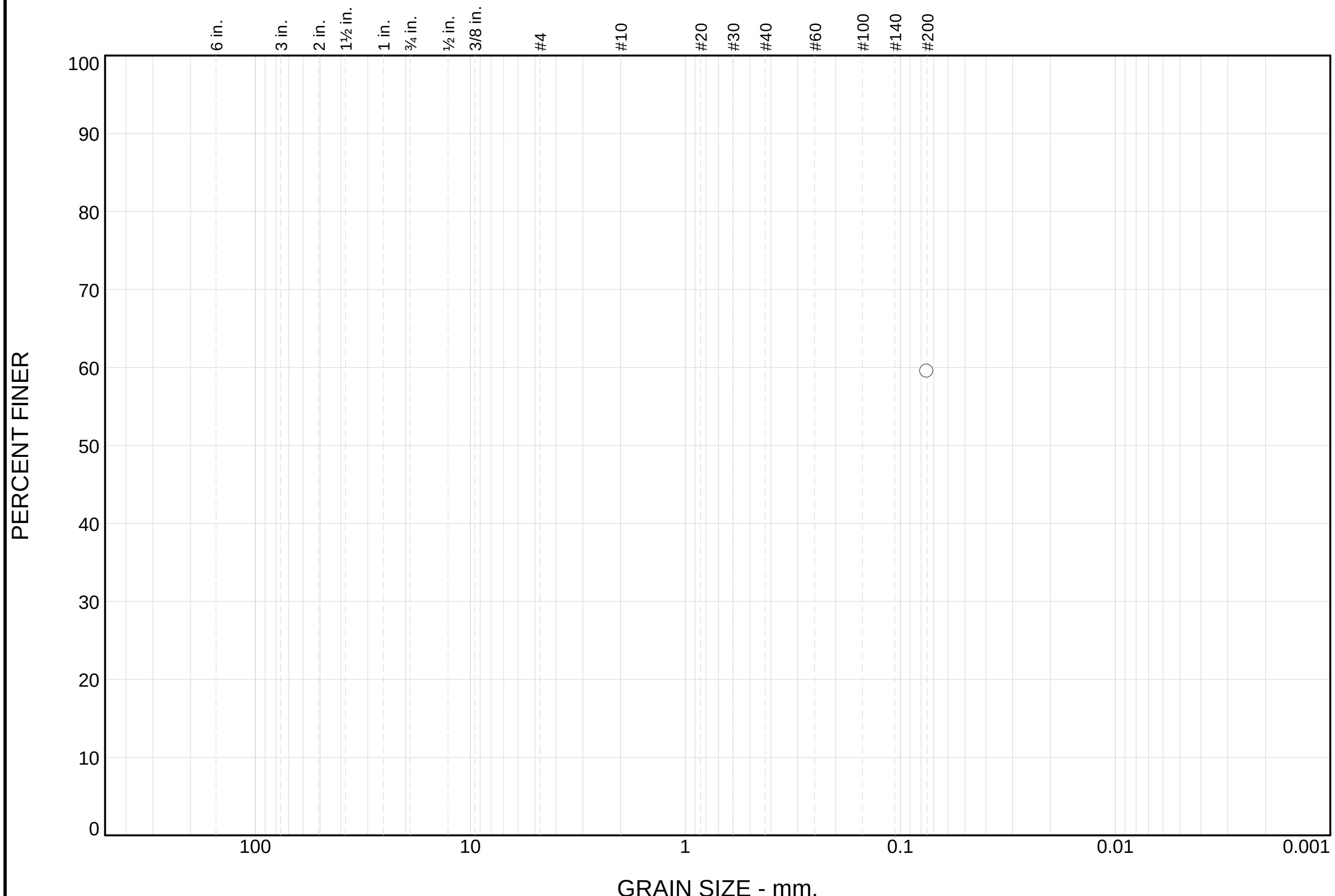
Figure 11

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							59.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP								

Material Description	USCS	AASHTO
○ GRAY MICACEOUS SAND, SM SILT		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-3 **Depth:** 10-12' **Sample Number:** S-3

Remarks:

○Sample contained high percentage of Mica

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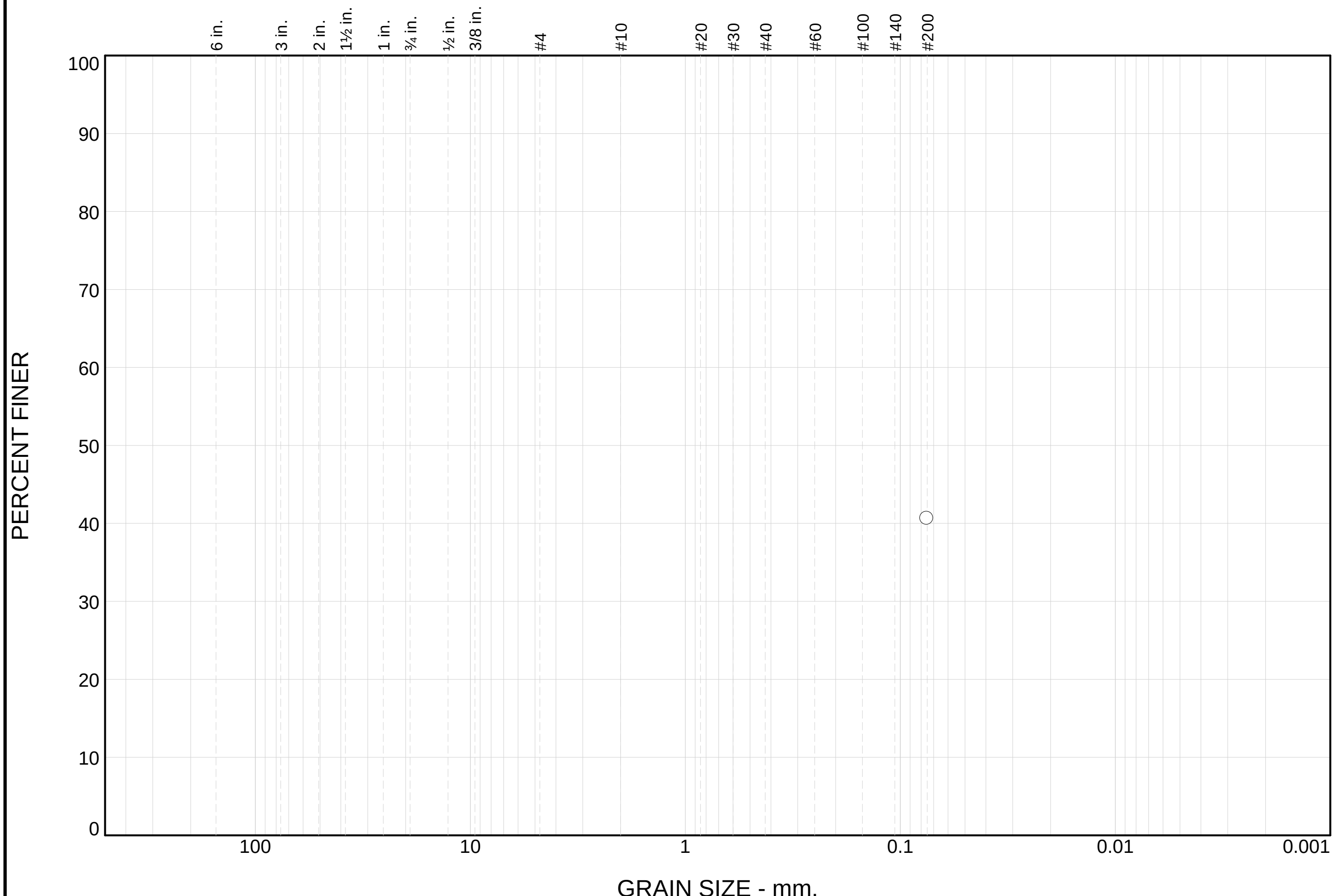
Figure 12

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							40.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ GRAY SILTY F/M SAND		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY
Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-3 **Depth:** 15-17' **Sample Number:** S-4

Remarks:
○Strong Gas/Petro Odor. Maerial contains a high percentage of Mica

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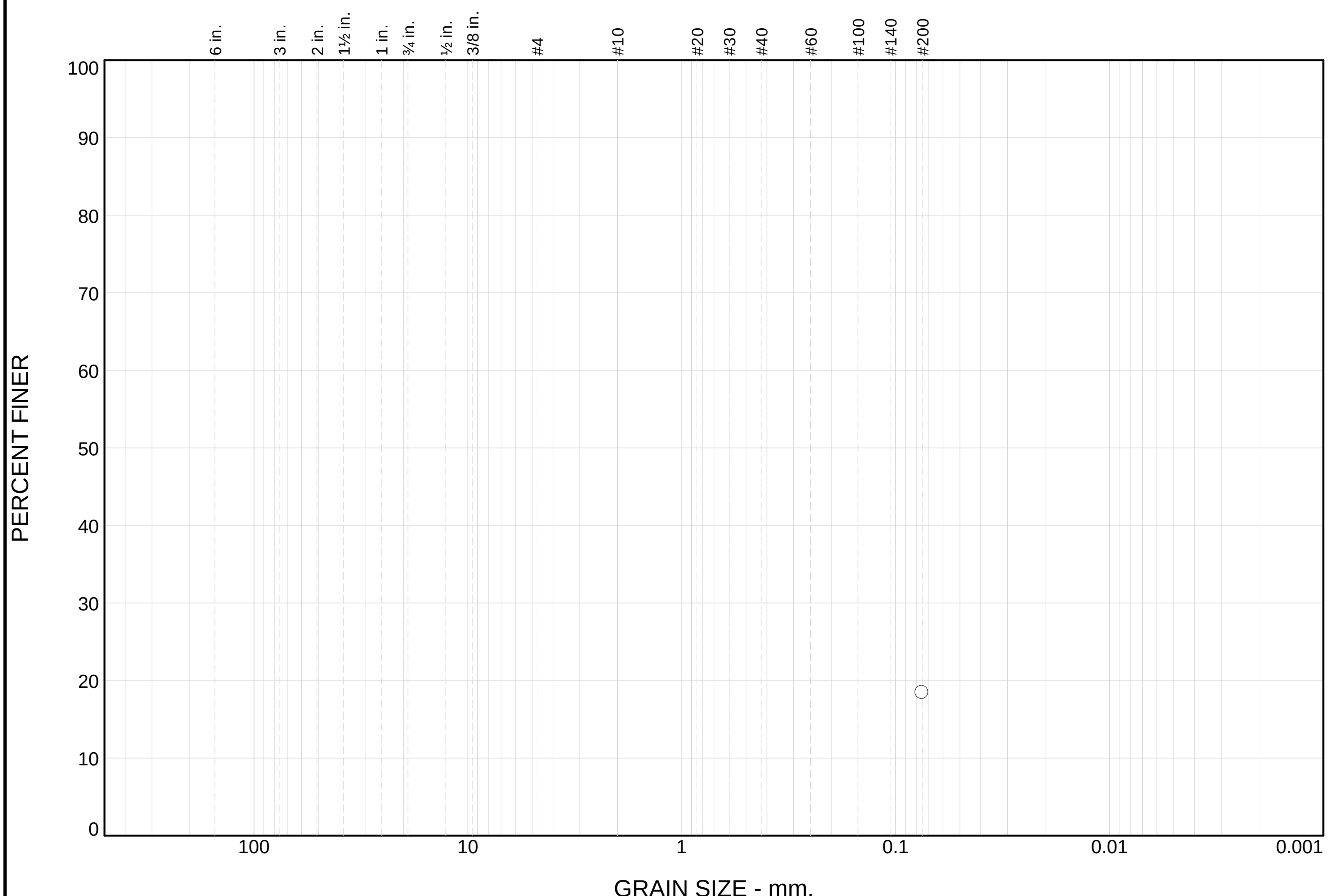
Figure 13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							18.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ DARK GRAY F/M/C SAND, SM SILT, TR GRAVEL		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-3 **Depth:** 20-22' **Sample Number:** S-5

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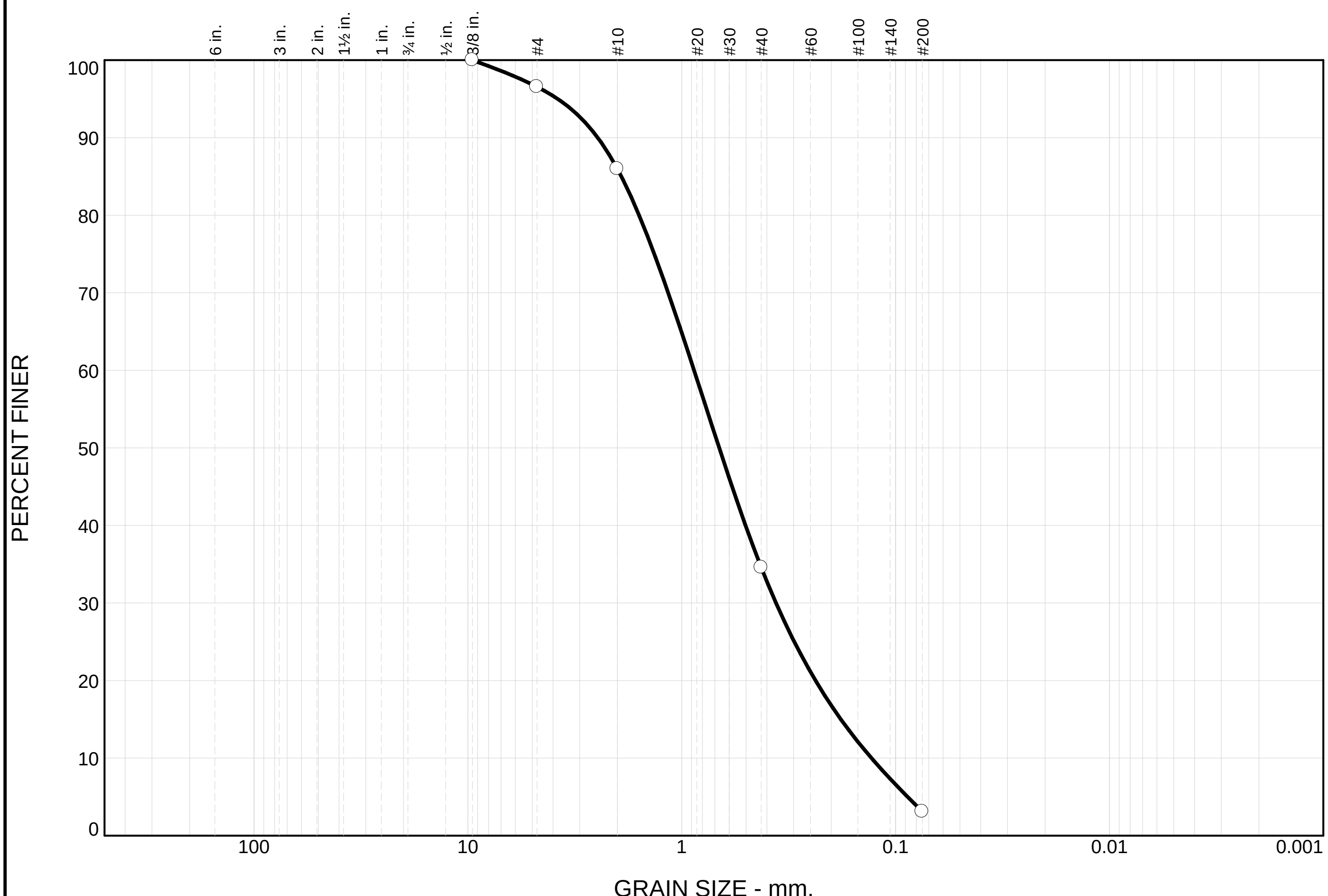
Remarks:

○Strong Gas/Petro Odor. Material contains wood chips

Figure 14

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.5	10.5	51.4	31.5	3.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.9156	0.8757	0.6679	0.3625	0.1803	0.1296	1.16	6.76

Material Description	USCS	AASHTO
○ DARK GRAY M/F/C SAND, TR F/ GRAVEL, TR SILT	SW	

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Sample Source:** GTB-3 **Depth:** 25-27' & 30-30.5' **Sample No.:** S-6 & S-7

Remarks:

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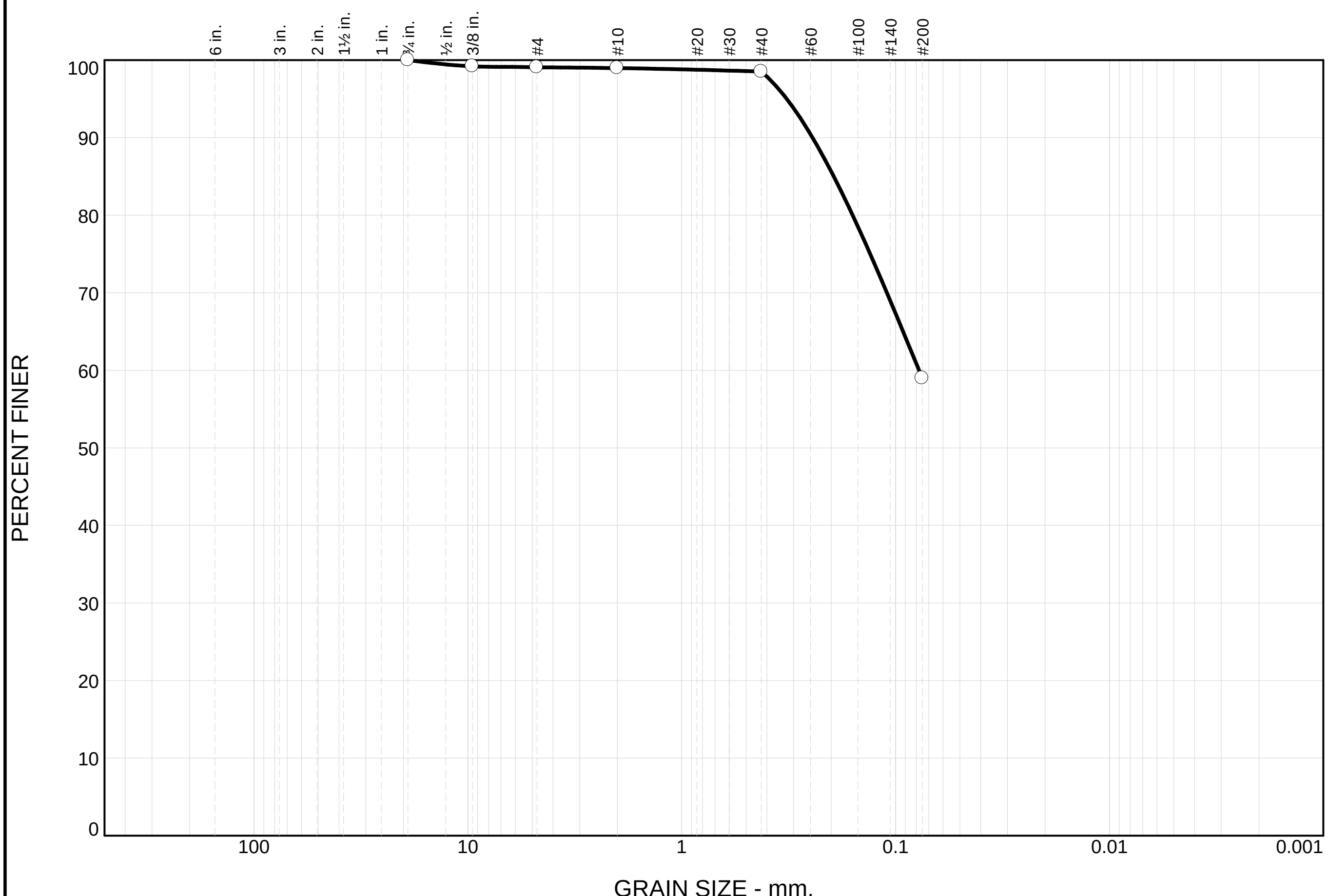
Figure 15

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.9	0.1	0.5	39.5	59.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1946	0.0777						

Material Description	USCS	AASHTO
○ DARK GRAY SANDY SILT, TR F/ GRAVEL		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-4 **Depth:** 5-7' **Sample Number:** S-2

Remarks:

○Material contains a high percentage of coal and Mica (Material retained above a #10 Sieve consists of all coal). Strong Gas/Petro Odor.

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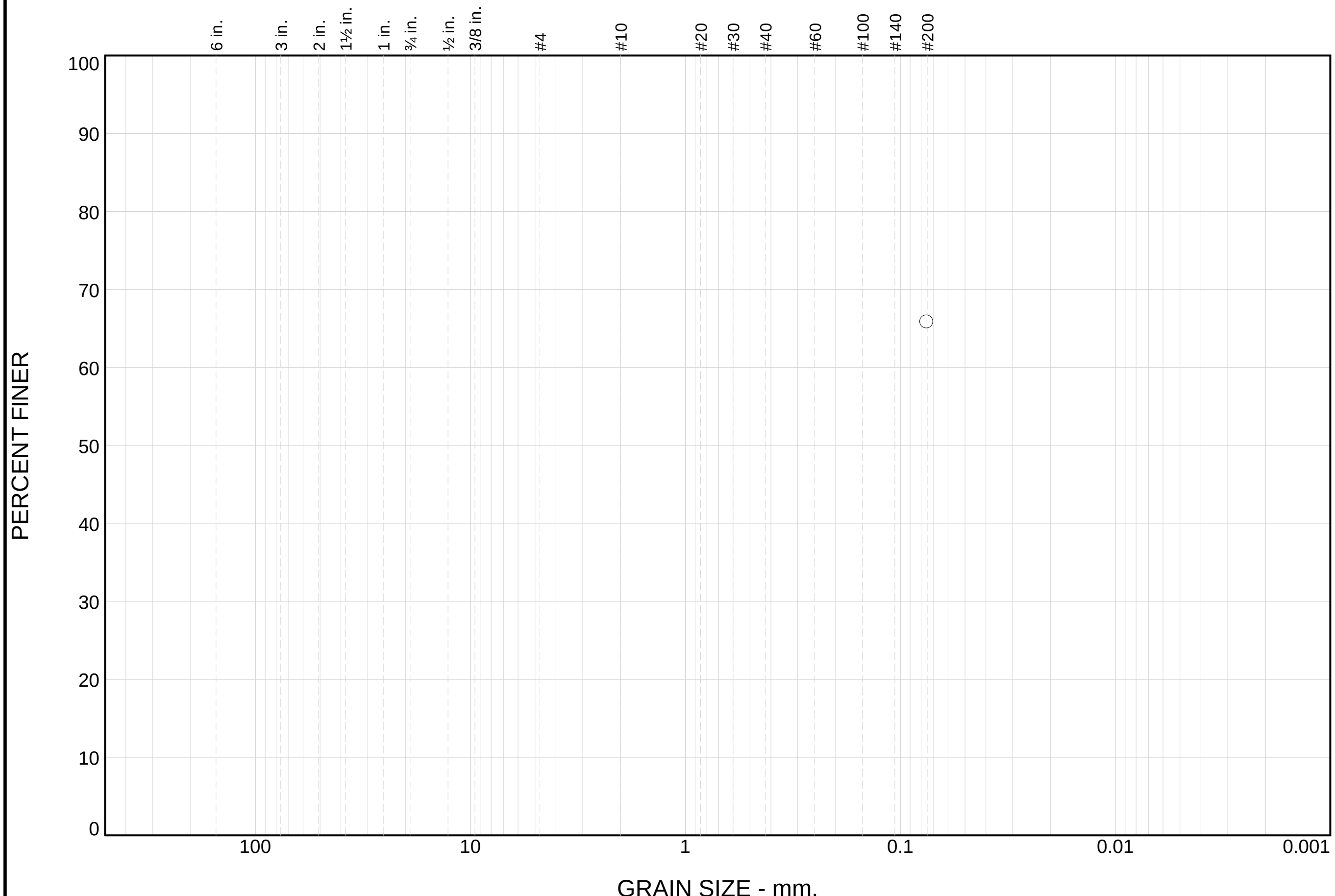
Figure 16

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						65.8	

LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u

Material Description	USCS	AASHTO
○ DARK GRAY SANDY SILT		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-4 **Depth:** 10-12' **Sample Number:** S-3

Remarks:
○Strong Gas/Petro Odor

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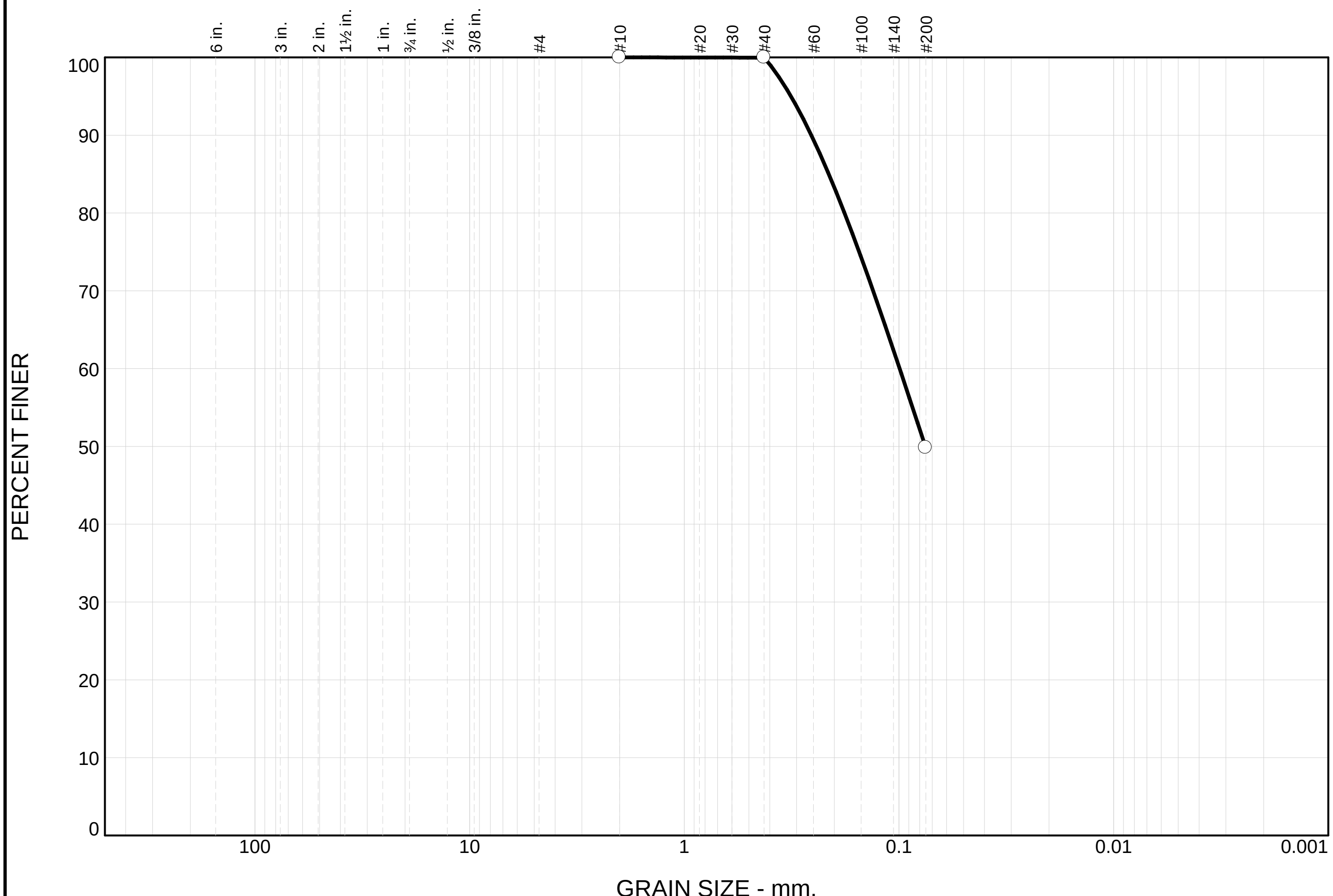
Figure 17

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	50.2	49.8	

╳	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2124	0.0993	0.0754					

Material Description	USCS	AASHTO
○ DARK GRAY SILTY F/ SAND		

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

○ **Source of Sample:** GTB-4 **Depth:** 15-17' **Sample Number:** S-4

Remarks:

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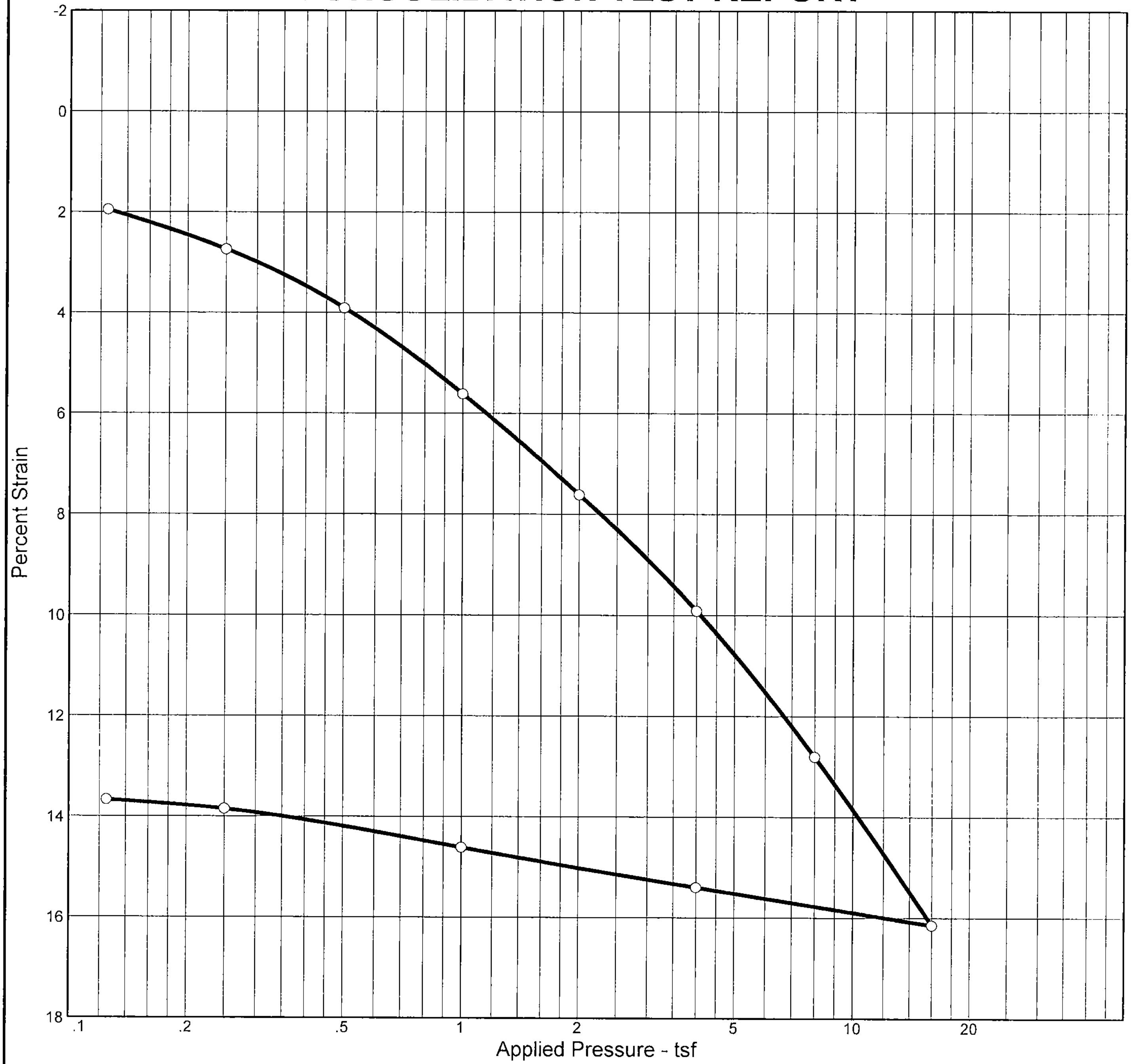
Figure 18

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
83.5 %	33.8 %	84.0	25	NP	2.75		A-4(0)	1.113

MATERIAL DESCRIPTION

GRAY MICACEOUS SILT, TR F/ SAND

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 **Sample No.:** U-1 **Elev./Depth:** 6-8'

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Remarks:

Figure 19

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 Sample No.: U-1 Elev./Depth: 6-8'

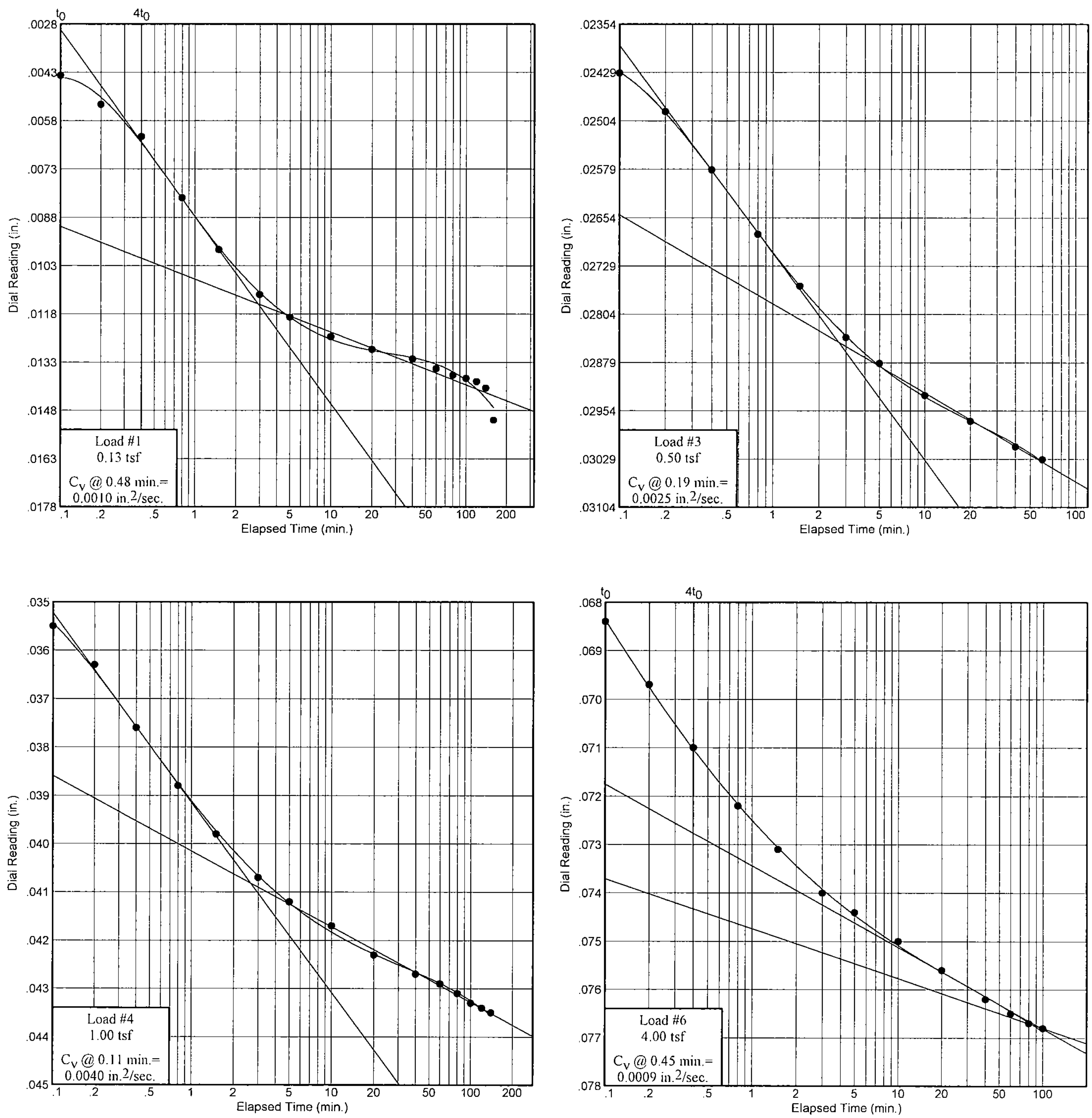

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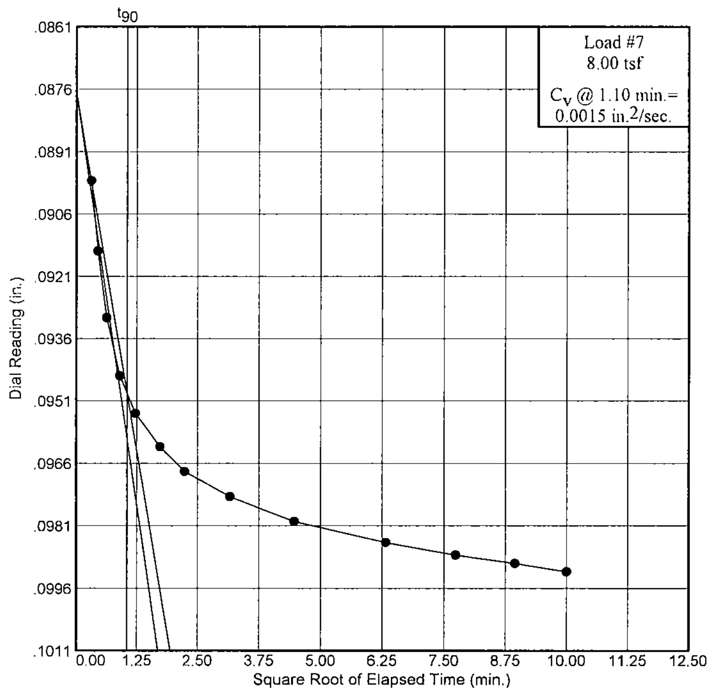
Figure 19

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 | Sample No.: U-1 | Elev./Depth: 6-8'



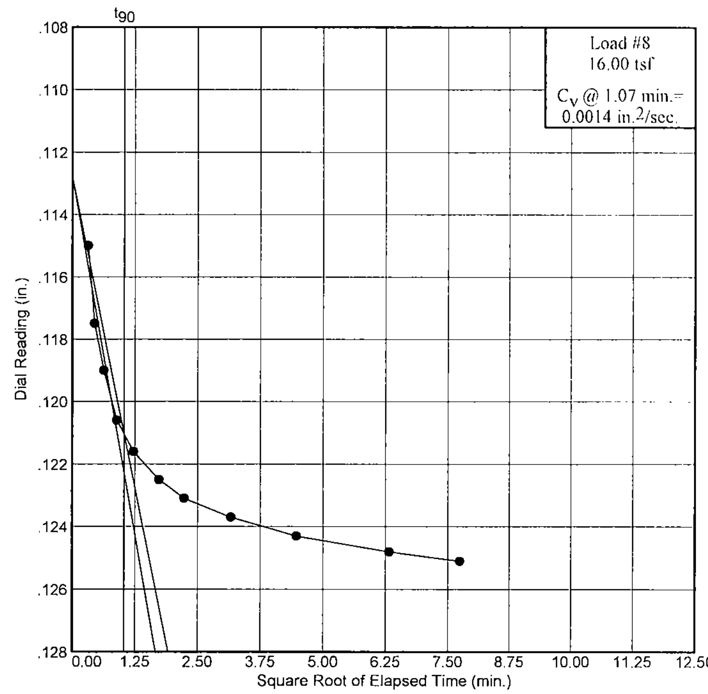


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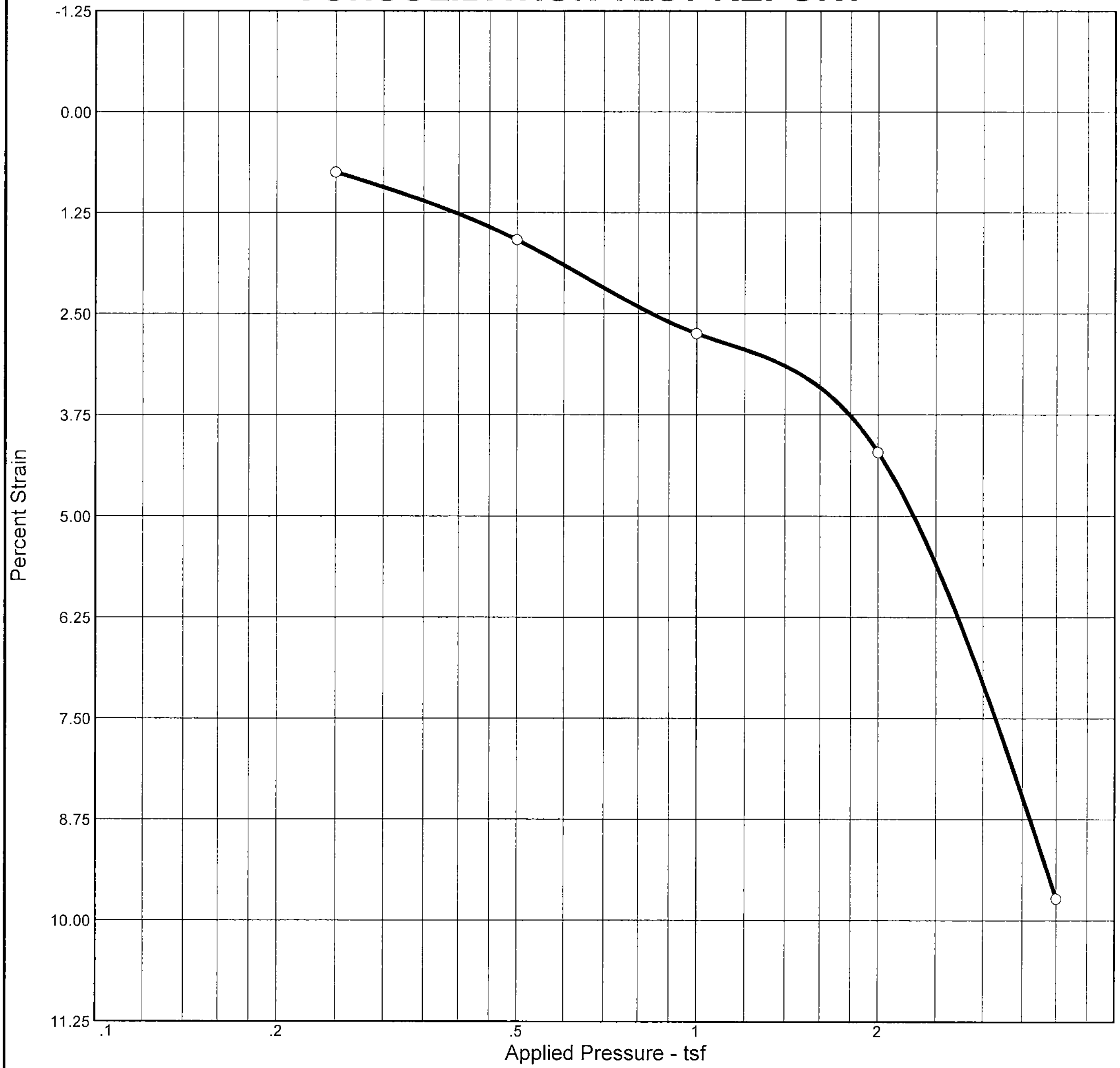
Figure 19

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
97.5 %	53.9 %	68.5	52	21	2.79	MH	A-7-5(26)	1.542

MATERIAL DESCRIPTION

BROWN CLAY, SM SILT

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 **Sample No.:** U-2 **Elev./Depth:** 40-42'

Remarks:

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Figure 20

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 Sample No.: U-2 Elev./Depth: 40-42'

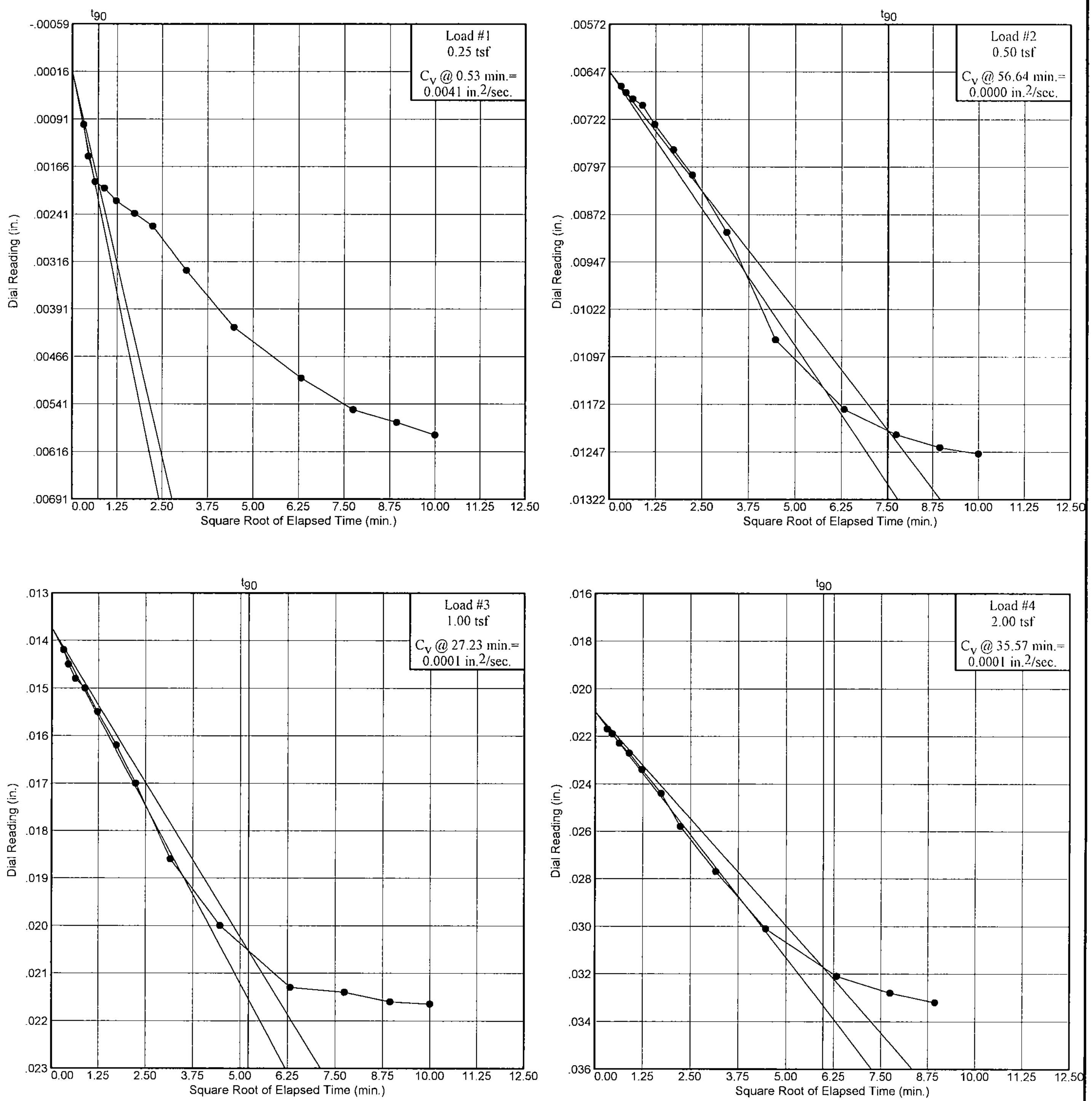

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Figure 20

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 Sample No.: U-2 Elev./Depth: 40-42'

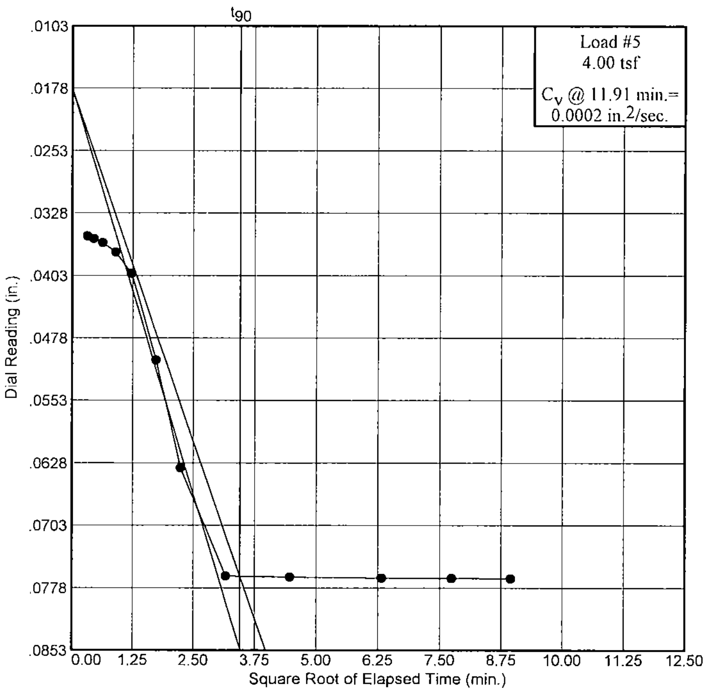

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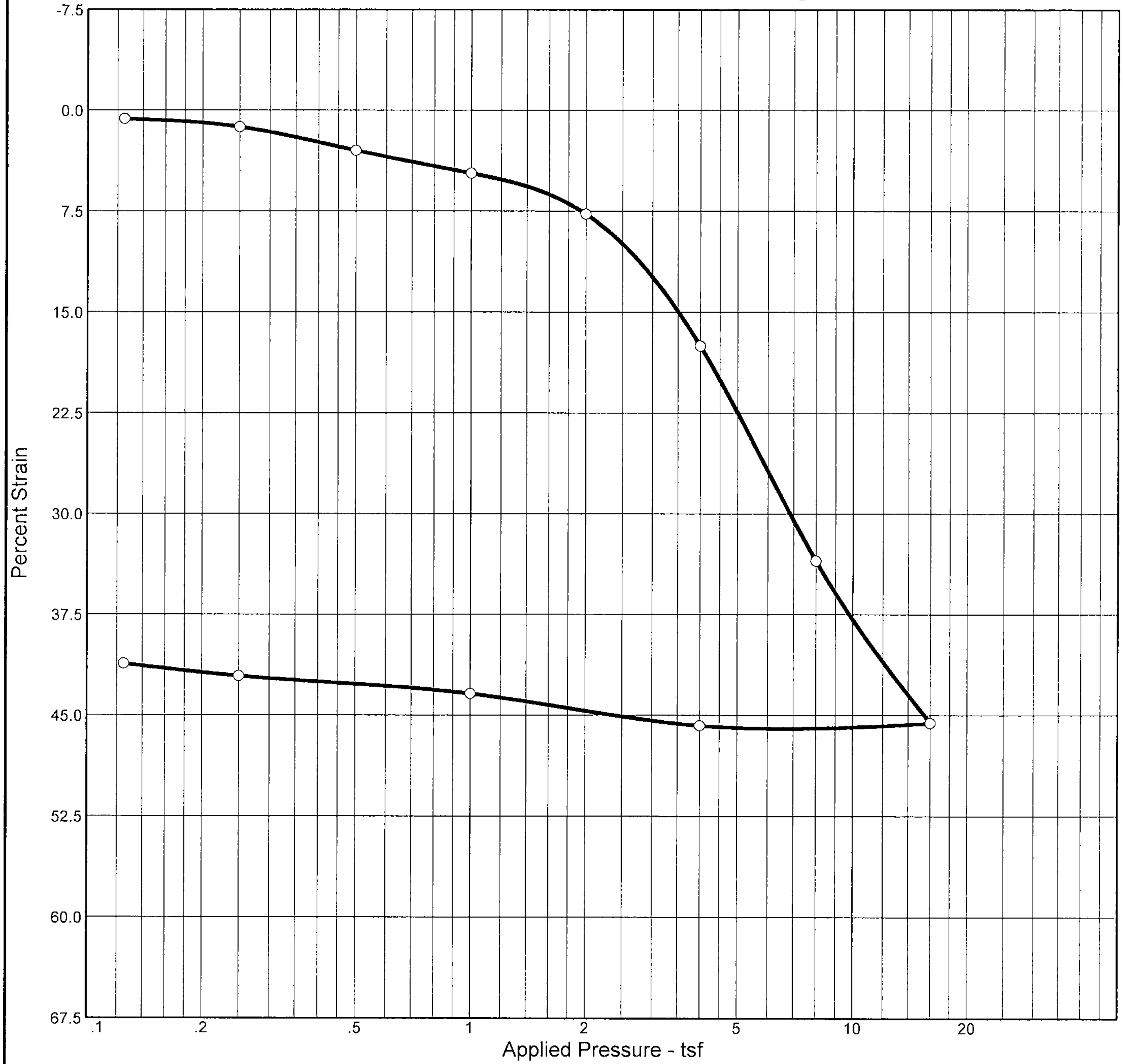
Figure 20

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
69.9 %	44.7 %	72.5	41	15	2.83	CL	A-7-6(18	1.811

MATERIAL DESCRIPTION

BROWN CLAY, SM SILT

Project No. 153306.039 **Client:** CONNECTICUT RESOURCES RECOVERY

Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 **Sample No.:** U-3 **Elev./Depth:** 55-57'

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:

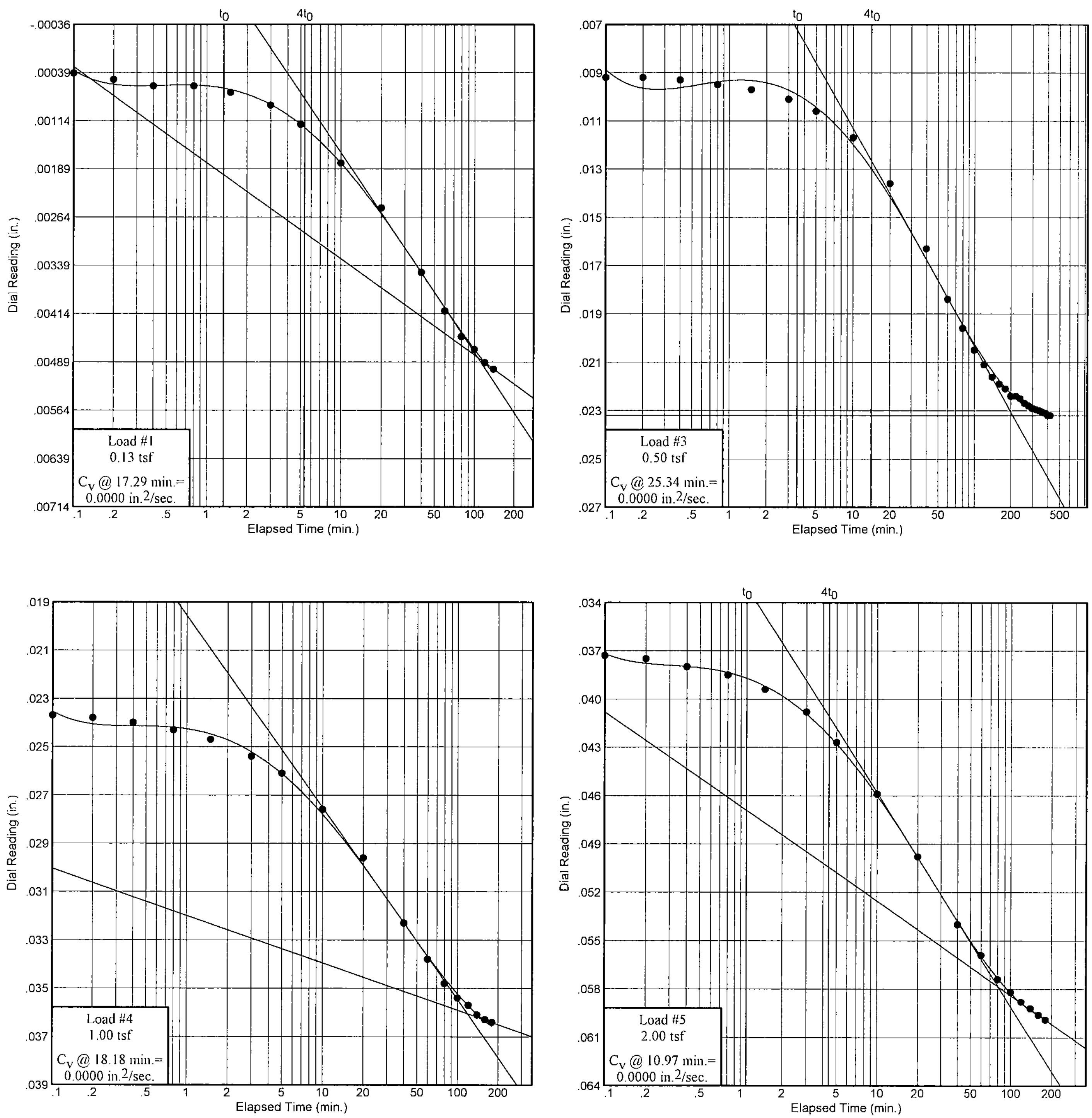
Material Pushed out around seating load during last load increment (16tsf)

Figure 21

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 Sample No.: U-3 Elev./Depth: 55-57'



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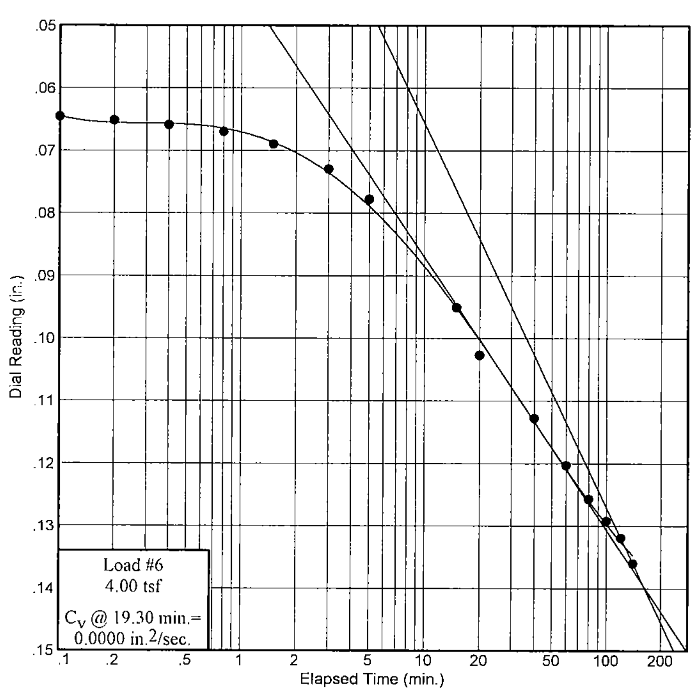
Mt. Laurel, NJ

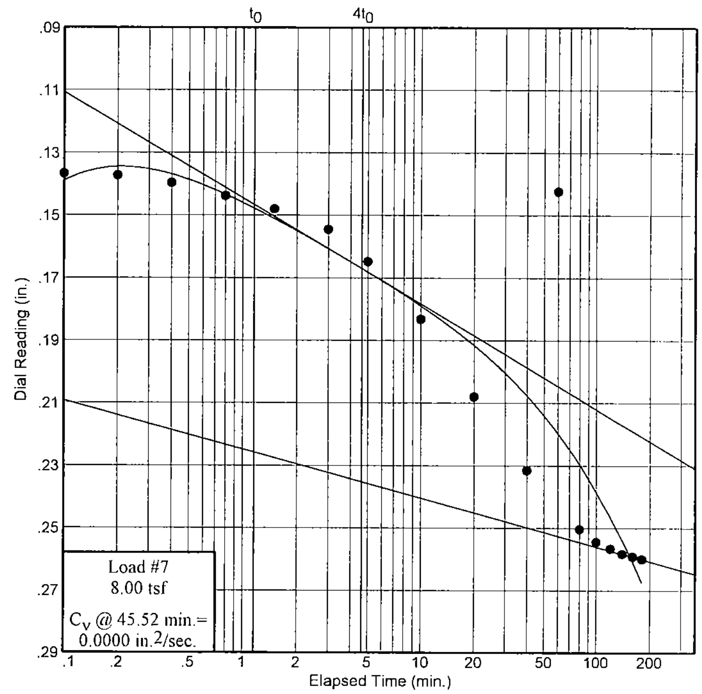
Figure 21

Dial Reading vs. Time

Project No.: 153306.039
Project: CRRA TANK NO. 6 REPLACEMENT

Source: GTB-2 Sample No.: U-3 Elev./Depth: 55-57'





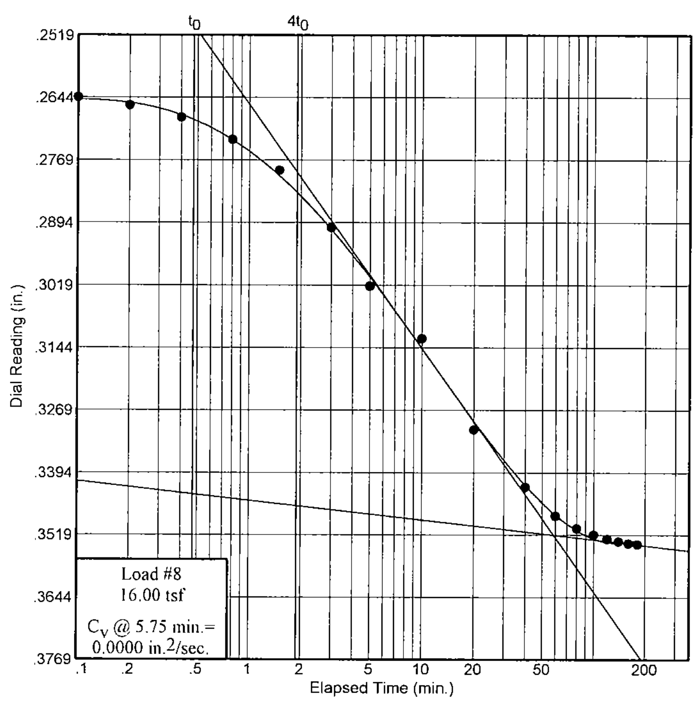


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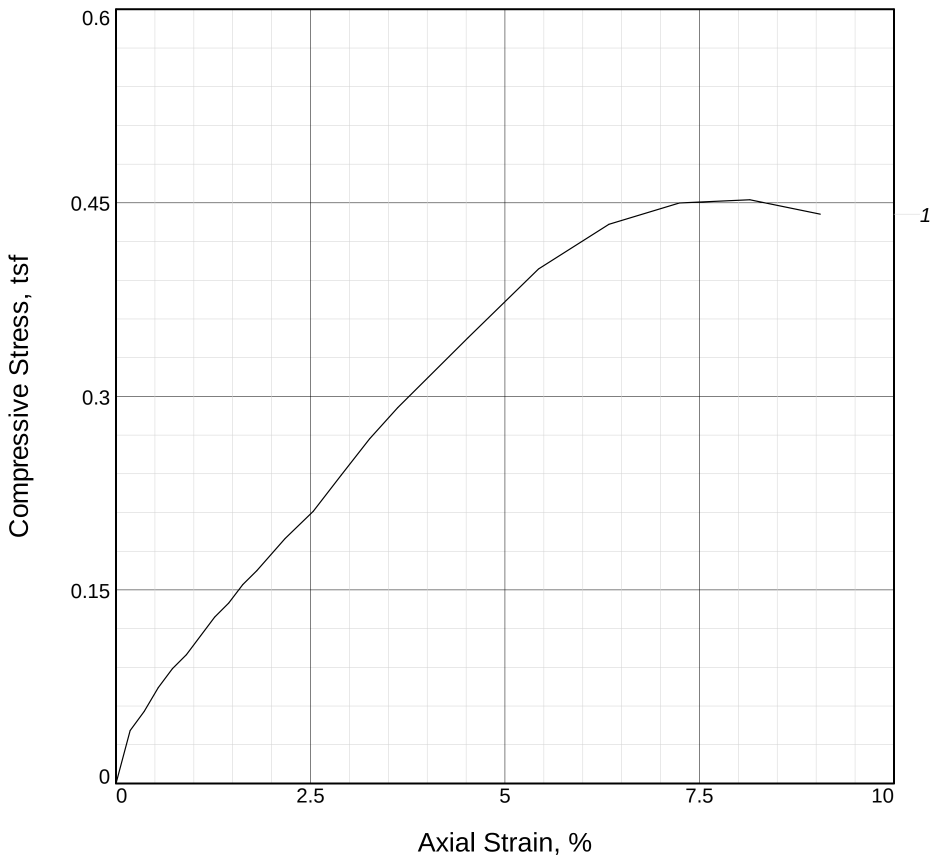
Figure 21

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.452			
Undrained shear strength, tsf	0.226			
Failure strain, %	8.1			
Strain rate, in./min.	0.05			
Water content, %	48.4			
Wet density, pcf	110.4			
Dry density, pcf	74.4			
Saturation, %	99.6			
Void ratio	1.3746			
Specimen diameter, in.	2.85			
Specimen height, in.	5.52			
Height/diameter ratio	1.94			

Description: BROWN CLAY, SM SILT

LL = 41	**PL =** 26	**PI =** 15	**GS=** 2.83	**Type:**

Project No.: 153306.039

Date Sampled:

Remarks:
Sample 2 - Remolded

Figure 22

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

Project: CRRA TANK NO. 6 REPLACEMENT

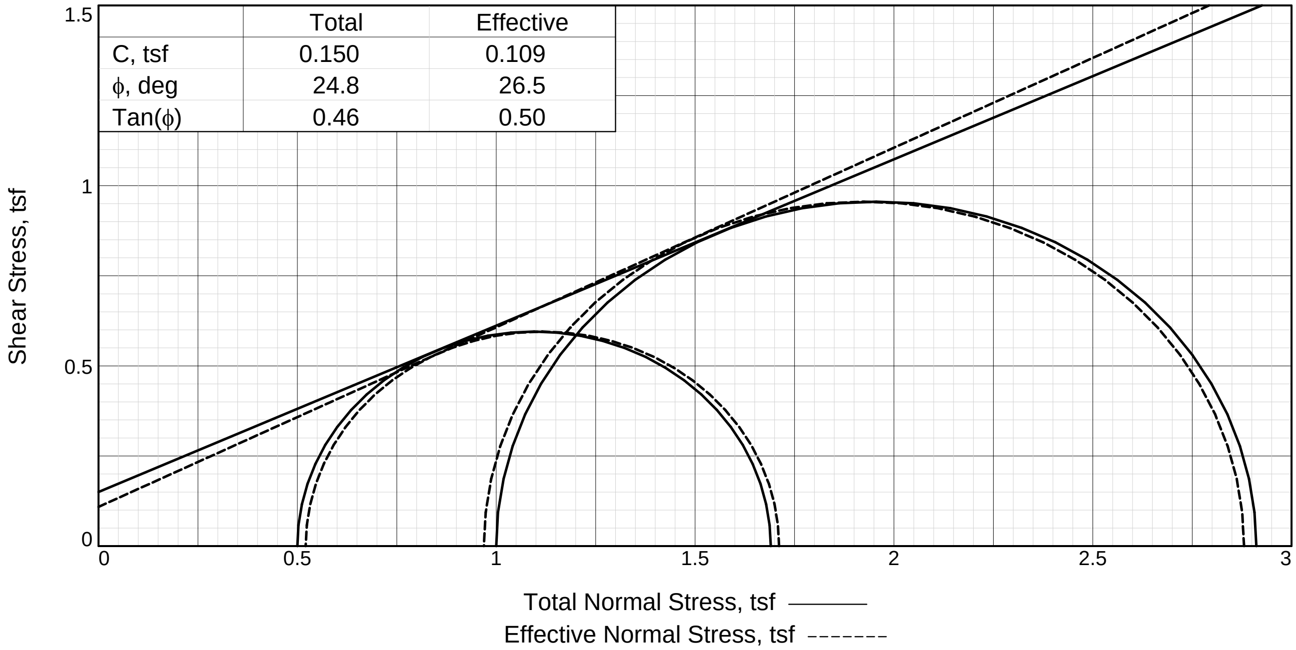
Source of Sample: GTB-2 **Depth:** 55-57'

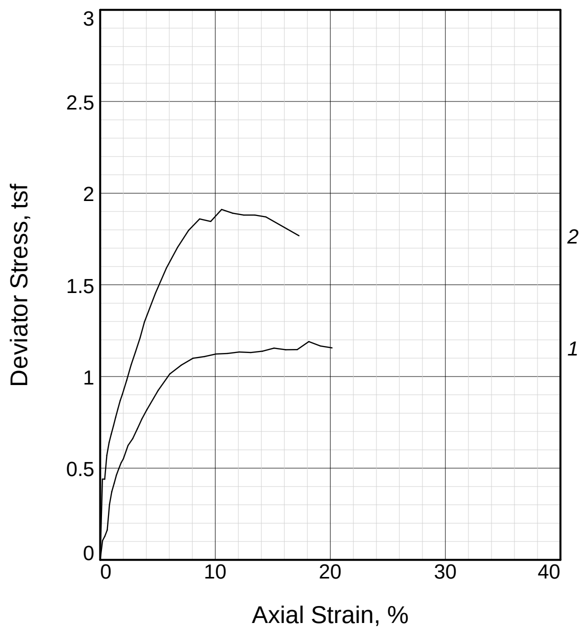
Sample Number: U-3

UNCONFINED COMPRESSION TEST

TRC Engineers, Inc.

	Total	Effective
C, tsf	0.150	0.109
ϕ, deg	24.8	26.5
Tan(ϕ)	0.46	0.50





Sample No.		1	2
Initial	Water Content, %	33.3	35.4
	Dry Density, pcf	85.4	85.5
	Saturation, %	90.5	96.6
	Void Ratio	1.0108	1.0075
	Diameter, in.	2.96	2.93
	Height, in.	4.97	5.21
At Test	Water Content, %	25.0	31.7
	Dry Density, pcf	85.6	85.5
	Saturation, %	68.3	86.7
	Void Ratio	1.0060	1.0075
	Diameter, in.	2.96	2.93
	Height, in.	4.97	5.21
Strain rate, in./min.		0.05	0.05
Back Pressure, tsf		0.00	0.00
Cell Pressure, tsf		0.50	1.00
Fail. Stress, tsf		1.19	1.91
Total Pore Pr., tsf		-0.02	0.03
Ult. Stress, tsf			
Total Pore Pr., tsf			
$\bar{\sigma}_1$ Failure, tsf		1.71	2.88
$\bar{\sigma}_3$ Failure, tsf		0.52	0.97

Type of Test:
CU with Pore Pressures

Sample Type:

Description: GRAY MICACEOUS SILT, TR F/ SAND

LL= 25 **PI=** NP

Specific Gravity= 2.75

Remarks: Material contained a Strong Gas/Petro Odor; *SAMPLE SLUMPING DURING INITIAL SETUP & DURING BEGINNING OF TEST

Figure 23

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

Project: CRRA TANK NO. 6 REPLACEMENT

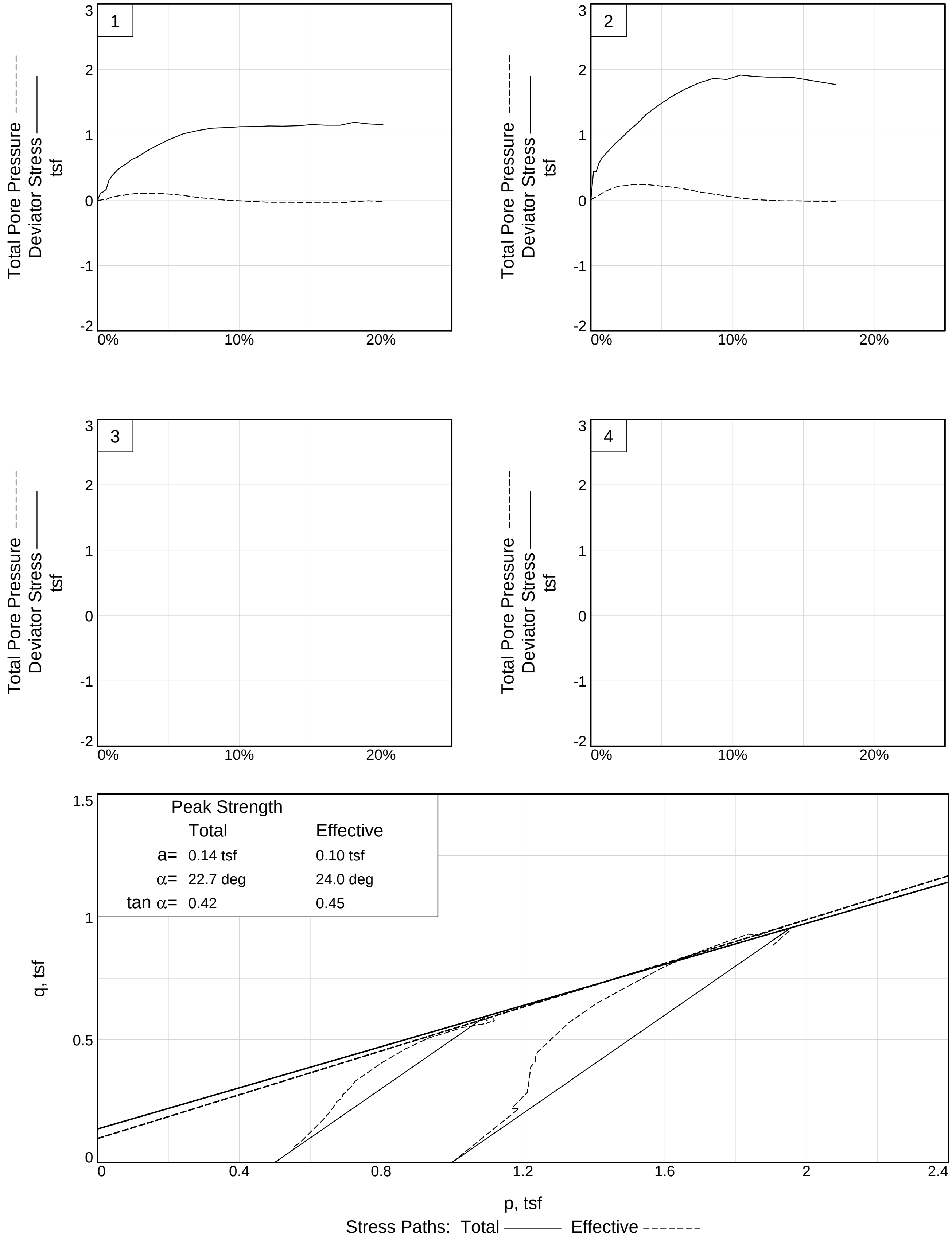
Source of Sample: GTB-2 **Depth:** 6-8'

Sample Number: U-1

Proj. No.: 153306.039 **Date Sampled:**

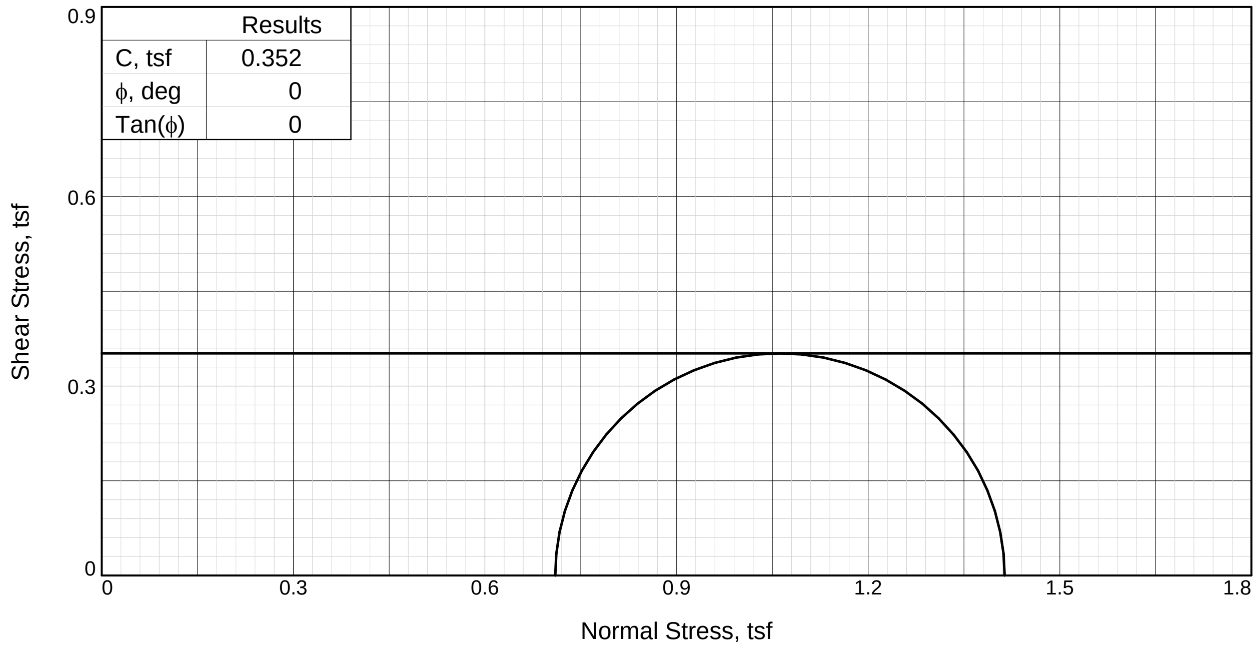
TRIAXIAL SHEAR TEST REPORT

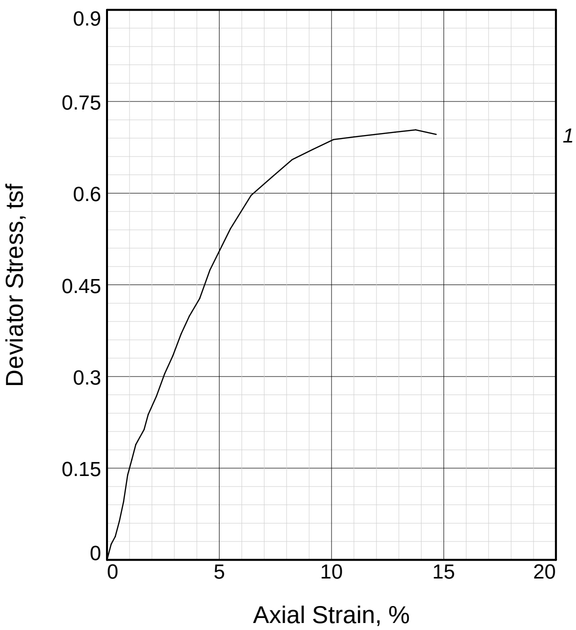
TRC Engineers, Inc.



Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY
Project: CRRA TANK NO. 6 REPLACEMENT
Source of Sample: GTB-2 **Depth:** 6-8' **Sample Number:** U-1
Project No.: 153306.039 **Figure** ________

TRC Engineers, Inc.





Sample No.		1
Initial	Water Content, %	41.9
	Dry Density, pcf	76.6
	Saturation, %	91.7
	Void Ratio	1.2737
	Diameter, in.	2.84
	Height, in.	5.46
At Test	Water Content, %	54.6
	Dry Density, pcf	76.6
	Saturation, %	119.5
	Void Ratio	1.2737
	Diameter, in.	2.84
	Height, in.	5.46
Strain rate, in./min.		0.05
Back Pressure, tsf		0.00
Cell Pressure, tsf		0.71
Fail. Stress, tsf		0.70
Ult. Stress, tsf		
σ_1 Failure, tsf		1.41
σ_3 Failure, tsf		0.71

Type of Test:
Unconsolidated Undrained

Sample Type:

Description: BROWN CLAY, SM SILT

LL= 52 **PL=** 31 **PI=** 21

Specific Gravity= 2.79

Remarks:

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

Project: CRRA TANK NO. 6 REPLACEMENT

Source of Sample: GTB-2 **Depth:** 40-42'

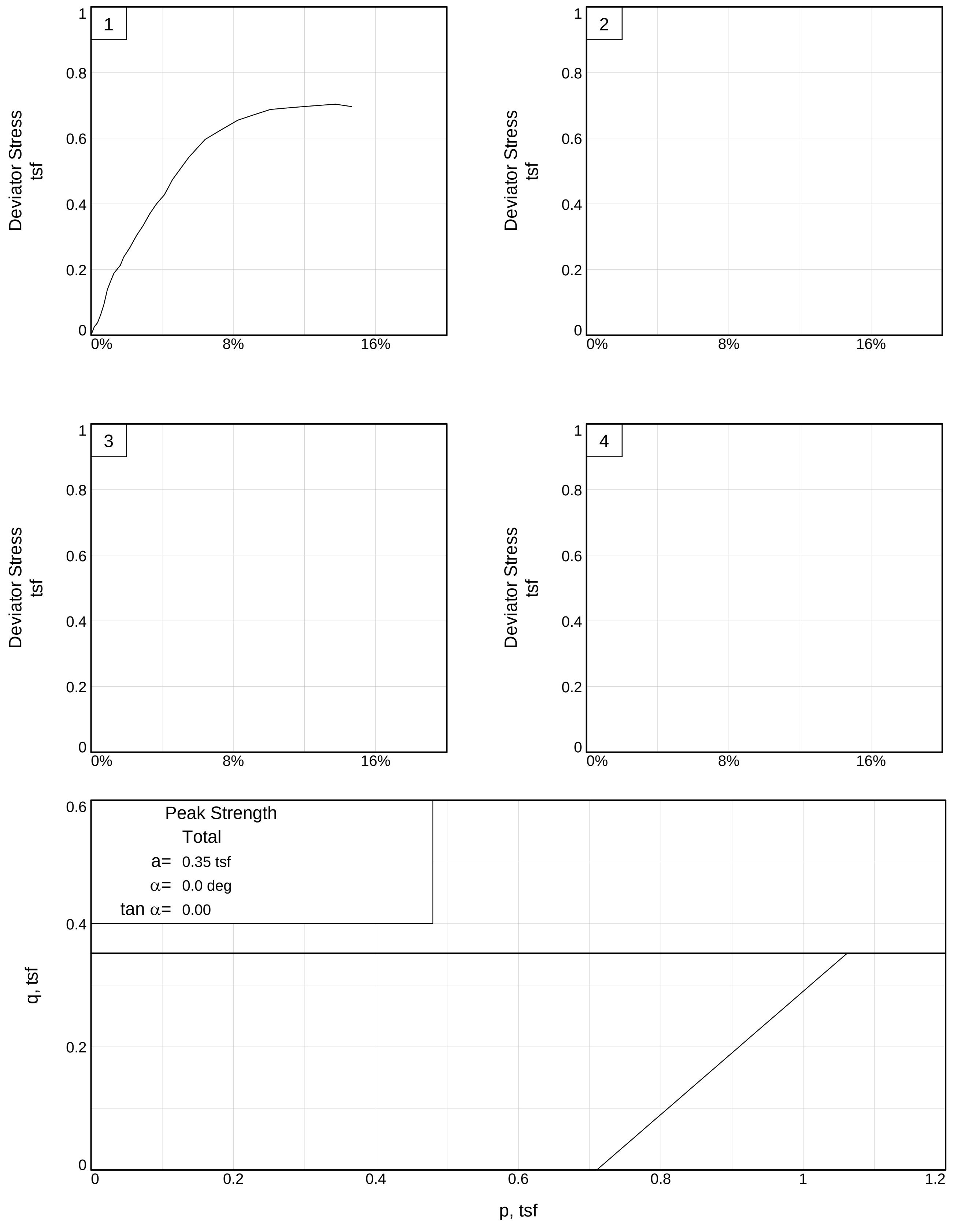
Sample Number: U-2

Proj. No.: 153306.039 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

TRC Engineers, Inc.

Figure 24



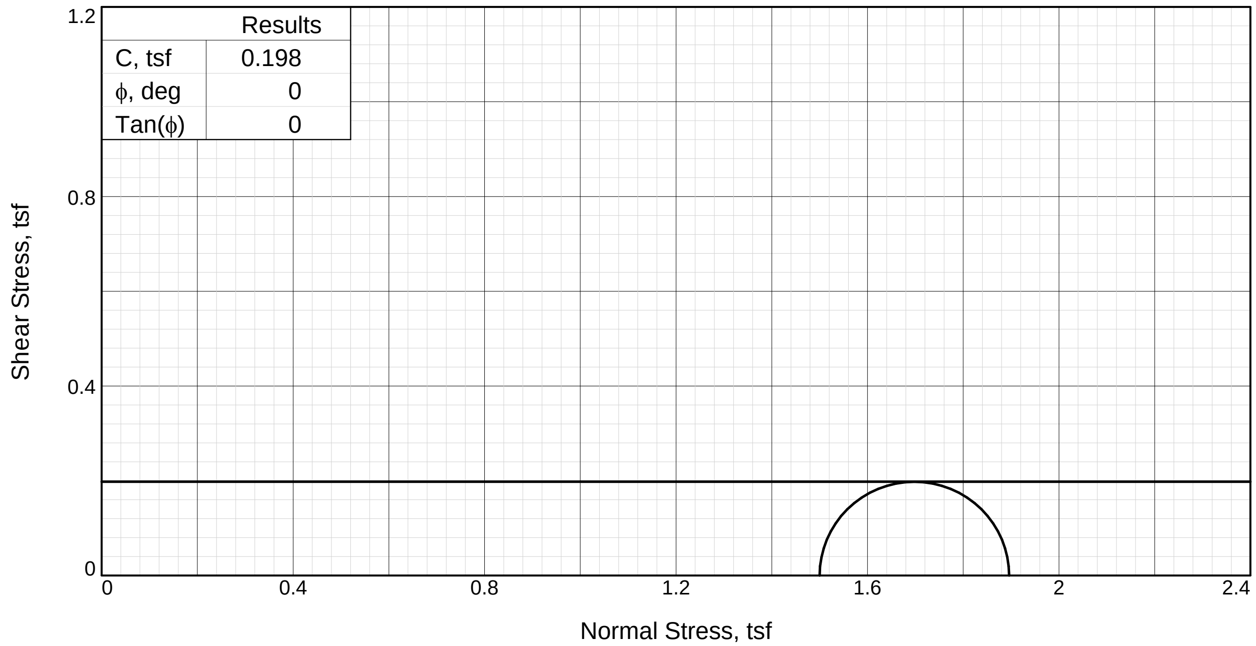
Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

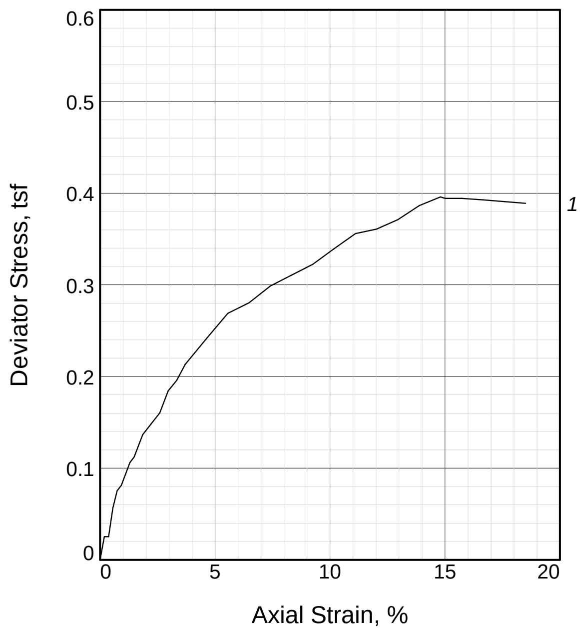
Project: CRRA TANK NO. 6 REPLACEMENT

Source of Sample: GTB-2 **Depth:** 40-42' **Sample Number:** U-2

Project No.: 153306.039 **Figure** ________

TRC Engineers, Inc.





Sample No.		1
Initial	Water Content, %	47.8
	Dry Density, pcf	72.4
	Saturation, %	93.9
	Void Ratio	1.4400
	Diameter, in.	2.85
	Height, in.	5.40
At Test	Water Content, %	50.4
	Dry Density, pcf	72.4
	Saturation, %	99.1
	Void Ratio	1.4400
	Diameter, in.	2.85
	Height, in.	5.40
Strain rate, in./min.		0.05
Back Pressure, tsf		0.00
Cell Pressure, tsf		1.50
Fail. Stress, tsf		0.40
Ult. Stress, tsf		
σ_1 Failure, tsf		1.90
σ_3 Failure, tsf		1.50

Type of Test:
Unconsolidated Undrained

Sample Type:

Description: BROWN CLAY, SM SILT

Specific Gravity= 2.83

Remarks:

Figure 25

Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

Project: CRRA TANK NO. 6 REPLACEMENT

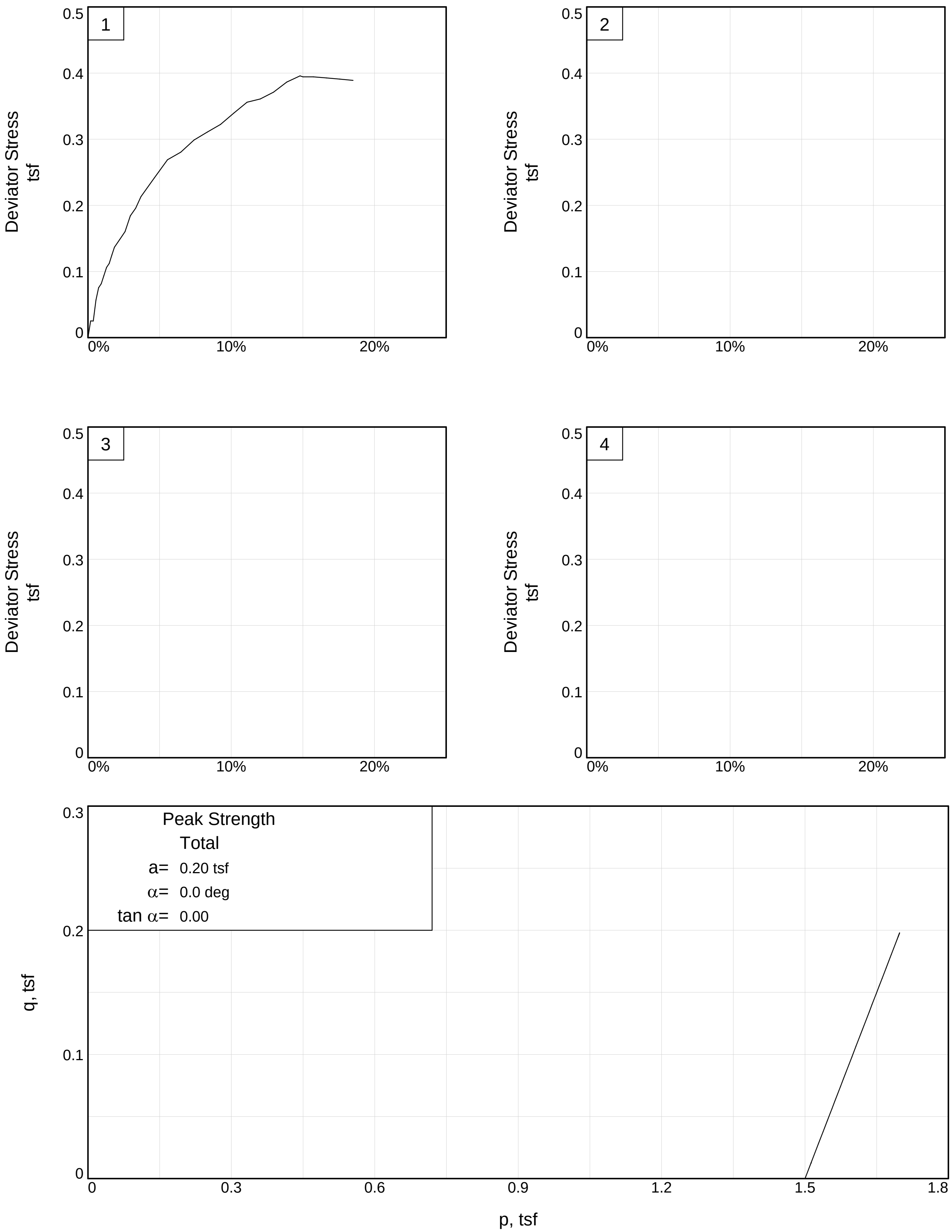
Source of Sample: GTB-2 **Depth:** 55-57'

Sample Number: U-3

Proj. No.: 153306.039 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

TRC Engineers, Inc.



Client: CONNECTICUT RESOURCES RECOVERY AUTHORITY

Project: CRRA TANK NO. 6 REPLACEMENT

Source of Sample: GTB-2 **Depth:** 55-57' **Sample Number:** U-3

Project No.: 153306.039 **Figure** ________

TRC Engineers, Inc.

New Jersey ACCUTEST Laboratories

IT'S ALL IN THE CHEMISTRY

04/02/10

Technical Report for

TRC

CRRA Tank No.6 Replacement

153306.039

Accutest Job Number: JA42690

Sampling Date: 03/01/10

Report to:

TRC

tthurston@trcsolutions.com

ATTN: Tara Thurston

Total number of pages in report: **11**

ACCREDITED IN ACCORDANCE WITH nelac

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs as applicable.

David N. Speis
VP Ops, Laboratory Director

Client Service contact: Nadine Yakes 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, DE, FL, IL, IN, KS, KY, LA, MA, MD, MI, MT, NC, PA, RI, SC, TN, VA, WV

Test results relate only to samples analyzed.

ACCUTEST LABORATORIES 50 YEARS 1956-2006

New Jersey • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

Table of Contents

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Sample Summary

TRC

Job No: JA42690

CRRA Tank No.6 Replacement
Project No: 153306.039

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JA42690-1	03/01/10	12:00	NA	03/25/10	SO	Soil	GTB-1
JA42690-2	03/01/10	12:00	NA	03/25/10	SO	Soil	GTB-2
JA42690-3	03/01/10	12:00	NA	03/25/10	SO	Soil	GTB-3
JA42690-4	03/01/10	12:00	NA	03/25/10	SO	Soil	GTB-4

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

Sample Results

Report of Analysis

Accutest Laboratories

Report of Analysis

Client Sample ID:	GTB-1		
Lab Sample ID:	JA42690-1	**Date Sampled:**	03/01/10
Matrix:	SO - Soil	**Date Received:**	03/25/10
		Percent Solids:	89.2
Project:	CRRA Tank No.6 Replacement		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	< 22	22	mg/kg	1	03/26/10 21:53	MS	EPA 300/SW846 9056
Solids, Percent	89.2		%	1	03/26/10	AL	SM18 2540G
Sulfate	< 110	110	mg/kg	1	03/26/10 21:53	MS	EPA 300/SW846 9056
pH	10.11		su	1	03/30/10	LMM	SW846 9045C,D

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	GTB-2		
Lab Sample ID:	JA42690-2	**Date Sampled:**	03/01/10
Matrix:	SO - Soil	**Date Received:**	03/25/10
		Percent Solids:	86.1
Project:	CRRA Tank No.6 Replacement		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	< 23	23	mg/kg	1	03/26/10 22:16	MS	EPA 300/SW846 9056
Solids, Percent	86.1		%	1	03/26/10	AL	SM18 2540G
Sulfate	< 120	120	mg/kg	1	03/26/10 22:16	MS	EPA 300/SW846 9056
pH	7.97		su	1	03/30/10	LMM	SW846 9045C,D

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	GTB-3		
Lab Sample ID:	JA42690-3	**Date Sampled:**	03/01/10
Matrix:	SO - Soil	**Date Received:**	03/25/10
		Percent Solids:	88.6
Project:	CRRA Tank No.6 Replacement		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	< 22	22	mg/kg	1	03/26/10 21:30	MS	EPA 300/SW846 9056
Solids, Percent	88.6		%	1	03/26/10	AL	SM18 2540G
Sulfate	< 110	110	mg/kg	1	03/26/10 21:30	MS	EPA 300/SW846 9056
pH	7.74		su	1	03/30/10	LMM	SW846 9045C,D

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	GTB-4		
Lab Sample ID:	JA42690-4	**Date Sampled:**	03/01/10
Matrix:	SO - Soil	**Date Received:**	03/25/10
		Percent Solids:	85.2
Project:	CRRA Tank No.6 Replacement		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Chloride	< 23	23	mg/kg	1	03/26/10 22:40	MS	EPA 300/SW846 9056
Solids, Percent	85.2		%	1	03/26/10	AL	SM18 2540G
Sulfate	< 120	120	mg/kg	1	03/26/10 22:40	MS	EPA 300/SW846 9056
pH	8.71		su	1	03/30/10	LMM	SW846 9045C,D

RL = Reporting Limit

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SO

SITE BLAUVELT ENGINEERS
a TRC company

Chain of Custody Record

16000 Commerce Parkway, Suite B
Mount Laurel, NJ 08054
609-273-1224 / FAX: 609-273-9224

E

JA42690

Proj. No. 153306.039 | Proj. Name CRRA Tank No. 6 Replacement

Samplers

	Sample No.	Date	Time	SOIL	AQUA	Sample Location	No. of Containers	pH	Chlorides	Sulfates	Remarks
-1	GTB-1	3/1/10	12pm	X		S-1 (0-2')	1	X	X	X	Please complete the 3 to 5 day TAT
-2	GTB-2	3/2/10	12pm	X		S-1 (0-2')	1	X	X	X	
-3	GTB-3	3/1/10	12pm	X		S-1 (0-2')	1	X	X	X	
-4	GTB-4	3/1/10	12pm	X		S-1 (0-2')	1	X	X	X	
											WC 39
											8oz Jar's 3-25-10

RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:
[signature]	3-25/1105Am	[signature]	11:05 3-25-10	[signature]	12:30 3-25-10	[signature]	
RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:

RECEIVED FOR THE LABORATORY BY:	DATE/TIME:	REMARKS: 5.0C

IA

JA42690: Chain of Custody
Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: JA42690 **Client:** **Immediate Client Services Action Required:** No

Date / Time Received: 3/25/2010 **Delivery Method:** **Client Service Action Required at Login:** No

Project: **No. Coolers:** 1 **Airbill #'s:**

Cooler Security

	Y	N		Y	N
1. Custody Seals Present:	☑	☐	3. COC Present:	☑	☐
2. Custody Seals Intact:	☑	☐	4. Smpl Dates/Time OK	☑	☐

Cooler Temperature

	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	Infared gun	
3. Cooler media:	Ice (bag)	

Quality Control Preservatio

	Y	N	N/A
1. Trip Blank present / cooler:	☐	☐	☑
2. Trip Blank listed on COC:	☐	☐	☑
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☐	☐	☑

Sample Integrity - Documentation

	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition

	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions

	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Comments

Accutest Laboratories 2235 US Highway 130 Dayton, New Jersey
V:732.329.0200 F: 732.329.3499 www/accutest.com

LABORATORY TESTING PROCEDURES

All testing is either done in general accordance with the indicated ASTM Designation-latest edition, or with other standard or generally accepted engineering practices as described hereafter:

1. Consolidation Test of Soils

   Preparation of samples and testing procedures generally follow the methods described in ASTM D 2435. In addition, the time of loading may be selected on the basis of:
   a. controlled rate of percent of consolidation
   b. controlled strain

   The method of test is selected to suit the soil type in question and the test is conducted in accordance with generally accepted engineering practice.

2. Atterberg Limits

   a. Liquid limit of soils, ASTM D 4318
   b. Plastic limit and plasticity index of soils, ASTM D 4318
   c. Shrinkage factors of soils, ASTM D 427

   (Moisture content is also determined with the Atterberg limits tests, and liquidity index is also computed.)

3. Moisture Content of Soil

   ASTM D 2216

4. Particle-Size Analysis of Soils

   ASTM D 422, Sieve and/or hydrometer analysis. (Specific gravity is determined with the hydrometer analysis).

5. Triaxial Compression Test of Soils

   Sample preparation, apparatus, and testing generally follow the procedures outlined in ASTM D 2850 and D 4767.

6. Unconfined Compressive Strength of Cohesive Soils

   ASTM D 2166

7. Specific Gravity of Soils

   ASTM D 854

8. Unit Weight Determination of Soils

   See ASTM D 2166 for preparation of specimen except that sample size may differ. For moisture content see ASTM D 2216.

9. Visual Identification of Soil Samples

   All soil samples are visually identified and/or classified. The classification system used is shown on the *Key to Symbols* sheet.

10. Identification of Rock

    Rock core samples are identified by the appearance and character of newly fractured surfaces of unweathered pieces, by core conditions and characteristics, and by the determination of simple physical and chemical properties.

11. Compaction Test of Soils

    a. Moisture-density relations of soils using 5.5 lb hammer and 12 in. drop, ASTM D 698
    b. Moisture-density relations of soils using 10 lb hammer and 18 in. drop, ASTM D 1557

12. Maximum and Minimum Densities of Granular Soils

    Testing procedures follow D.M. Burmister, "Suggested Method of Test for Maximum and Minimum Densities of Granular Soils" cited in *Proceeds for Testing Soils*, Fourth Edition, ASTM, Philadelphia, 1964, pp. 175-77.

13. Bearing Ratio of Laboratory Compacted Soils

    ASTM D 1883
    (Sometimes called California Bearing Ratio or CBR).

14. Organic Content

    A modified dichromate oxidation method using ferrous ammonium sulfate solution is employed in determining the percent of organic matter in the soil.

TRC

STANDARD SYMBOLS

B	width of footing
c	cohesion
c_v	coefficient of consolidation
C_c	compression index
$C\alpha$	coefficient of secondary compression
C_s	swelling index
C_u	uniformity coefficient - D_{60}/D_{10}
CBR	California Bearing Ratio
D_f	depth of foundation
D_{10}	effective grain size
E	modulus of linear deformation - Young's Modulus
e	void ratio
FS	factor of safety
G	specific gravity of solids
h	hydraulic head
i	hydraulic gradient
I_L	liquidity index = $(w_n - w_p)/I_p$
I_p	elasticity index = $w_L - w_p$
k	coefficient of permiability
k_h	coefficient of horizontal subgrade reaction
k_s	coefficient of vertical subgrade reaction
K_a	coefficient of active pressure
K_p	coefficient of passive earth pressure
K_o	coefficient of at-rest pressure
L	length of footing
n	porosity
P_c	estimated preconsolidation pressure
P_o	existing overburden pressure
q_a	allowable soil bearing pressure
q_u	unconfined compression strength
S_r	degree of saturation
u	pore-water pressure
U	degree of consolidation
U_c	unconfined compression test
UU	triaxial test-unconsolidated/undrained
CU	triaxial test-consolidated/undrained
CD	triaxial test-consolidated/drained
w_f	moisture content at end of test
w_L	liquid limit
w_n	natural moisture content
w_p	plastic limit
γ	unit weight
γ_d	dry unit weight
γ_b	submerged unit weight
ϵ	unit linear strain
ϵ_f	unit linear strain at failure
σ	normal stress
σ_1	major principal stress
σ_3	minor principal stress
τ	shear stress
ϕ	angle of internal friction
δ	friction angle
$\tan\delta$	friction factor