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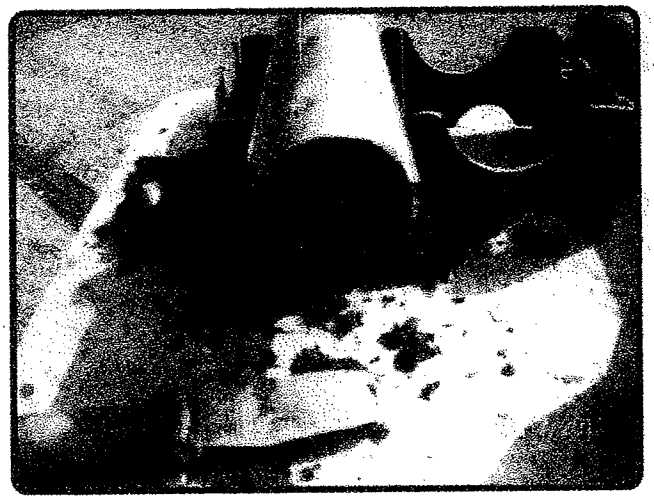
GEOTECHNICAL INVESTIGATION REPORT

Proposed Western Avenue Jacking Pits
Water Main Replacement Project
City of Torrance, Los Angeles County, California



GEI Project No: 172-49

Prepared for

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September 2, 2011

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GEOTECHNICAL INVESTIGATION REPORT
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CITY OF TORRANCE, LOS ANGELES COUNTY, CALIFORNIA

Prepared for

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation performed by Geo-Environmental, Inc. (GEI) for the proposed Western Avenue jacking pits as part of the Water Main Replacement Project along Western Avenue in the City of Torrance, County of Los Angeles, California (Figure 1). GEI's services were provided in general accordance with GEI proposal 11-065, dated June 28, 2011. This investigation was authorized by Mr. John Dettle, Engineering Manager for the City of Torrance Public Works Department. This report provides conclusions and recommendations to assist the City of Torrance (City) in preparing project plans, specifications, and estimates for the proposed installation of the water main underneath the existing utility lines crossing perpendicular to Western Avenue.

2.0 PURPOSE AND SCOPE OF WORK

The purpose of this geotechnical investigation was to explore the subsurface conditions along the alignment of the proposed water main, evaluate the engineering properties of the on-site soils, and provide recommendations for the design and installation of the water main as influenced by the subsurface conditions. The scope of our services consisted of the following tasks:

- Data review and preparation of the subsurface exploration program;
- Field investigation consisting of visiting the site and marking boring locations, drilling hollow-stem auger borings, and collecting drive and bulk soil samples from the borings;
- Laboratory testing of selected soil samples obtained from the borings;
- Geotechnical and environmental engineering analysis;
- Preparation of a geotechnical report presenting our conclusions and recommendations regarding:

    - *Subsurface soil and groundwater conditions;*
    - *Suitability of on-site soils for pipe support and backfill;*
    - *Excavation and shoring design;*
    - *Dewatering;*
    - *Jacking operation;*
    - *Pipe-jacking requirements;*
    - *Pipe bedding requirements and installation;*
    - *Pavement section designs;*
    - *Mitigation measures of contaminated onsite soils (if any); and*
    - *Site preparation for the proposed installation of the water main.*

3.0 PROJECT DESCRIPTION AND PROPOSED IMPROVEMENTS

Based on the drawing (Plan No. WP-291) prepared by RBF Consulting for the City of Torrance Public Works Department, it is our understanding that the proposed 12-inch diameter Ductile Iron Pipe (DIP) Class 350 will be installed parallel to Western Avenue. The starting point for the installation of the water line starts at Del Amo Boulevard and Western Avenue intersection at approximate station 10+01. From this point, the proposed 12 inch water line will extend northerly along Western Avenue. At an approximate station 11+35 (jacking pit), the water line will be encased to underpass many utility lines crossing perpendicular to Western Avenue. Approximately 117 lineal feet of a 20-inch diameter steel casing will be jacked to install the proposed water line. It is observed on the drawing that the casing will have a slope gradient of approximately 2%. The proposed water line will be installed to a depth ranging between four (4) and 11 feet below the existing ground surface.

The recommendations presented in this report are based on the depths and locations of the water main stated above. GEI should be notified of any significant pipe alignment and/or grade changes during the project design to either confirm or modify our recommendations.

4.0 FIELD EXPLORATION

The field exploration was conducted on Wednesday, August 17, 2011 and consisted of drilling two (2) eight-inch diameter hollow-stem auger borings, B-1 and B-2 (Figure 2). The borings were drilled to a maximum depth of 15.5 feet below the existing ground surface. No caving was observed in the exploratory borings upon the retrieval of the augers. The boreholes were backfilled with soil cuttings and patched with cold patch asphalt when appropriate immediately after drive samples were successfully obtained.

Relatively undisturbed drive samples were collected from the borings at specified depths using a 2.5-inch outside diameter, 18-inch long split-barrel lined with one-inch-high brass rings. The sampler was driven into the bottom of the borehole using a 140-pound hammer falling 30 inches. The brass rings were carefully removed from the sampler, transferred to a plastic tube, and sealed at both ends with plastic caps to protect and maintain the in-situ moisture content of the soils. Bulk samples of the surficial soils were collected for subsequent laboratory analysis.

The Boring Record was prepared in accordance with Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010). The Logs of Test Borings (LOTB) are presented in Appendix A.

5.0 LABORATORY TESTING

5.1 INTRODUCTION

Laboratory testing on samples of the soils obtained from the borings were performed according to American Society for Testing and Materials (ASTM) and Caltrans specifications. Relatively undisturbed and bulk soil samples obtained from the borings were tested in the laboratory to determine in-situ moisture content and

dry density, grain-size distribution, plasticity/expansive characteristics, sand equivalency, compaction characteristics (maximum dry density and optimum water content/maximum wet density) by modified proctor testing and Caltrans method, shear strength, R-Value, and corrosive properties (resistivity, pH, soluble sulfates, and chloride). The results of moisture content and dry density testing are indicated on the boring logs in Appendix A. The results of all other laboratory testing are presented below and in Appendix B. Brief descriptions of the laboratory tests performed are presented in the following sections.

5.2 In-Situ Moisture Content and Dry Density

5.2.1 In-Situ Moisture Content

The in-situ moisture content of the soils was determined in accordance with the ASTM D-2216-05 Test Method and the Caltrans Test Method (CT) 226. This method involves obtaining the moist weight of the sample and then drying the sample to obtain its dry weight. The moisture content is calculated by taking the difference between the wet and dry weights, dividing it by the dry weight of the sample, and expressing the result as a percentage.

5.2.2 In-Situ Dry Density

In-situ dry density testing was performed in accordance with the ASTM D-2937-04 Test Method. This method involves obtaining a relatively undisturbed soil sample by driving a thin-walled cylinder into the soil to determine the dry weight and volume of the sample. Simple computations are then performed to determine the dry unit weight of the soil, generally referred to as the in-situ density of that material. The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A.

5.3 Sieve Analysis

Representative samples were dried, weighed, and soaked in water until individual soil particles were separated; then the samples were washed on the No. 200 sieve. The portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with the ASTM D-422 Test Method and the CT 202. The grain-size distribution data is shown in Figure B-1 in Appendix B.

5.4 Atterberg Limits

5.4.1 Liquid Limit

The liquid limit (LL) is determined by performing trials in which a portion of the specimen is spread into a brass cup, divided in two (2) with a grooving tool, and allowed to flow together by repeatedly dropping the cup in a standard mechanical device. The multi-point method involves a series of trials over a range of moisture contents. The LL (moisture content at which the soil groove closes for a distance of ½-inch in 25 blows) is determined by the plotted data.

5.4.2 Plastic Limit

The plastic limit (PL) is determined by alternately pressing together and rolling a portion of the plastic soil into a 1/8-inch diameter thread until the moisture content is reduced to a point at which the thread crumbles and is no longer able to be pressed together and rerolled into a 1/8-inch diameter thread. The moisture content at this stage is reported as the PL. The Plasticity Index (PI) is calculated as the difference between the LL and the PL. Test results are presented below in Table 1 and in Figure B-2 in Appendix B.

Table 1 – Atterberg Limits Test Results

Boring No. and Depth	LL (%)	PL (%)	PI (%)	Plasticity Characteristics
B-1 @ 0-5 feet	NP	NP	NP	Non-plastic
B-2 @ 8 feet	36	8	28	High
B-2 @ 14 feet	27	12	15	Medium

NP = Plasticity could not be measured

5.5 MODIFIED PROCTOR (COMPACTION)

Compaction testing was performed on representative samples of surficial soils in general accordance with the ASTM D1557-09 Test Method. This method involves placing soil at a selected moisture-content in five (5) layers into a 4-inch diameter mold with a volume of 1/30 cubic foot. Each layer is compacted with 25 blows of a 10-pound hammer dropped from a distance of 18 inches, thus producing a total compactive effort of approximately 56,000 ft.-lb./ft^3. The resulting dry unit weight is determined. The procedure is repeated at different moisture contents to establish a relationship between the moisture content and dry unit weight of the soil. When plotted, the data produces a compaction curve, from which the maximum dry density and optimum moisture content of the soil can be determined. The in-situ dry density determined is compared to the maximum dry density for the same material to determine the degree of relative compaction. Results of the Modified Proctor testing performed on a selected sample of the subgrade soils are presented in Table 2 and on Figure B-3 in Appendix B.

Table 2 – Compaction Test Results

Boring No.	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Water Content (%)
B-2	2-5	Sandy Clay (CL)	121.5	10.0

5.6 DIRECT SHEAR

Direct shear testing was performed on a selected sample in accordance with the ASTM D-3080-04 Test Method on relatively undisturbed ring samples. This method consists of placement of the soil sample in a direct shear device, application of a predetermined normal stress, provision for wetting or draining of the soil specimen, or both, consolidation of the specimen under the normal stress, and then shearing the specimen at a constant rate of shearing deformation. The shearing force and horizontal displacements are measured and recorded as the soil specimen is sheared. The shearing is continued well beyond the point of maximum

stress until the stress reaches a constant or residual value. Three (3) samples of the same material are sheared at different confining pressures. By plotting the shear stress versus the confining pressure for the samples, a best-fit straight line drawn through the data yields the angle of internal friction and the apparent cohesion of the material. Plot of direct shear testing, value of cohesion, and the angle of friction are presented on Figure B-4 in Appendix B. The results are also summarized in Table 3.

Table 3 – Direct Shear Test Results

Boring No. and Depth	Peak Cohesion (psf)	Peak Friction Angle (degrees)
B-1 @ 8 feet	770	29

5.7 Resistance Value (R-Value)

R-Value testing of the subgrade soils was performed in the laboratory on selected samples in accordance with California Test Method No. 301. This method involves six (6) steps: (1) preparation of materials for testing; (2) compaction, exudation pressure determination, and measurements of R-Value test specimens; (3) determination of the expansion pressure of R-Value test specimens; (4) measurement of the horizontal pressure and displacement by means of the stabilometer; (5) calculation of the moisture content and density of R-Value test specimens; and (6) determination of the R-Value of the material. The results of the R-Value testing on a selected soil sample are shown in Table 4.

Table 4 – R-Value Test Results

Boring No. & Depth	By Exudation (TI = 4.0)	By Expansion (TI = 4.0)
B-1 @ 0-5 feet	10.0	---

5.8 Sand Equivalent

Sand equivalent tests were performed in general accordance with ASTM D2419-95. This method involves determining the relative proportions of clay-like or plastic fines and dust in granular soils and fine aggregates that pass the No. 4 (4.75 mm) sieve. A sample is poured into a plastic cylinder containing a calcium chloride solution, which is then shaken to completely disperse the fine-grained material. An irrigator tube is used to flood the sample and increase the liquid volume to a specified level. The sample is allowed to sit for 20 minutes at which time the level of the clay suspension and sand is recorded. The sand equivalent is computed by dividing the sand reading by the clay suspension reading and expressing the result as a percentage by multiplying it by 100. The results of the test are presented below in Table 5.

Table 5 – Sand Equivalent Test Result

Boring No.	Depth (ft)	Sand Equivalency
B-1	0-5	18

5.9 EXPANSION INDEX

Expansion index testing was performed on a bulk sample of the subsurface soils in accordance with the ASTM D-4829-08 Standard Test Method. This test method allows for determination of expansion potential of compacted soils when inundated with distilled water. The expansion index (EI) provides an indication of swelling potential of a compacted soil. A specimen is compacted into a metal ring so that the degree of saturation is between 40% and 60%, and the specimen and the ring are placed in a consolidometer. A vertical confining pressure of 1.0 pounds per square inch (psi) is applied to the specimen and then the specimen is inundated with distilled water. The deformation of the specimen is recorded for 24 hours or until the rate of deformation becomes less than 0.005 mm/hour. The EI is used to measure a basic index property of soil and therefore, the EI is comparable to other indices such as the liquid limit, plastic limit, and plasticity index of soils. The results of our laboratory expansion index testing are presented in Table 6.

Table 6 – Expansion Index Test Results

Boring No.	Depth (ft)	Soil Description	Expansion Index	Expansion Potential
B-2	0-5	Sandy Clay (CL)	31	Low

5.10 CORROSION POTENTIAL

Soil corrosivity testing was performed in the laboratory on a selected sample (B-1 @ 0 – 5 feet) of the soils encountered in borings drilled at the site.

Caltrans Corrosion Guidelines (2003) classify soil as corrosive if the soluble chloride content is less than 500 ppm, the soluble sulfate content is less than 2,000 ppm, and the pH value is 5.5 or higher. Based on the test results and Caltrans Criteria, the onsite soils should be considered potentially corrosive to bare metals and concrete in contact with the onsite soils. A brief description of each test is described below.

5.8.1 Minimum Resistivity and pH

Testing of the subgrade soils was performed in the laboratory on a selected sample to determine the resistivity and pH of the material in accordance with CT 643. Factors that contribute to corrosion include the presence of soluble salts, soil resistivity, soil pH, and the presence of oxygen. The minimum resistivity of the soil indicates the relative quantity of soluble salts, while the pH of the soil indicates the degree of acidity or alkalinity. The laboratory resistivity and pH measurements for a soil sample are determined using this test method. The pH of the soil is 7.3 which is considered alkaline (Base). The minimum resistivity discovered was 599 ohm-cm which indicates the soil is strongly aggressive electrolytic-type corrosion.

5.8.2 Sulfate Content

Testing of the sulfate content of the subgrade soils was performed in the laboratory on a selected sample in accordance with CT 417. This method is used for determination of the sulfate content of soils and waters. In this test method, the sulfate ion is precipitated with barium chloride, in an acidic medium, to barium

sulfate crystals of uniform size. The barium sulfate present in suspension is determined by a measurement of its turbidity and comparison with a known standardization curve. The results are used to determine the corrosive nature of the environment for concrete structures, as well as for other purposes. The soil sulfate content detected was 823 ppm; therefore, a Type II Portland cement may be used for concrete in contact with the subgrade soils.

5.8.3 Chloride Content

Determination of the chloride content in the subgrade soils was performed in the laboratory on the selected samples in accordance with CT 422. The test method is divided into two (2) parts for determination of the chloride content of waters and the water-soluble chloride content of soils. Part 2 was performed to determine the chloride content of the subgrade soils at the subject site. The chloride content of the soil was 148 ppm which generally indicates corrosive potential to ferrous metal in contact with the soils.

In general, metal pipes or structural members to be buried below grade should be properly coated or wrapped and sealed with corrosion resistant tar, enamel, or plastic tape for protection against the onsite soils. As appropriate, a qualified corrosion engineer should be consulted for a more in-depth evaluation of the corrosive nature of the onsite soils and for any special corrosion protection design that may be required.

- DO WE NEED TO COAT THE 20" Ø PIPE?
- IS THE 6 MIL POLY FOR THE 12" Ø PIPE ...?

6.0 SITE CONDITIONS

6.1 SURFACE CONDITIONS

The proposed water main along Western Avenue is located in a commercial area. The proposed water main is within the paved section of the existing road. The ground surface profile along the project alignment generally descends gently to the south. Existing underground storm drains, sewer, water, utility, gas and oil lines are reported extending parallel and perpendicular or across to the proposed water main alignment.

6.2 SUBSURFACE CONDITIONS

The subsurface soils encountered in the borings along the proposed water main alignment generally consist of stiff to very stiff and occasionally hard, sandy clays, with a thin medium dense layer of silt with sand. Caving was not observed in all the borings after removal of the auger at the completion of the drilling operation. A more detailed description of the subsurface conditions is presented in the logs of the soil borings in Appendix A.

6.3 GROUNDWATER

Groundwater was not encountered in any of our exploratory borings, extending to a maximum depth of approximately 15.5 feet below the existing ground surface. The depth of the groundwater table may fluctuate depending on environmental changes such as heavy rains, injection of water in nearby areas, or dewatering operations in surrounding project sites.

7.0 SEISMICITY

An active fault is defined by the California Division of Mines and Geology (now the California Geological Survey, CGS) as a fault that has exhibited surface displacement within the last 11,000 years. Potentially active faults are defined as those with a history of movement between 11,000 and 1.6 million years. Based on our literature research, no active or potentially active faults are mapped as underlying the site. The site is not mapped within a designated Alquist-Priolo Earthquake Fault Zone (CDMG) for fault rupture hazard. The potential for ground surface rupture to occur at the site due to faulting is considered low.

The peak ground acceleration at the site on alluvium (Quaternary old alluvial - Qoa) with a 10% probability of exceedance in 50 years is estimated to be 0.45g, based on the Probabilistic Seismic Hazard Assessment Maps (CGS, 2002) and on the CGS website: http://www.consrv.ca.gov/cgs/rghm/pshamap/pshamain.html.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 General Conclusions

Based on the results of our field exploration and laboratory tests, combined with our engineering analysis, experience and judgment, it is our professional opinion that the proposed water main may be installed essentially as planned. Based on our assumption, installation of the water main will involve excavation of the pipe trench ranging from about 9 to 12 feet in depth and jacking operation beneath the utility, oil and gas lines.

The soils to be encountered during excavation for the proposed water main are generally expected to consist predominantly of stiff to very stiff clays with sand deposits. The on-site soils generally are not suitable for use as bedding or shading for the pipe installation, and a select import bedding material is recommended for such application. However, if imported bedding material is placed as recommended in this report, the underlying on-site soils should be capable of providing satisfactory support for the bedding and the pipe.

Groundwater was not encountered in our exploratory borings. Due to the close proximity of the ocean, groundwater level may rise to within or above the proposed pipe zone in the future. The placement of the water line, bedding, pipe zone and backfill materials should generally conform to the most recent Standard Specifications for Public Work Construction, and to the requirements of the City of Torrance, Department of Public Works. The bottom of the trench excavation should be approved by the Soils Engineer before placing pipe bedding material. Recommendations are presented in the following sections for water main design and construction.

8.2 Pipe Jacking

The jacking operation is recommended because of many existing utility, oil, and gas lines crossing perpendicular along the proposed water line at Western Avenue. Since the City of Torrance does not want to reroute or expose these lines at this location, the 117 foot segment underneath these lines should be jacked to complete the project alignment.

It is important to note that the existing soil at this location, based on the laboratory test results and boring logs, is stiff clay with sand which with proper shoring allows a jacking operation for this project. However, the jacking and receiving pits which must be constructed for this project must be securely shored per the recommendation provided in this report under shoring design section to prevent failure. Therefore, the proposed shoring design to support the lateral earth pressure and traffic surcharge is required for the jacking and receiving pits. It should also be noted that the jacking equipment should not impose a reaction more than 4000 psf on the soils adjacent to the jacking pit.

Although no ground water was encountered during drilling, preparation of dewatering including treatment and discharge procedures should be in place when excavating for jacking pits.

Bracing to prevent casing shifting or floatation, and pressure concrete mix design, placement method, and equipment requirements are needed for jacking operation. Installation of the casing by jacking should be performed in accordance with the latest edition of the Standards Specifications for Public Works Construction.

Additional reinforcement or adecuate strength of the casing is required to withstand jacking pressure other than the vertical loads that the casing is designed for. The joints of sections of casing to be jacked should be welded with a continuous circumferential weld. The leading section of the casing should be equipped with a jacking head securely anchored thereto to prevent any wobble or vibration in the project alignment during the jacking operation and must have sufficient bearing shims to properly distribute the jacking stresses.

Excavated material should be removed as jacking operation progresses and the material should not be accumulated. Upon completion of the jacking operations, all voids around the outside face of the water pipe must be grouted using cement Type II.

8.3 Pipe Design and Loadings

The waterline DIP Class 350 sections should be capable of supporting a minimum vertical soil overburden pressure of 125 lb/ft^2 per foot of depth below the finished grade. In the areas where the top of pipe is within 10 feet of the final street grade, a traffic surcharge load from roadway vehicles should be included in the design. An average angle of internal friction of 29 degrees for the subsurface soils may be assumed in design computations.

The allowable design soil bearing value for associated storm drain structures, such as water lines, is 2,500 psf (net) at a minimum depth of 18 inches below the lowest adjacent final grade.

8.4 Temporary Sloped Excavations

Based on our borings, the proposed water line excavation may be accomplished with conventional equipment capable of excavating to the depths of the proposed water pipe. The excavations, however, are not expected to stand vertically for any extended period of time. Therefore all excavations must either be properly sloped or shored. Where sufficient space is available for sloped excavation, the excavation may be sloped to no steeper than 1:1 (horizontal to vertical) in the predominantly clay with sand deposits. Flattened side slopes may be required where less stable localized deposits are encountered. The exposed slope faces

should be kept moist and not allowed to dry out. Recommendations for shoring design are given in the Shoring Design section of this report.

Surcharge loads should not be permitted within five (5) feet from the top edge of the slopes, unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 1.5:1 below adjacent existing facility should be properly shored to maintain support of the adjacent structures.

The contractor should be aware that slope height, slope inclination, excavation depths, and shoring design must be in compliance with local, state and federal safety regulations, e.g. OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner and contractor could be liable for substantial penalties. Excavations and shoring, which are 20 feet and greater in depth must be designed by a qualified registered Civil Engineer or Structural Engineer.

It is important to note that soil conditions may vary significantly along the proposed water line alignment, and possible localized seeps may be encountered. Our preliminary soil classifications are based solely on the materials encountered at the actual boring locations. The contractor should verify subsurface conditions throughout the proposed areas of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that our office be contacted immediately to evaluate the conditions encountered and provide appropriate recommendations.

8.5 SHORING DESIGN

Because major portions of the proposed water line is located within the existing paved street areas and adjacent to the existing facilities, open-cut excavations generally might not be desirable. Where there are space limitations for sloped excavations or because of nearby existing structures or facilities, temporary shoring is required. Temporary shoring may consist of the use of a trench box, where feasible, conventional soldier piles and lagging or sheeting, or interlocking sheet pile systems. The shoring for the pipe excavations may be cantilevered or may be laterally supported by walers and cross-bracings. Drilled excavations for soldier piles may require casing or drilling mud to prevent caving and to maintain an open hole for pile installation.

For the design of temporary cantilever shoring supporting a level grade, an equivalent fluid pressure of 45 psf/ft of depth below grade may be used.

For the design of braced shoring, we recommend such shoring be designed using a rectangular-shaped distribution of lateral earth pressure. For the case where a level grade is supported by the shoring, the maximum earth pressure would be 19H (in psf) where H is the height (in feet) of the shored cut face.

In addition to the lateral earth pressure, additional pressure due to surcharge loads, such as from soil stockpiles, vehicular traffic, or construction equipment located adjacent to the shoring, should be considered in the design of the shoring. The shoring design should include a minimum surcharge pressure of 100 psf due to regular vehicular traffic within 10 feet of the shoring. All shoring should be designed and installed in accordance with the latest requirements of the Standard Specifications for Public Works Construction, and OSHA Health and Safety Standards for Excavations.

For the design of soldier piles spaced at least two (2) diameters on centers, the passive resistance of the soils adjacent to the piles may be assumed to be 300 psf/ft of embedment depth. Soldier pile members placed in drilled holes should be properly backfilled with sand/cement slurry or lean concrete in order to develop the required passive resistance.

The lagging between the soldier piles may consist of wood members, or solid plywood or steel sheets. In our opinion, steel sheetings are expected to be more expedient than wood lagging to install, especially where running sand, if any, is encountered. Although soldier piles and any bracings used should be designed for the full anticipated earth pressures and surcharge pressures, the pressures on the lagging are less because of the effect of arching between the soldier piles. Accordingly, the lagging between the piles may be designed for a nominal pressure of 400 psf maximum.

8.6 Bedding and Shading

It is anticipated that the on-site soils at the bottom of the proposed water line will be suitable for support of the bedding and pipe. Care should be exercised by the contractor to minimize disturbance to the subgrade soils during excavation. The pipe trench should be overexcavated as recommended by the Soils Engineer to provide at least six (6) inches of approved imported bedding material underneath the pipe for a uniform support. We recommend that the bedding material consist of clean, well-graded sand or a washed, well-graded crushed rock with a maximum particle size of 3/8 inch and a sand equivalent of at least 30. Coarse and uniformly-graded bedding material should be avoided as intrusion of such bedding material into the fine subgrade soils, or migration of the natural soils into the voids of the coarse bedding material are undesirable and potentially detrimental to the quality of the completed construction.

In the event that the subgrade soils below the proposed bottom of pipe are disturbed during excavation or that exceptionally soft and weak material is encountered, the unsuitable soils should be overexcavated to suitable material as recommended by the Soils Engineer. The over-excavated areas may be backfilled using the approved bedding material.

For the shading around the pipe and up to one (1) foot above the top of pipe, an imported granular material with a sand equivalent greater than 30 is recommended. Compaction of the shading material should be accomplished by saturating the shading material with water and or limited jetting (these operations should be closely observed by the Soils Engineer for preventing saturation of the subgrade soils), provided provisions are incorporated to drain and remove the water rapidly from within the bedding material to facilitate densification of the material.

8.7 Trench/Pit Backfill

Based on the borings, the soils to be excavated for the main water line are expected to be generally acceptable for use as backfill, provided any debris, organic matter, and particles greater than 6 inches are removed. Based on our exploratory borings, the on-site soils generally have moisture contents below or up to the optimum moisture content; drying of the on-site materials prior to placement as backfill soils generally is not anticipated. Additional moisture should be provided as required to facilitate proper backfill compaction.

The backfill soils should be placed in thin layers, 18 inches or less in thickness, and be compacted to at least 90 percent of the maximum dry density as determined by ASTM Test Method D1557 or CT 216. Compaction of the on-site soils by flooding or jetting is not acceptable due to the fine-grained nature of the on-site soils.

Major portions of the trench excavations will be within the existing paved roadway areas where the existing pavement section must be replaced. Before placement of aggregate base, the finished subgrade should be compacted to at least 95 percent in the top 24 inches of final subgrade. The aggregate base material for the pavement section should be compacted to at least 95 percent of the maximum laboratory dry density. The replacement pavement section should be at least one (1) inch greater in thickness than the existing pavement section. Pavement section designs are recommended in Section 8.8 of this report

8.7.1 Imported Fill Material

Fill soils should consist of onsite soils or an approved import material per Caltrans specifications. If import material is required for use as fill for this project, it should be predominantly granular (35% or less passing the No. 200 sieve), non-expansive (Expansion Index (EI) less than 20 and/or PI less than 12), and should be free of organic or inorganic debris, contamination, and materials with any dimension larger than six (6) inches. Import material should be tested and approved by GEI prior to importation to the job site. *GEI should be notified a minimum of three (3) working days prior to the scheduled importation of the soil to the project site.*

8.8 New Pavement Sections and Reconstruction

For the placement of new pavement sections or for reconstruction, any existing Portland cement concrete (PCC), AC, base material, and debris should be completely removed. The subgrade soils should be prepared and a flexible pavement section should be constructed in accordance with the design recommendations below.

For the proposed design of the street sections, we utilized an R-Value of 10 and Traffic Indexes (TIs) of 7.0, 8.0, and 9.0 to calculate the required pavement sections based on design criteria in accordance with the California Division of Highways Design Method (*Highway Design Manual, Sixth Edition, September 1, 2006*). The results of the calculations are shown in Table 7.

Table 7 – Recommended Section Thickness (Inches)

R-Value	TI	Reconstruction Pavement Sections (inches)		
		Option 1		Option 2
		AC	AB*	FDA
10.0	7.0	7.0	9.0	10.0
	8.0	8.0	8.0	12.0
	9.0	8.0	12.0	13.0

*Class II Aggregate Base

The improvements to the project streets can be achieved by placement of a new pavement section consisting of either AC and AB (Option 1) or full-depth asphalt (FDA) (Option 2). Thicknesses can be determined from the above table after the selection of the appropriate TI. The selection of the appropriate TI (and hence the corresponding pavement section) should be made by the City or Caltrans personnel who may have data in their possession related to the traffic volume on the street and are in a better position to make a judgment regarding the selection of the TI based on their knowledge of traffic on the street.

8.8.1 Pavement Subgrade Preparation

The subgrade for support of the new pavement section should consist of a firm and unyielding surface. Excavation of a portion of the underlying subgrade may be required where substantially weak or saturated soils are exposed. Prior to placement of any backfill or pavement section, the exposed subgrade should be closely observed by the Soils Engineer or his representative. Additional excavation may be necessary to remove any surplus underlying weak or disturbed soil, along with any deleterious material. Depressions resulting from the site clearing should be properly cleaned of any loose or disturbed soils and deleterious substances.

The onsite soils should be compacted with a water content at or a few percentages over optimum as determined by ASTM Test Method D1557-09 or CT 216; select non-expansive import material may be compacted at about optimum moisture content.

Immediately before placement of the pavement section, the subgrade or base material should be proof-rolled to obtain a firm and unyielding surface for support of the pavement structural section. Any soft and spongy areas should be excavated and replaced with properly compacted fill or AB. The materials should be compacted to a minimum of 95% relative compaction.

The subgrade soils or base materials, if prepared as recommended above, are expected to provide safe support to the new pavement section. No treatment of the subgrade soils with additives such as cement or lime is warranted for this design.

8.9 DEWATERING

Groundwater was not encountered during our drilling operations; however, there is always a possibility that water attributed to minor seeps during construction activities may be encountered. The presence of seepage water at the site is anticipated to be limited and its removal using sumps and pumps should be adequate.

All water encountered during the construction must be disposed in such a manner that will not create a nuisance for health, or damage public or private property. If groundwater is encountered during excavations, the Contractor should provide dewatering and treatment systems to contain, treat, monitor, and discharge groundwater generated from construction dewatering activities. The design, implementation, inspection, monitoring, and maintenance of the dewatering and treatment system should be in full compliance with the Monitoring and Reporting Program and Waste Discharge Requirements (CA G 994002, CI-8354) of the NPDES permit and Caltrans requirements.

All operations by the Contractor should be in full compliance with all other applicable Federal, State, and local laws and regulations that govern water quality.

8.10 Drainage and Other Construction Issues

The existing street drainage should be maintained in accordance with City of Torrance Public Works and Caltrans standards. In general, the proper control of surface drainage is important for the long-term performance of the pavement, supporting base materials, and subgrade soils. Therefore, the final project design should include provisions for the proper collection and disposal of all surface and subsurface drainage within the project areas.

8.11 Environmental Test Results and Conclusions

The soil mixture sample was analyzed in the TestAmerica laboratory located in Irvine, California for metals using U.S. Environmental Protection Agency (EPA) Method 6010B/7471A and for total petroleum hydrocarbons (TPH) in gasoline range, diesel range, and motor oil range using EPA Method 8015M.

The analytical test results obtained testing soil sample collected at B-1 @ 8 feet revealed that the detected concentration levels of metals such as barium, cobalt, copper, mercury, nickel, vanadium, and zinc are all below their respective U.S. EPA Region 9 Preliminary Remediation Goal (PRG) screening levels (EPA, 2008). Chromium was detected at a concentration of 19 milligrams per kilogram (mg/kg), which is slightly above the PRG screening level of 5.6 mg/kg (EPA, 2008) for industrial soil. Also, the analytical test results obtained testing soil sample collected at B-2 @ 14 feet revealed that the detected concentration levels of metals such as barium, beryllium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc are all below their respective U.S. EPA Region 9 Preliminary Remediation Goal (PRG) screening levels (EPA, 2008). Arsenic and chromium were detected at concentrations of 2.7 and 25 mg/kg, which are slightly above the PRG screening levels of 1.6 and 5.6 mg/kg (EPA, 2008) for industrial soil.

All these metals occur naturally in the soil. The concentration level of chromium and arsenic detected in the soil mixture sample could be naturally occurring background level.

TPH in gasoline and diesel range was detected in the soil mixture samples at a concentration ranging between 4.5 mg/kg and 25 mg/kg, respectively, which are below the target screening level of 100 mg/kg as recommended in the California State Water Resources Control Board (SWRCB) leaking underground fuel tank (LUFT) manual (SWRCB, 1989). Based on the test results, we conclude that the soil material can be used as backfill material and it will not have an impact to the human health.

9.0 POST DESIGN SERVICES

Post-design geotechnical services will be required during construction. It is recommended that GEI review the project plans and specifications prior to finalization. Construction should be observed and tested, if necessary, at the following stages by the Soils Engineer and/or his representative:

- *During excavation operations and subgrade preparation;*

- *Bedding and shading of the water line;*
- *During backfilling and compaction operations;*
- *Construction of pavement structural sections; and*
- *When any unusual subsurface soil conditions are encountered.*

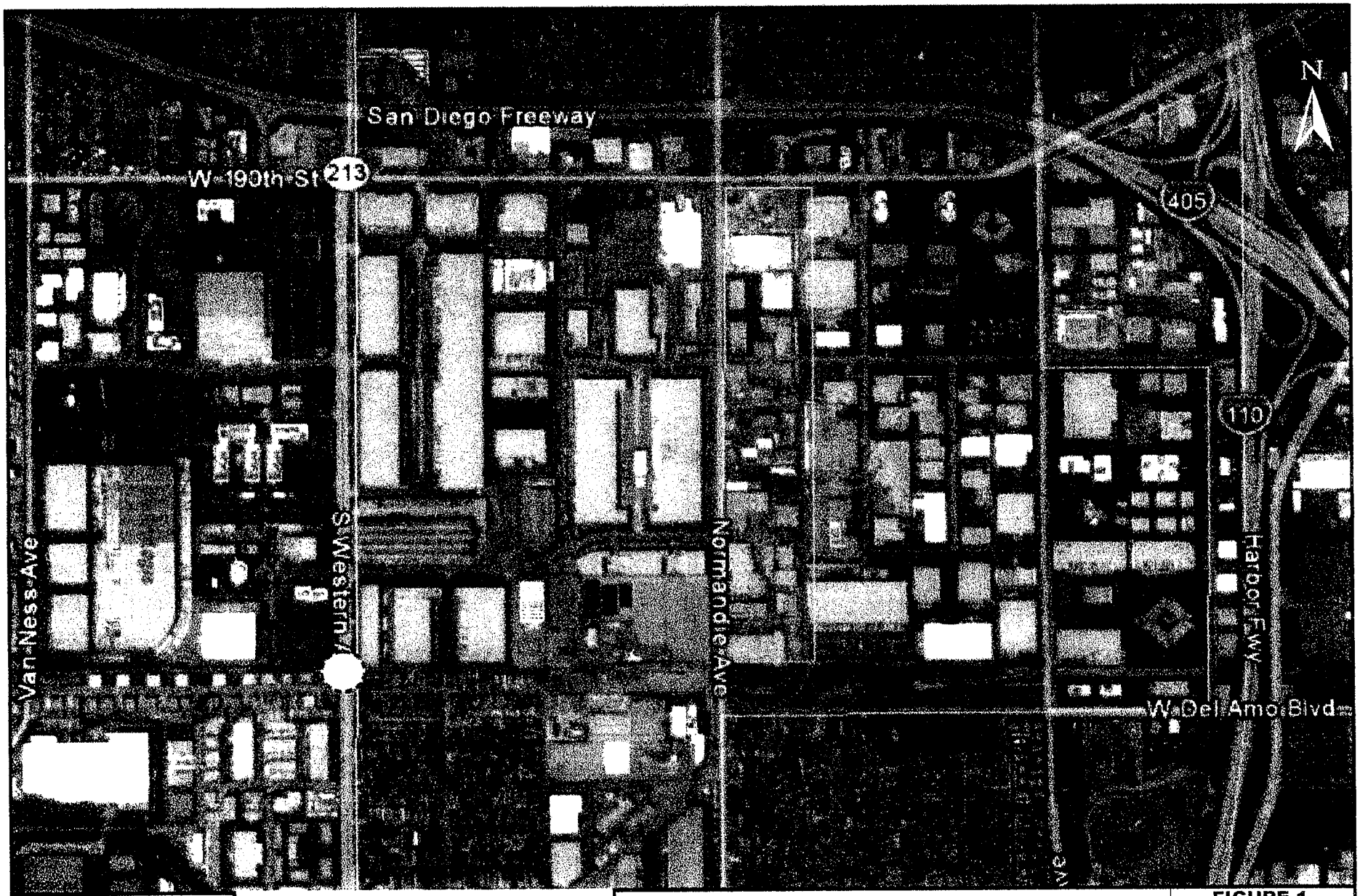
10.0 LIMITATIONS

The report, exploration logs, and other information resulting from GEI's efforts were prepared exclusively for use by the City of Torrance and their consultants in designing the proposed water line. The report is not intended to be suitable for reuse on extensions or modifications of the project or for use on any project other than the currently proposed as it may not contain sufficient or appropriate information for such uses. If this report or portions of this report are provided to the contractors or included in the project specifications, it should be understood that they are provided for information only.

This report presents recommendations for the subject site based on the assumption that the subsurface conditions do not deviate appreciably from those disclosed in our recent site investigation. The possibility of different local soil conditions cannot be discounted. It is the responsibility of the owner or his representative to bring any deviations or unexpected conditions observed during construction to the attention of the Soils Engineer. In this way, any required supplemental recommendations can be made with a minimum of delay to the project.

Our investigation and evaluations were performed using generally accepted engineering approaches and principles available at this time and the degree of care and skill ordinarily exercised under similar circumstances by reputable Soils Engineers practicing in this area. No other representation, either expressed or implied, is included or intended in our report.

ILLUSTRATIONS



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LEGEND:

Project Location

VICINITY MAP

Geotechnical Investigation Report
Proposed Western Avenue Jacking Pits as part of the Water Main Replacement Project
City of Torrance, Los Angeles County, California

FIGURE 1	
DRAWN BY:	RCF
APPROVED BY:	FHS
PROJECT NO:	172-49
DATE:	08/31/2011

APPENDIX A

LOGS OF TEST BORINGS AND BORING RECORDS

LOG OF BOREHOLE B-1

Date Drilled: 8/17/11 Logged by: RCF Project Manager: FHS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 lbs @ 30" drop

Surface Elevation(ft): ~ 53.3' Depth to Water(ft): Not Encountered

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/FOOT	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB. TESTS And/Or OVA READINGS (ppm)
		ASPHALT CONCRETE (AC), 5 inches thick **AGGREGATE BASE (AB)**, 19 inches thick						
		SANDY SILT (ML), dark brown, moist, fine- to coarse- grained, non-plastic fine	■	X	23	17.4	112.2	R-Value PI, GS, SE, CORROS.
5		**SANDY CLAY (CL)** yellowish brown, moist, very dense, fine- to coarse- grained, mostly plastic fines						
		-Hard	■		57	16.5	116.8	DS
10								
		-Very Stiff	■		43	13.9	123.3	
15								
		Borehole terminated at 15.5 feet below the existing ground surface. No groundwater was encountered during drilling operations. Borehole was backfilled and compacted with soil cuttings and patched with cold asphalt.						
20		This Boring Record was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).						

LAGNNN01 172-49.GPJ LAGNNN01.GDT 9/6/11

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Western Ave. Jacking Pits for W. M. R. Project
City of Torrance, CA
GEI Project No.: 172-49

Figure A-1

LOG OF BOREHOLE B-2

Date Drilled: 8/17/11 Logged by: RCF Project Manager: FHS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 lbs @ 30" drop

Surface Elevation(ft): ~53.6' Depth to Water(ft): Not Encountered

DEPTH (ft)	GRAPHIC LOG	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/FOOT	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB. TESTS And/Or OVA READINGS (ppm)
		ASPHALT CONCRETE (AC), 4 inches thick **AGGREGATE BASE (AB)**, 20 inches thick						
		SANDY CLAY (CL) dark brown to black, moist, stiff, Plastic, fine- to coarse- grained	■	X	20	15.2	114.3	SE, COMPACT.
5		-Yellowish gray, very stiff, high plastic fines	■		33	16.6	115.0	GS, PI
10		-Gray, medium plastic fines	■		38	13.7	120.2	GS, PI
15		Borehole terminated at 15.5 feet below the existing ground surface. No groundwater was encountered during drilling operations. Borehole was backfilled and compacted with soil cuttings and patched with cold asphalt.						
20		This Boring Record was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).						

LAGNNN01 172-49.GPJ LAGNNN01.GDT 9/6/11

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Western Ave. Jacking Pits for W. M. R. Project
City of Torrance, CA
GEI Project No.: 172-49

Figure A-2

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names	Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 5333)
CP	Compaction Curve (CTM 216)
CR	Corrosion, Sulfates, Chlorides (CTM 643, CTM 417, CTM 422)
CU	Consolidated Undrained Triaxial (ASTM D 4767)
DS	Direct Shear (ASTM D 3080)
EI	Expansion Index (ASTM D 4829)
M	Moisture Content (ASTM D 2216)
OC	Organic Content (ASTM D 2974)
P	Permeability (CTM 220)
PA	Particle Size Analysis (ASTM D 422)
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89, AASHTO T 90)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
R	R-Value (CTM 301)
SE	Sand Equivalent (CTM 217)
SG	Specific Gravity (AASHTO T 100)
SL	Shrinkage Limit (ASTM D 427)
SW	Swell Potential (ASTM D 4546)
UC	Unconfined Compression - Soil (ASTM D 2166) Unconfined Compression - Rock (ASTM D 2938)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850)
UW	Unit Weight (ASTM D 4767)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

REFERENCE Caltrans Soil and Rock Logging. Classification, and Presentation Manual (2010).

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BORING RECORD LEGEND

Geotechnical Investigation Report
Proposed Jacking Pits as part of the Water Main Replacement Project
City of Torrance, Los Angeles County, California

PROJECT NO: 172-49

CONSISTENCY OF COHESIVE SOILS				
Description	**Shear Strength (tsf)**	**Pocket Penetrometer, PP, Measurement (tsf)**	**Torvane, TV, Measurement (tsf)**	**Vane Shear, VS, Measurement (tsf)**
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2

APPARENT DENSITY OF COHESIONLESS SOILS	
Description	**SPT N_{60} (blows / 12 inches)**
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE	
Description	**Criteria**
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS	
Description	**Criteria**
Trace	Particles are present but estimated to be less than 5%
Few	5 - 10%
Little	15 - 25%
Some	30 - 45%
Mostly	50 - 100%

PARTICLE SIZE		
Description		**Size (in)**
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

CEMENTATION	
Description	**Criteria**
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

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BORING RECORD LEGEND

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City of Torrance, Los Angeles County, California

PROJECT NO: 172-49

LEGEND OF ROCK MATERIALS


IGNEOUS ROCK


SEDIMENTARY ROCK


METAMORPHIC ROCK

BEDDING SPACING

Description	Thickness/Spacing
Massive	Greater than 10 ft
Very Thickly Bedded	3 ft - 10 ft
Thickly Bedded	1 ft - 3 ft
Moderately Bedded	4 in - 1 ft
Thinly Bedded	1 in - 4 in
Very Thinly Bedded	1/4 in - 1 in
Laminated	Less than 1/4 in

WEATHERING DESCRIPTORS FOR INTACT ROCK

	Diagnostic Features					
	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Leaching		
Description	Body of Rock	Fracture Surfaces		Texture	Leaching	General Characteristics
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No leaching	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation, grain boundary conditions	All fracture surfaces are discolored or oxidized; surfaces friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Texture altered by chemical disintegration (hydration, argillation)	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored of oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

PERCENT CORE RECOVERY (REC)

$$\frac{\Sigma \text{ Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\frac{\Sigma \text{ Length of intact core pieces} \geq 4 \text{ in.}}{\text{Total length of core run (in.)}} \times 100$$

RQD* indicates soundness criteria not met.

ROCK HARDNESS

Description	Criteria
Extremely Hard	Cannot be scratched with a pocketknife or sharp pick. Can only be chipped with repeated heavy hammer blows
Very Hard	Cannot be scratched with a pocketknife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Can be scratched with a pocketknife or sharp pick with difficulty (heavy pressure). Breaks with heavy hammer blows.
Moderately Hard	Can be scratched with a pocketknife or sharp pick with light or moderate pressure. Breaks with moderate hammer blows
Moderately Soft	Can be grooved 1/16 in. deep with a pocketknife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily with a pocketknife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Can be readily indented, grooved or gouged with fingernail, or carved with a pocketknife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures
Very Slightly Fractured	Core lengths greater than 3 ft.
Slightly Fractured	Core lengths mostly from 1 to 3 ft.
Moderately Fractured	Core lengths mostly 4 in. to 1 ft.
Intensely Fractured	Core lengths mostly from 1 to 4 in.
Very Intensely Fractured	Mostly chips and fragments.

REFERENCE Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

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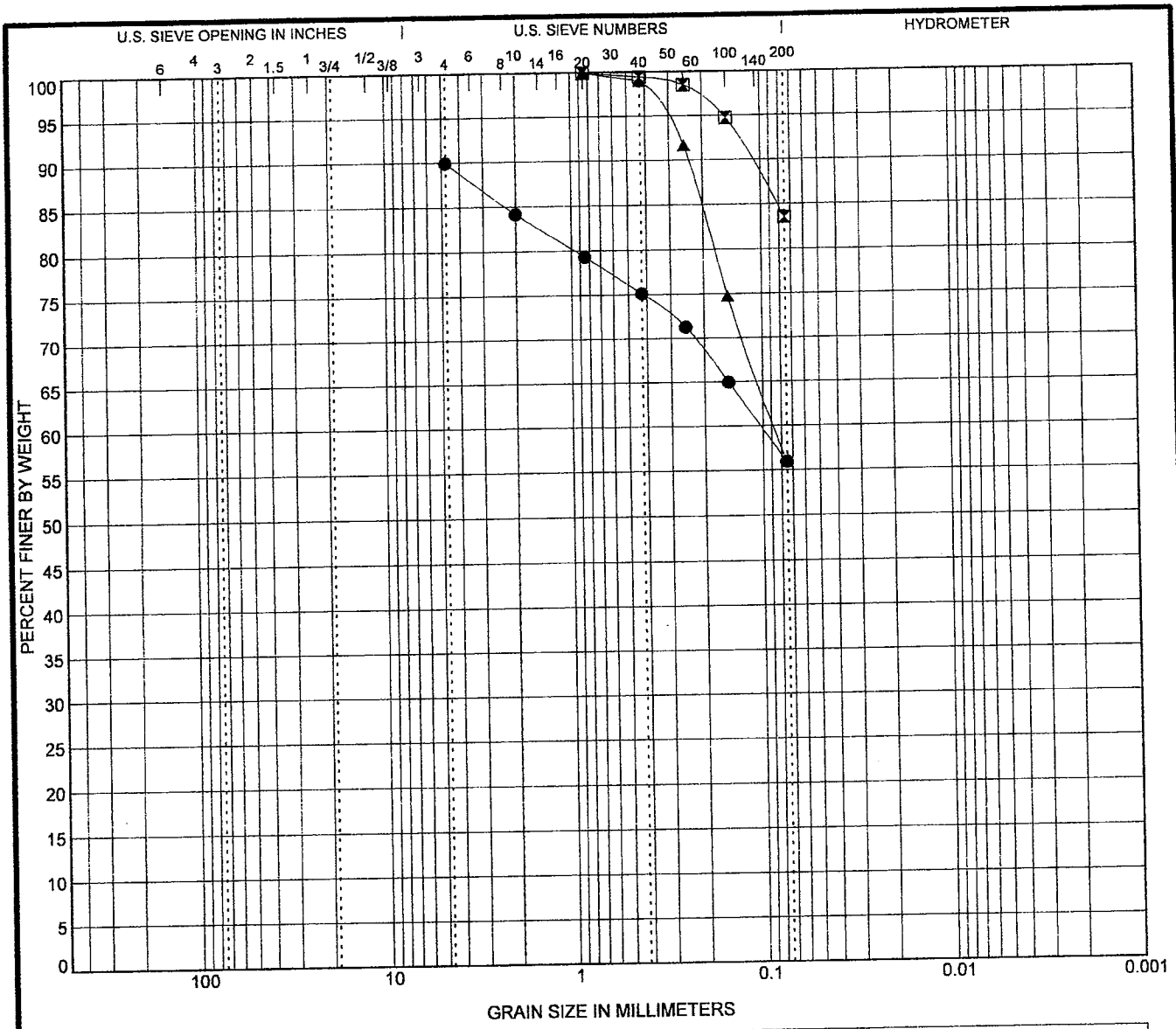
BORING RECORD LEGEND

Geotechnical Investigation Report
Proposed Jacking Pits as part of the Water Main Replacement Project
City of Torrance, Los Angeles County, California

PROJECT NO: 172-49

APPENDIX B

GEOTECHNICAL LABORATORY TESTING



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 @ 5.0 ft.	SANDY SILT (ML)	NP	NP	NP		
⊠ B-2 @ 8.0 ft.	SANDY CLAY (CL)	36	8	28		
▲ B-2 @ 14.0 ft.	SANDY CLAY (CL)	27	12	15		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 @ 5.0 ft.	4.75	0.103			0.0	34.0	55.9	
⊠ B-2 @ 8.0 ft.	0.85				0.0	16.4	83.5	
▲ B-2 @ 14.0 ft.	0.85	0.087			0.0	44.0	55.9	

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Telephone: (949) 263-8334
Fax: (949) 263-8338

GRAIN SIZE DISTRIBUTION

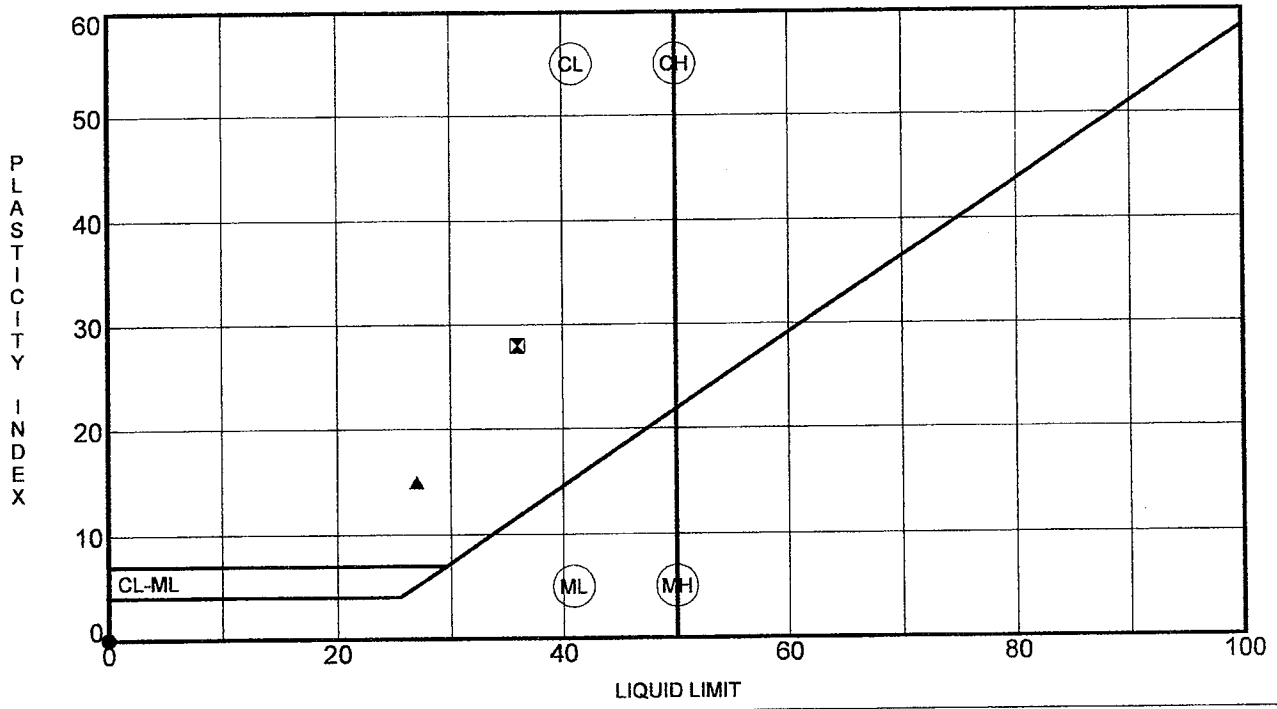
Project: Western Ave. Jacking Pits for W. M. R. Project

Location: City of Torrance, CA

GEI Project No.: 172-49

Figure B-1

US_GRAIN_SIZE_172-49.GPJ LAGNNN01.GDT 9/6/11



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-1	5.0	NP	NP	NP	56	SANDY SILT (ML)
⊠	B-2	8.0	36	8	28	84	SANDY CLAY (CL)
▲	B-2	14.0	27	12	15	56	SANDY CLAY (CL)

GEI

GEO-ENVIRONMENTAL, INC.
2691 Richter Avenue, Suite 127
Irvine, California 92606-5125
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ATTERBERG LIMITS' RESULTS

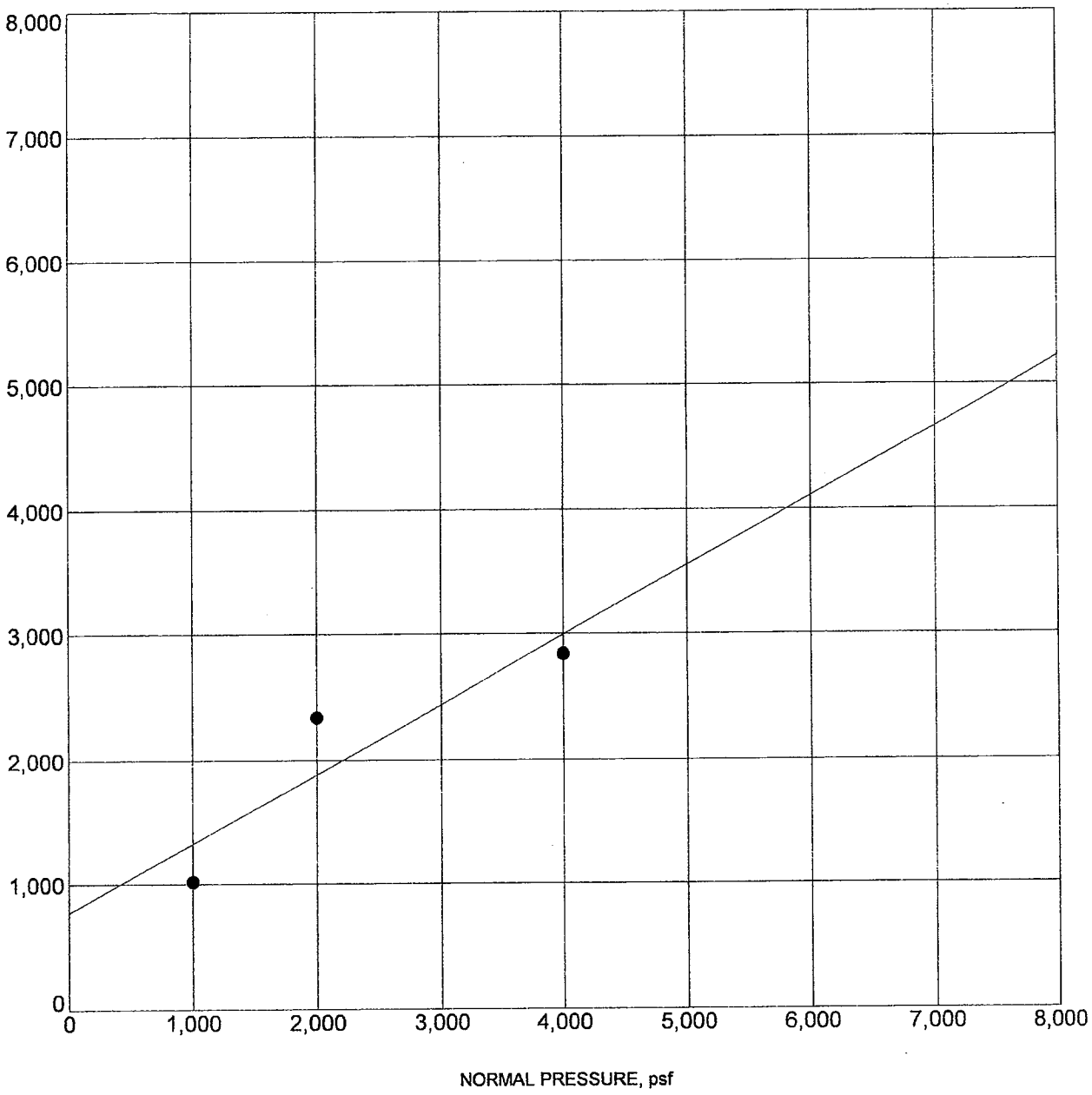
Project: Western Ave. Jacking Pits for W. M. R. Project

Location: City of Torrance, CA

GEI Project No.: 172-49

Figure B-2

US ATTERBERG LIMITS 172-49.GPJ LAGNNN01.GDT 9/1/11



Specimen Identification	Classification	γ_d	MC%	c	ϕ
● B-1 @ 8.0 ft.	SANDY CLAY (CL)	117	17	770	29

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DIRECT SHEAR TEST

Project: Western Ave. Jacking Pits for W. M. R. Project

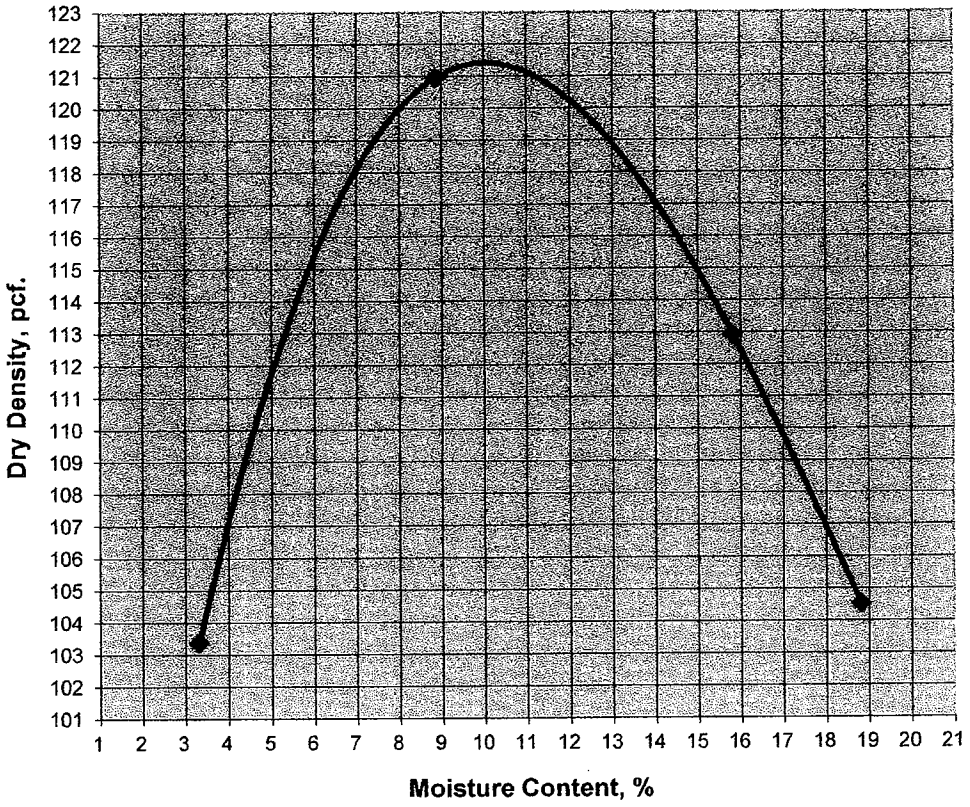
Location: City of Torrance, CA

GEI Project No.: 172-49

Figure B-3

US_DIRECT_SHEAR_172-49.GPJ_LAGNNN01.GDT_9/6/11

Dry Density - Moisture Content Relationship



Sample No.: B-2 @ 2-5'

Soil Type: SANDY CLAY (CL)

Method of Compaction: ASTM D 1557-00

Maximum Dry Density: 121.5 pcf

Optimum Moisture Content: 10.0%

GEO-ENVIRONMENTAL, INC.

Caltrans Certified
DBE Firm

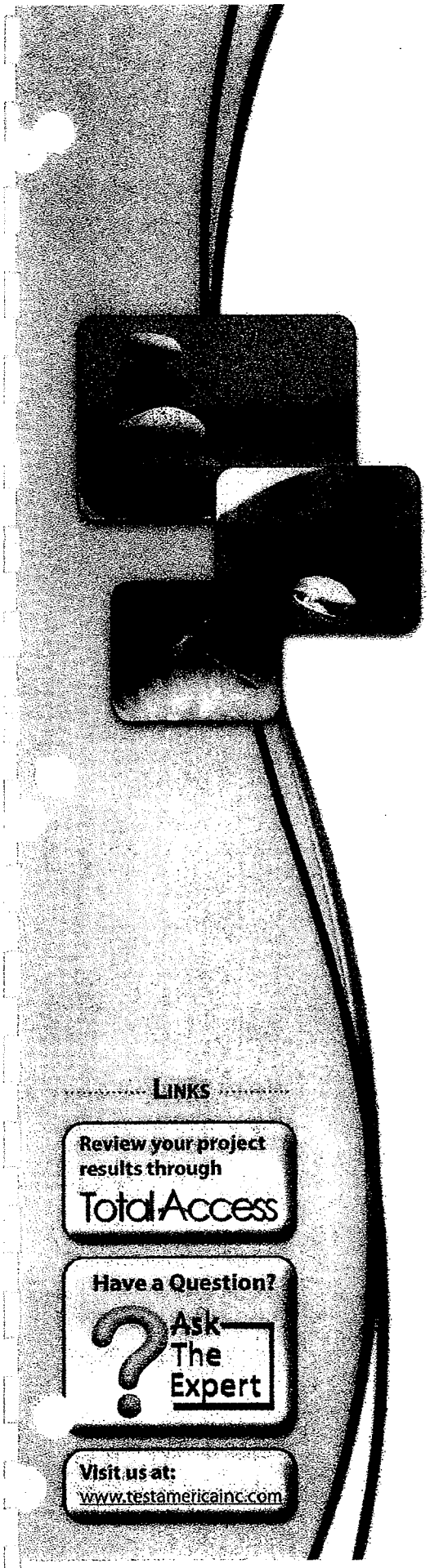
Geotechnical Investigation Report
Western Ave. Jacking Pits for W. M. R. Project
City of Torrance, California

GEI-Project No: 172-49

Figure B-4

APPENDIX C

ENVIRONMENTAL LABORATORY TESTING



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Irvine
17461 Derian Avenue. Suite 100
Irvine, CA 92614
Tel: (949) 261-1022

TestAmerica Job ID: IUH2314
Client Project/Site: 172-49
Client Project Description: Western Ave. - Jacking Pit Project

For:
Geo Environmental, Inc.
2691 Richter Avenue, Suite 127
Irvine, CA 92706-5125

Attn: Arjun Subedi

Authorized for release by:
08/31/2011 04:10:11 PM

Lena Davidkova
Project Manager
Lena.Davidkova@testamericainc.com

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Certification Summary 15
Chain of Custody 16

Sample Summary

Client: Geo Environmental, Inc.
Project/Site: 172-49

TestAmerica Job ID: IUH2314

3

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
IUH2314-01	B-1 3'	Solid	08/22/11 15:35	08/22/11 15:35
IUH2314-02	B-1 8'	Solid	08/22/11 15:35	08/22/11 15:35
IUH2314-03	B-1 14'	Solid	08/22/11 15:35	08/22/11 15:35
IUH2314-04	B-2 3'	Solid	08/22/11 15:35	08/22/11 15:35
IUH2314-05	B-2 8'	Solid	08/22/11 15:35	08/22/11 15:35
IUH2314-06	B-2 14'	Solid	08/22/11 15:35	08/22/11 15:35

Client Sample ID: B-1 3'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-01
Matrix: Solid

4

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
EFH (C13 - C40)	**25**		5.0	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C13 - C14)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C15 - C16)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C17 - C18)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C19 - C20)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C21 - C22)	**4.5**		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C23 - C24)	**5.5**		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C25 - C26)	**5.1**		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C27 - C28)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C29 - C30)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C31 - C32)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C33 - C34)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C35 - C36)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C37 - C38)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0
EFH (C39 - C40)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:23	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-Octacosane	*76*		*40 - 140*	*08/27/11 10:04*	*08/27/11 19:23*	*1.0*

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C4 - C12)	ND		0.39	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C4-C5	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C6	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C7	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C8	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C9	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C10	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C11	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0
C12	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 22:52	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-BFB (FID)	*85*		*65 - 140*	*08/24/11 09:00*	*08/24/11 22:52*	*1.0*

Client Sample ID: B-1 8'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-02
Matrix: Solid

Method: EPA 6010B - METALS

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND	RL1	20	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Arsenic	ND	RL1	4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Barium	**120**		2.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Beryllium	ND	RL1	1.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Cadmium	ND	RL1	1.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Chromium	**19**		2.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Cobalt	**7.1**		2.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Copper	**83**		4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Lead	ND	RL1	4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Molybdenum	ND	RL1	4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0

Client Sample ID: B-1 8'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-02
Matrix: Solid

4

Method: EPA 6010B - METALS (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Nickel	12		4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Selenium	ND	RL1	4.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Silver	ND	RL1	2.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Thallium	ND	RL1	20	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Vanadium	42		2.0	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0
Zinc	75		10	mg/kg		08/26/11 09:36	08/28/11 16:33	2.0

Method: EPA 7471A - METALS

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.036		0.020	mg/kg		08/23/11 12:08	08/24/11 15:37	1.0

Client Sample ID: B-1 14'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-03
Matrix: Solid

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
EFH (C13 - C40)	ND		5.0	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C13 - C14)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C15 - C16)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C17 - C18)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C19 - C20)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C21 - C22)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C23 - C24)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C25 - C26)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C27 - C28)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C29 - C30)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C31 - C32)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C33 - C34)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C35 - C36)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C37 - C38)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0
EFH (C39 - C40)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 18:43	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-Octacosane	*74*		*40 - 140*	*08/27/11 10:04*	*08/27/11 18:43*	*1.0*

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C4 - C12)	ND		0.38	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C4-C5	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C6	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C7	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C8	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C9	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C10	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C11	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0
C12	ND		0.056	mg/kg		08/24/11 09:00	08/24/11 23:19	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-BFB (FID)	*92*		*65 - 140*	*08/24/11 09:00*	*08/24/11 23:19*	*1.0*

Client Sample ID: B-2 3'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-04
Matrix: Solid

4

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
EFH (C13 - C40)	ND		5.0	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C13 - C14)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C15 - C16)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C17 - C18)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C19 - C20)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C21 - C22)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C23 - C24)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C25 - C26)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C27 - C28)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C29 - C30)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C31 - C32)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C33 - C34)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C35 - C36)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C37 - C38)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0
EFH (C39 - C40)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:43	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-Octacosane	*72*		*40 - 140*	*08/27/11 10:04*	*08/27/11 19:43*	*1.0*

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C4 - C12)	ND		0.39	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C4-C5	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C6	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C7	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C8	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C9	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C10	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C11	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0
C12	ND		0.058	mg/kg		08/24/11 09:00	08/24/11 23:46	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-BFB (FID)	*72*		*65 - 140*	*08/24/11 09:00*	*08/24/11 23:46*	*1.0*

Client Sample ID: B-2 8'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-05
Matrix: Solid

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
EFH (C13 - C40)	ND		5.0	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C13 - C14)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C15 - C16)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C17 - C18)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C19 - C20)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C21 - C22)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C23 - C24)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C25 - C26)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C27 - C28)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C29 - C30)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0

Client Sample ID: B-2 8'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-05
Matrix: Solid

4

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B) (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
EFH (C31 - C32)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C33 - C34)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C35 - C36)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C37 - C38)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0
EFH (C39 - C40)	ND		3.5	mg/kg		08/27/11 10:04	08/27/11 19:03	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-Octacosane	*62*		*40 - 140*	*08/27/11 10:04*	*08/27/11 19:03*	*1.0*

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C4 - C12)	ND		0.37	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C4-C5	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C6	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C7	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C8	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C9	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C10	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C11	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0
C12	ND		0.056	mg/kg		08/24/11 09:00	08/25/11 00:13	1.0

Surrogate	*% Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-BFB (FID)	*75*		*65 - 140*	*08/24/11 09:00*	*08/25/11 00:13*	*1.0*

Client Sample ID: B-2 14'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-06
Matrix: Solid

Method: EPA 6010B - METALS

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		10	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Arsenic	**2.7**		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Barium	**110**		1.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Beryllium	**0.72**		0.50	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Cadmium	ND		0.50	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Chromium	**25**		1.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Cobalt	**5.2**		1.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Copper	**22**		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Lead	**4.6**		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Molybdenum	ND		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Nickel	**15**		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Selenium	ND		2.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Silver	ND		1.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Thallium	ND		10	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Vanadium	**42**		1.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0
Zinc	**48**		5.0	mg/kg		08/26/11 09:36	08/26/11 23:36	1.0

Method: EPA 7471A - METALS

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.044**		0.020	mg/kg		08/23/11 12:08	08/24/11 15:44	1.0

Lab Chronicle

Client: Geo Environmental, Inc.
Project/Site: 172-49

TestAmerica Job ID: IUH2314

Client Sample ID: B-1 3'

Lab Sample ID: IUH2314-01
Matrix: Solid
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	CADHS LUFT		1.0	11H3711_P	08/27/11 10:04	IB	TAL IRV
Total	Analysis	EPA 8015B		1.0	11H3711	08/27/11 19:23	CP	TAL IRV
Total	Prep	EPA 5030B		0.97	11H3271_P	08/24/11 09:00	APT	TAL IRV
Total	Analysis	EPA 8015B MOD		1.0	11H3271	08/24/11 22:52	FB	TAL IRV

Client Sample ID: B-1 8'

Lab Sample ID: IUH2314-02
Matrix: Solid
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	EPA 3050B ICP		1.0	11H3616_P	08/26/11 09:36	MPS	TAL IRV
Total	Analysis	EPA 6010B		2.0	11H3616	08/28/11 16:33	NH	TAL IRV
Total	Prep	EPA 7471A Hg		1.0	11H3123_P	08/23/11 12:08	SN	TAL IRV
Total	Analysis	EPA 7471A		1.0	11H3123	08/24/11 15:37	DB	TAL IRV

Client Sample ID: B-1 14'

Lab Sample ID: IUH2314-03
Matrix: Solid
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	CADHS LUFT		1.0	11H3711_P	08/27/11 10:04	IB	TAL IRV
Total	Analysis	EPA 8015B		1.0	11H3711	08/27/11 18:43	CP	TAL IRV
Total	Prep	EPA 5030B		0.94	11H3271_P	08/24/11 09:00	APT	TAL IRV
Total	Analysis	EPA 8015B MOD		1.0	11H3271	08/24/11 23:19	FB	TAL IRV

Client Sample ID: B-2 3'

Lab Sample ID: IUH2314-04
Matrix: Solid
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	CADHS LUFT		1.0	11H3711_P	08/27/11 10:04	IB	TAL IRV
Total	Analysis	EPA 8015B		1.0	11H3711	08/27/11 19:43	CP	TAL IRV
Total	Prep	EPA 5030B		0.97	11H3271_P	08/24/11 09:00	APT	TAL IRV
Total	Analysis	EPA 8015B MOD		1.0	11H3271	08/24/11 23:46	FB	TAL IRV

Client Sample ID: B-2 8'

Lab Sample ID: IUH2314-05
Matrix: Solid
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	CADHS LUFT		1.0	11H3711_P	08/27/11 10:04	IB	TAL IRV
Total	Analysis	EPA 8015B		1.0	11H3711	08/27/11 19:03	CP	TAL IRV
Total	Prep	EPA 5030B		0.93	11H3271_P	08/24/11 09:00	APT	TAL IRV
Total	Analysis	EPA 8015B MOD		1.0	11H3271	08/25/11 00:13	FB	TAL IRV

Lab Chronicle

Client: Geo Environmental, Inc.
Project/Site: 172-49

TestAmerica Job ID: IUH2314

Client Sample ID: B-2 14'
Date Collected: 08/22/11 15:35
Date Received: 08/22/11 15:35

Lab Sample ID: IUH2314-06
Matrix: Solid

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Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
Total	Prep	EPA 3050B ICP		1.0	11H3616_P	08/26/11 09:36	MPS	TAL IRV
Total	Analysis	EPA 6010B		1.0	11H3616	08/26/11 23:36	DP	TAL IRV
Total	Prep	EPA 7471A Hg		1.0	11H3123_P	08/23/11 12:08	SN	TAL IRV
Total	Analysis	EPA 7471A		1.0	11H3123	08/24/11 15:44	DB	TAL IRV

Laboratory References:
TAL IRV = TestAmerica Irvine, 17461 Derian Avenue. Suite 100, Irvine, CA 92614, TEL (949) 261-1022

Method: EPA 8015B - EXTRACTABLE FUEL HYDROCARBONS (CADHS/8015B)

Lab Sample ID: 11H3711-BS1
Matrix: Soil
Analysis Batch: 11H3711

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3711_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
EFH (C10 - C28)	33.3	24.7	MNR	mg/kg		74	45 - 115

Surrogate	*LCS % Recovery*	*LCS Qualifier*	*Limits*
n-Octacosane	*73*	*MNR*	*40 - 140*

Method: EPA 6010B - METALS

Lab Sample ID: 11H3616-BLK1
Matrix: Soil
Analysis Batch: 11H3616

Client Sample ID: Method Blank
Prep Type: Total
Prep Batch: 11H3616_P

Analyte	Blank Result	Blank Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		10	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Arsenic	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Barium	ND		1.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Beryllium	ND		0.50	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Cadmium	ND		0.50	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Chromium	ND		1.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Cobalt	ND		1.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Copper	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Lead	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Molybdenum	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Nickel	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Selenium	ND		2.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Silver	ND		1.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Thallium	ND		10	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Vanadium	ND		1.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00
Zinc	ND		5.0	mg/kg		08/26/11 09:36	08/28/11 16:16	1.00

Lab Sample ID: 11H3616-BS1
Matrix: Soil
Analysis Batch: 11H3616

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3616_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	49.5	43.7		mg/kg		88	80 - 120
Arsenic	49.5	42.9		mg/kg		87	80 - 120
Barium	49.5	45.9		mg/kg		93	80 - 120
Beryllium	49.5	43.5		mg/kg		88	80 - 120
Cadmium	49.5	44.6		mg/kg		90	80 - 120
Chromium	49.5	46.2		mg/kg		93	80 - 120
Cobalt	49.5	44.1		mg/kg		89	80 - 120
Copper	49.5	46.1		mg/kg		93	80 - 120
Lead	49.5	44.4		mg/kg		90	80 - 120
Molybdenum	49.5	43.4		mg/kg		88	80 - 120
Nickel	49.5	43.8		mg/kg		88	80 - 120
Selenium	49.5	40.3		mg/kg		81	80 - 120
Silver	24.8	22.9		mg/kg		93	80 - 120
Thallium	49.5	43.7		mg/kg		88	80 - 120
Vanadium	49.5	45.3		mg/kg		92	80 - 120

Method: EPA 6010B - METALS (Continued)

Lab Sample ID: 11H3616-BS1
Matrix: Soil
Analysis Batch: 11H3616

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3616_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Zinc	49.5	42.9		mg/kg		87	80 - 120

Lab Sample ID: 11H3616-MS1
Matrix: Soil
Analysis Batch: 11H3616

Client Sample ID: Matrix Spike
Prep Type: Total
Prep Batch: 11H3616_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	ND		49.8	14.8	M2	mg/kg		30	75 - 125
Arsenic	ND		49.8	40.8		mg/kg		82	75 - 125
Barium	7.84		49.8	51.5		mg/kg		88	75 - 125
Beryllium	ND		49.8	42.0		mg/kg		85	75 - 125
Cadmium	ND		49.8	41.6		mg/kg		84	75 - 125
Chromium	0.488		49.8	43.9		mg/kg		87	75 - 125
Cobalt	ND		49.8	42.1		mg/kg		85	75 - 125
Copper	11.4		49.8	56.8		mg/kg		91	75 - 125
Lead	ND		49.8	41.1		mg/kg		83	75 - 125
Molybdenum	0.730		49.8	29.2	M2	mg/kg		57	75 - 125
Nickel	5.02		49.8	44.7		mg/kg		80	75 - 125
Selenium	ND		49.8	39.4		mg/kg		79	75 - 125
Silver	ND		24.9	20.4		mg/kg		82	75 - 125
Thallium	ND		49.8	16.7	M2	mg/kg		34	75 - 125
Vanadium	0.846		49.8	42.9		mg/kg		85	75 - 125
Zinc	30.3		49.8	67.8		mg/kg		75	75 - 125

Lab Sample ID: 11H3616-MSD1
Matrix: Soil
Analysis Batch: 11H3616

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total
Prep Batch: 11H3616_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Antimony	ND		49.5	14.8	M2	mg/kg		30	75 - 125	0.2	20
Arsenic	ND		49.5	40.9		mg/kg		83	75 - 125	0.3	20
Barium	7.84		49.5	53.6		mg/kg		92	75 - 125	4	20
Beryllium	ND		49.5	42.4		mg/kg		86	75 - 125	0.8	20
Cadmium	ND		49.5	42.2		mg/kg		85	75 - 125	1	20
Chromium	0.488		49.5	46.3		mg/kg		92	75 - 125	5	20
Cobalt	ND		49.5	42.8		mg/kg		87	75 - 125	2	20
Copper	11.4		49.5	67.0		mg/kg		112	75 - 125	16	20
Lead	ND		49.5	41.3		mg/kg		83	75 - 125	0.4	20
Molybdenum	0.730		49.5	29.6	M2	mg/kg		58	75 - 125	1	20
Nickel	5.02		49.5	59.2	R	mg/kg		109	75 - 125	28	20
Selenium	ND		49.5	38.3		mg/kg		77	75 - 125	3	20
Silver	ND		24.8	20.5		mg/kg		83	75 - 125	0.5	20
Thallium	ND		49.5	17.3	M2	mg/kg		35	75 - 125	3	20
Vanadium	0.846		49.5	43.9		mg/kg		87	75 - 125	2	20
Zinc	30.3		49.5	74.5		mg/kg		89	75 - 125	9	20

Method: EPA 7471A - METALS

Lab Sample ID: 11H3123-BLK1
Matrix: Soil
Analysis Batch: 11H3123

Client Sample ID: Method Blank
Prep Type: Total
Prep Batch: 11H3123_P

Analyte	Blank Result	Blank Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	mg/kg		08/23/11 12:08	08/24/11 15:06	1.00

Lab Sample ID: 11H3123-BS1
Matrix: Soil
Analysis Batch: 11H3123

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3123_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Mercury	0.0800	0.0893		mg/kg		112	80 - 120

Lab Sample ID: 11H3123-MS1
Matrix: Soil
Analysis Batch: 11H3123

Client Sample ID: Matrix Spike
Prep Type: Total
Prep Batch: 11H3123_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits
Mercury	0.0260		0.800	0.931		mg/kg		113	70 - 130

Lab Sample ID: 11H3123-MSD1
Matrix: Soil
Analysis Batch: 11H3123

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total
Prep Batch: 11H3123_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Mercury	0.0260		0.800	0.901		mg/kg		109	70 - 130	3	20

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.)

Lab Sample ID: 11H3271-BLK1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Method Blank
Prep Type: Total
Prep Batch: 11H3271_P

Analyte	Blank Result	Blank Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C4 - C12)	ND		0.40	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C4-C5	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C6	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C7	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C8	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C9	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C10	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C11	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00
C12	ND		0.060	mg/kg		08/24/11 09:00	08/24/11 10:56	1.00

Surrogate	*Blank % Recovery*	*Blank Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-BFB (FID)	*109*		*65 - 140*	*08/24/11 09:00*	*08/24/11 10:56*	*1.00*

Lab Sample ID: 11H3271-BS1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3271_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
GRO (C4 - C12)	1.60	1.58		mg/kg		99	70 - 135

Method: EPA 8015B MOD - VOLATILE HYDROCARBON DISTRIBUTION (EPA 8015 Mod.) (Continued)

Lab Sample ID: 11H3271-BS1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Lab Control Sample
Prep Type: Total
Prep Batch: 11H3271_P

Surrogate	LCS % Recovery	LCS Qualifier	Limits
4-BFB (FID)	208	Z2	65 - 140

Lab Sample ID: 11H3271-BSD1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Lab Control Sample Dup
Prep Type: Total
Prep Batch: 11H3271_P

Analyte			Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
GRO (C4 - C12)			1.60	1.54		mg/kg		96	70 - 135	3	20

Surrogate	LCS Dup % Recovery	LCS Dup Qualifier	Limits
4-BFB (FID)	93		65 - 140

Lab Sample ID: 11H3271-MS1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Matrix Spike
Prep Type: Total
Prep Batch: 11H3271_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits		
GRO (C4 - C12)	0.241		0.412	0.465	M2	mg/kg		54	60 - 140		

Surrogate	Matrix Spike % Recovery	Matrix Spike Qualifier	Limits
4-BFB (FID)	75		65 - 140

Lab Sample ID: 11H3271-MSD1
Matrix: Soil
Analysis Batch: 11H3271

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total
Prep Batch: 11H3271_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
GRO (C4 - C12)	0.241		0.437	0.579		mg/kg		78	60 - 140	22	30

Surrogate	Matrix Spike Dup % Recovery	Matrix Spike Dup Qualifier	Limits
4-BFB (FID)	102		65 - 140

Qualifiers

Diesel

Qualifier	Qualifier Description
MNR	No results were reported for the MS/MSD. The sample used for the MS/MSD required dilution due to the sample matrix. Because of this, the spike compounds were diluted below the detection limit.

Metals

Qualifier	Qualifier Description
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
R	The RPD exceeded the method control limit due to sample matrix effects. The individual analyte QA/QC recoveries, however, were within acceptance limits.
RL1	Reporting limit raised due to sample matrix effects.

BTEX

Qualifier	Qualifier Description
Z2	Surrogate recovery was above the acceptance limits. Data not impacted.
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit (Dioxin)
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or method detection limit if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: Geo Environmental, Inc.
Project/Site: 172-49

TestAmerica Job ID: IUH2314

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Irvine	Arizona	State Program	9	AZ0671
TestAmerica Irvine	California	LA Cty Sanitation Districts	9	10256
TestAmerica Irvine	California	NELAC	9	1108CA
TestAmerica Irvine	California	State Program	9	2706
TestAmerica Irvine	Guam	State Program	9	Cert. No. 10.001r
TestAmerica Irvine	Hawaii	State Program	9	N/A
TestAmerica Irvine	Nevada	State Program	9	CA015312007A
TestAmerica Irvine	Northern Mariana Islands	State Program	9	MP0002
TestAmerica Irvine	USDA	USDA		P330-09-00080

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Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

GEO-ENVIRONMENTAL, INC.
Caltrans Certified
DBE Firm

LABORATORY TESTS REQUEST

1UH2314 - REV

Project Name: Proposed Weston Ave. Jacking Pit for water main replacement project

Client: City of Torrance

Date: 8-22-2011

Requested by: A.S.

Job Number: 172-49

Due by: ~~ASAP~~ e-7day
Th 8/22/11
per Arjun S.

Boring Number	sample Depth	Sample Type*	Index Properties: Moisture Content	Dry Density	Atterberg Limits	Sieve Analysis	Expansion Index	Hydrometer	% Passing #200	Sand Equivalent	specific Gravity.	Engineering Properties: Consolidation: 1st load	add water at	Load to	Reload	Test Progress	Direct Shear: 1st load	2nd load	3rd load	Test Progress	Unconfined Compression	Triaxial Test	Corrosion: Resistivity	pH	Chlorine	Sulfate	Comp-action: ASTM D1557	R. Value	Other: TPH (EPA 8015M)	Title 22 metals (EPA 6010)	cond.
B-1	3'	D																											/	/	
	8'	D																											/		
	14	D																											/	/	
B-2	3'	D																											/	/	
	8'	D																											/		
	14	D																											/	/	

*D= drive / Tube Sample
BB = big bag
SB = small bag

Technician's Initial:

Special Instructions: Test America Lab performed this test.
4 (TPH) and 2 metals
(EPA 8015M) (EPA 6010)

Rel by: Arjun Subedi 8-22-2011, 8/22/11 15:35

08/31/2011

GEO-ENVIRONMENTAL, INC.
Caltrans Certified
DBE Firm

LABORATORY TESTS REQUEST

IUH2314

Project Name: Proposed Western Ave. Jacking Pit for water main replacement project Client: City of Torrance Date: 8-22-2011

Requested by: A.S. Job Number: 172-49 Due by: ASAP

Boring Number	sample Depth	Sample Type*	Index Properties: Moisture Content	Dry Density	Atterberg Limits	Sieve Analysis	Expansion Index	Hydrometer	% Passing #200	Sand Equivalent	specific Gravity	Engineering Properties: Consolidation: 1st load	add water at	Load to	Reload	Test Progress	Direct Shear: 1st load	2nd load	3rd load	Test Progress	Unconfined Compression	Triaxial Test	Corrosion: Resistivity	pH	Chlorine	Sulfate	Compaction: ASTM D1557	R. Value	Other: TPH (EPA 8015M)	Title 22 metals (EPA 6010)	
B-1	3'	D																											/	/	
	8'	D																											/	/	
	14	D																											/	/	
B-2	3'	D																											/	/	
	8'	D																											/	/	
	14	D																											/	/	

*D= drive / Tube Sample
BB = big bag
SB = small bag

Technician's Initial:

Special Instructions: Test America lab performed this test: 4 (TPH) (EPA 8015M) and 2 metals (EPA 6010)

Rel. by: Arjun Subedi 8-22-2011, 15:35

Rec'd by: VuBanh 8/22/11 15:35

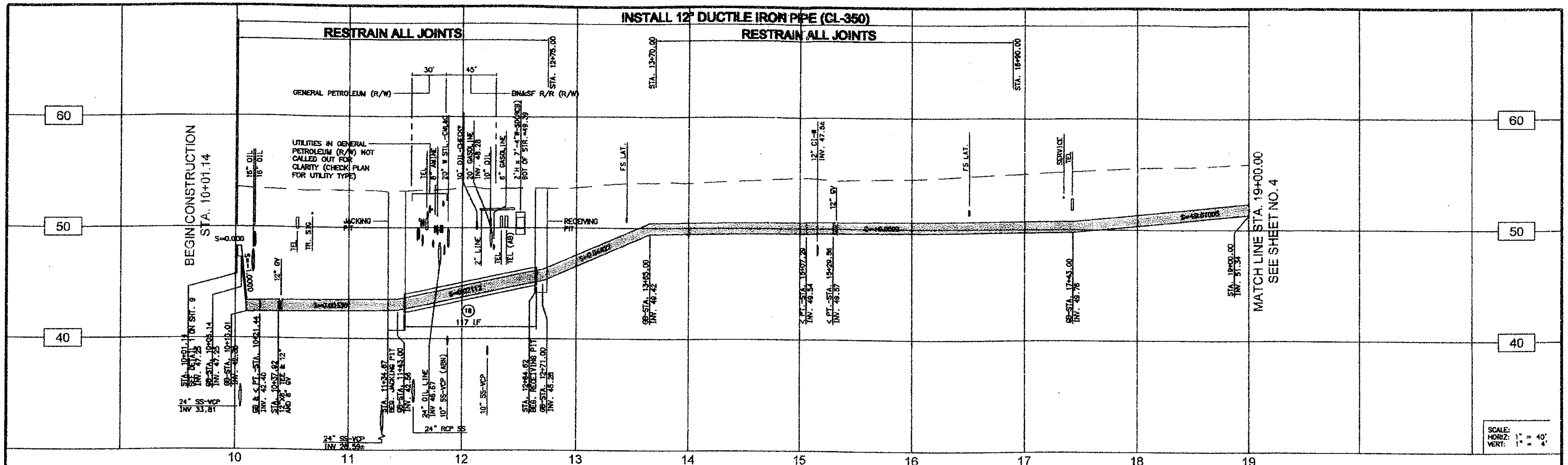
08/31/2011

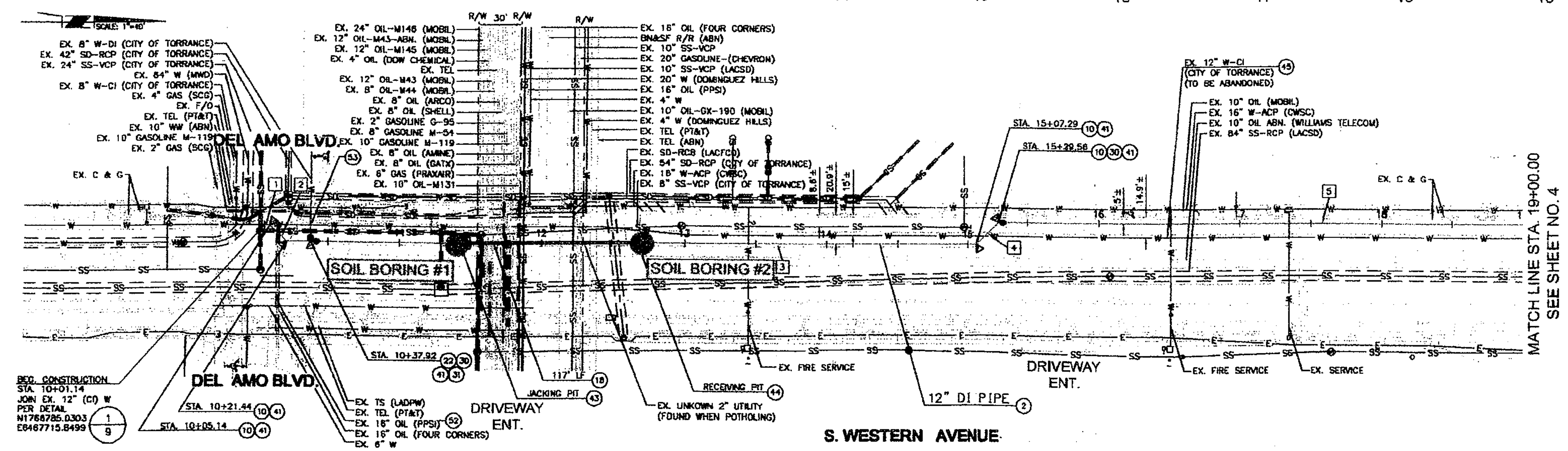
APPENDIX D

SITE PHOTOGRAPHS

Photo 1: Photograph showing the drilling operations at soil boring location B-1 on Western Avenue in the City of Torrance, California.

Photo 2: Photograph showing type of soil encountered at soil boring B-2.





CONSTRUCTION NOTES

(2) INSTALL 12" DI PIPE, CL-350, BEDDING PER CITY OF TORRANCE STD. NO. T701

(10) INSTALL 12"-45° DI BEND, MJ OR FLG'D.

(18) INSTALL 20" STEEL CASING PER CITY OF TORRANCE STD. NO. T715-2

(22) INSTALL 12"X8" DI TEE, MJ OR FLG'D.

(30) INSTALL 12" RW GATE VALVE, MJ OR FLG'D AND VALVE BOX PER CITY OF TORRANCE STD. NO. T712

(31) INSTALL 8" RW GATE VALVE, MJ OR FLG'D AND VALVE BOX PER CITY OF TORRANCE STD. NO. T712

(41) CONSTRUCT CONCRETE THRUST BLOCK PER CITY OF TORRANCE STD. NO. T713

(43) JACKING PIT

(44) RECEIVING PIT

(45) EXISTING WATERMAIN TO BE ABANDONED IN PLACE OR CUT UNLESS SHOWN ON THE PLANS. DO NOT FILL EXISTING WATERMAIN WITH SLURRY

(52) ALL MANHOLES ON 18" OIL PIPE LINE (PIPELINE CATHODIC PROTECTION MANHOLES) TO BE PROTECTED IN PLACE. DO NOT REPAVE OVER, GRIND OVER OR ALTER MANHOLES IN ANY WAY. CONTACT ENGINEER FOR ANY MODIFICATIONS.

(53) CUT, REMOVE INTERFERING PORTIONS OF EXISTING PIPE AND RECONNECT WITH FLEX COUPLING

LINE/CURVE DATA TABLE

NO.	BEARING/DELTA	RADIUS	LENGTH	TANGENT
1	N 00°12'41" W	—	4.00'	—
2	N 44°47'19" E	—	18.30'	—
3	N 00°12'41" W	—	485.84'	—
4	N 45°12'41" W	—	22.27'	—
5	N 00°12'41" W	—	1020.19'	—

(TOTAL DISTANCE)

RBF CONSULTING — PLANNING ■ DESIGN ■ CONSTRUCTION

REV.	DATE	DESCRIPTION	BY	CHECKED

CITY OF TORRANCE
PUBLIC WORKS DEPARTMENT

DRAWN: D.M.

DESIGNED: S. CONNER

PROJECT ENGINEER:

ENGINEERING MANAGER:

FIGURE 2

ELIZABETH OVERSTREET DATE
ACTING CITY ENGINEER
R.C.E. NO. 63944 EXP. 09/30/12

SCALE: AS SHOWN SHEET 3 OF 18

PLAN NO. **WP-291**

Photo 1: Photograph showing the drilling operations at soil boring location B-1 on Western Avenue in the City of Torrance, California.

Photo 2: Photograph showing type of soil encountered at soil boring B-2.