APPENDIX E

GEOTECHNICAL ENGINEERING INVESTIGATION REPORT

GEOTECHNICAL INVESTIGATION AND FAULT HAZARD REVIEW
48-UNIT TOWNHOUSE PROJECT
RYAN INDUSTRIAL COURT
SAN RAMON, CALIFORNIA

FOR
ACRE RESIDENTIAL COMPANY, LLC
September 4, 2012

Job No. 3505.100

BERLOGAR STEVENS & ASSOCIATES

Via E-Mail and Mail

BERLOGAR
STEVENS &
ASSOCIATES

September 4, 2012
Job No. 3405.100

Mr. Tom Schulz
ACRE Residential Company, LLC
5050 Hopyard Road, Suite 350
Pleasanton, California 94588

Subject: Geotechnical Investigation and Fault Hazard Review
48-Unit Townhouse Project
Ryan Industrial Court
San Ramon, California

Dear Mr. Schulz:

INTRODUCTION

This report presents the results of our geotechnical investigation and fault hazard review for the proposed 48-unit townhouse project in San Ramon, California. The site is located at the northwestern terminus of Ryan Industrial Court as shown on the Vicinity Map, Plate 1.

The approximately 3-acre site was subject to extensive prior grading involving cuts and fills perhaps up to 10 feet in depth and is currently in use for Canyon View Office Park with two existing office buildings. Based on the preliminary land plan by Carlson, Barbee & Gibson Inc. (CBG) dated January 30, 2012, we understand that 48 residential units will be sited in eight 6-plex buildings. Details of building loads are not available at this time. Based on CBG's preliminary cross section exhibit, site grading will generally consist of cut and fill up to about 5 feet in depths. It is anticipated that an approximately 4-foot-high terraced wall will be constructed in front of and below the existing 4-foot-high retaining wall along the toe of the slope on the northwest side of the site to achieve site grading. Two water quality ponds are planned adjacent to the southeastern site boundary. It is anticipated that new utilities including water lines, joint trenches, sanitary sewers and storm drains will be installed along the new access road within the site.

PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation was to evaluate the proposed project with respect to the site soil, bedrock and groundwater conditions, and to provide geotechnical recommendations for the design and construction of the project. The scope of our services included a review of pertinent geologic/geotechnical literature and maps, field exploration, laboratory testing, engineering analyses based on field and laboratory data, and preparation of this report.

As part of this investigation, we also performed a fault hazard review by researching previous fault investigations by others in the area. The results of our fault hazard review are included in this report.

FIELD EXPLORATION AND LABORATORY TESTING

Our field exploration was performed between May 11 and 17, 2012, and consisted of drilling eight borings (Borings B-1 through B-6, and H-1 and H-2) at the approximate locations shown on the Site Plan, Plate 2. Borings B-1 through B-6 were drilled to depths ranging from about 13½ to about 24½ feet, below the existing ground surface, using a truck-mounted hollow-stem auger rig. Upon completion of drilling and sampling, the boreholes were backfilled with neat cement grout as required by the Contra Costa County Environmental Health Division. Borings H-1 and H-2 were performed with a hand auger at the existing slope on the northwest side of the site, where bedrock refusal was encountered at a depth of about 2 feet. Materials encountered in each boring were visually classified in the field and a log was recorded. The boring logs showing soil classification and blow counts, together with a Key to Boring Log Symbols, are presented in Appendix A.

Laboratory testing was performed on selected samples from our borings, including moisture content, dry density, Atterberg limits, sieve analysis, hydrometer analysis and direct shear tests. The moisture content and dry density test results are presented on the individual boring logs. The remaining test results are presented in Appendix B.

In addition, a soil sample (from Boring B-4 at 2 to 2½ feet) was delivered to CERCO Analytical, Inc. in Concord, California for corrosivity testing. The results of the corrosivity tests are included in Appendix C.

SITE CONDITIONS

SURFACE CONDITIONS

The site is approximately square-shaped and measures approximately 350 feet by 380 feet. It is located at the northwestern terminus of Ryan Industrial Court, and is bounded by office buildings to the northeast, apartments and townhomes to the west and northwest, and the Home Depot store to the southwest. At present, the site is in use for Canyon View Office Park with two existing office buildings. The locations of the two existing office buildings relative to the eight proposed 6-plex buildings are shown on the Site Plan, Plate 2.

The site generally slopes down gently at about 10 percent towards Ryan Industrial Court. The existing ground surface around the existing office buildings is covered by asphalt pavement, with elevations ranging from about Elevations 575 and 571 feet at the western and northern corners, respectively, to about Elevation 545 feet to the southeast at the Ryan Industrial Court cul-de-sac. The elevations referenced in this report are based on the topographic information shown on the preliminary land plan by CBG.

The northeastern and southwestern boundaries of the site are marked by a series of minor retaining walls that separate the site from the adjacent properties. Most of these retaining walls are individually less than 3 feet high. The northwestern side of the site is an ascending slope, which generally varies in height from approximately 20 to 30 feet and inclination from approximately 2 horizontal to 1 vertical (2H:1V) to 1½ H:1V. Along the toe of the slope is also a retaining wall, generally less than 4 feet high.

The southeastern boundary of the site, which is dissected by the cul-de-sac of Ryan Industrial Court, is bordered by tiered retaining walls. During our site visits, we observed some major signs of distress at these tiered retaining walls:

- Cracks up to about ½ inch wide were observed at the middle wall (see Plate 4).
- The middle wall was founded on concrete piers. Between the concrete piers, it appeared that the wall was not embedded deep enough and some of the backfill materials behind the wall have sloughed under the base of the wall (see Plate 5).
- The lower wall was observed to be leaning (see Plates 6 and 7).

SUBSURFACE CONDITIONS

As encountered in Borings B-1 through B-6, the site is generally covered by alternating layers of generally stiff to hard silty clay, sandy clay, sandy silt and very dense clayey sand. The results of the Atterberg limits tests indicate that these soils generally have moderate expansion potential. At Borings B-1 through B-5, the soils are underlain by highly weathered and friable sandstone/siltstone bedrock at depths ranging from approximately 5½ to 14½ feet below the existing ground surface. Bedrock was not encountered at Boring B-6, which was drilled at the eastern corner of the site to a depth of approximately 24½ feet.

At the slope on the northwest side of the site, the two hand-auger borings (H-1 and H-2) encountered approximately 1 foot of surficial soils consisting of medium dense to dense silty sand, underlain by highly weathered and friable sandstone bedrock.

Groundwater was not encountered in the borings during our field exploration. However, it should be anticipated that the actual groundwater level may fluctuate depending on factors such as seasonal rainfall, time of the year and local irrigation. For a more detailed description of the soil and bedrock conditions encountered, please see the boring logs included in Appendix A.

FAULT HAZARD REVIEW

BACKGROUND

The site is located within a state designated Alquist-Priolo (A-P) Earthquake Fault Zone for the Calaveras fault (CDMG[1] 1982) as shown on Plate 3. It is noted that, on the 1982 A-P Map, the main trace of Calaveras fault is shown to be approximately 100 feet northeast of the eastern corner of the site, by a solid line that indicates this trace is accurately located. To review the risk of faulting at the site, we researched previous fault investigations by others in the area.

1 California Division of Mines and Geology (CDMG) has been renamed the California Geological Survey (CGS).

PREVIOUS FAULT INVESTIGATIONS

Several fault investigations have been performed in the vicinity of the site in accordance with the A-P Act. One of them was performed at the subject site and two others were performed on adjacent properties to the east and west (see Plate 3). The findings are summarized below.

PARCELS A & B AT RYAN INDUSTRIAL COURT (COVERING THE SUBJECT SITE)

A fault investigation was performed by Abel R. Soares and Associates in 1974 for Parcels A and B at Ryan Industrial Court. Parcel A is the property immediately southeast of the subject site and on the left side of Ryan Industrial Court (currently occupied by the San Ramon Valley Bible Church). Parcel B is the subject site. Two trenches (see Trenches A and B on Plate 3) of 155 feet and 440 feet in length were excavated to investigate the potential for faulting. The report concluded that Parcel B (the subject site) is free of any fault-related features. This investigation was submitted to the County and the State as A-P Report 32. In the letter by the Contra Costa County Planning Department dated December 30, 1974, the following conclusion was made: *"With respect to parcel B, it is my opinion that the study is adequate and that the parcel can be developed, in accordance with other pertinent county regulations."* At present, Parcel B has been developed with office buildings as noted above.

At Parcel A, an "anomalous zone" was identified in Trench A, crossing the eastern corner of Parcel A. Abel R. Soares and Associates recommended that a 25-foot wide setback zone be established along the anomalous zone. The Site Map included in Abel R. Soares' report indicates that the anomalous zone, if projected following the trend observed at Parcel A, would be about 80 feet away from the eastern corner of Parcel B.

CROW CANYON COURT (ADJACENT PROPERTY TO THE NORTHEAST)

A fault investigation with eight trenches (see T1 through T8 on Plate 3) was performed by Engeo Incorporated between 1977 and 1979 for Crow Canyon Court (Subdivision 5526) immediately northeast of the subject site. This investigation was submitted to the County and the State as A-P Report 619. The trenching identified an active fault trace within Crow Canyon Court, at a location very close to the main trace of Calaveras fault shown on the 1982 A-P Map, which is approximately 100 feet northeast of the eastern corner of the subject site. A building free setback zone was established within Crow Canyon Court (see Plate 3).

HOME DEPOT STORE (ADJACENT PROPERTY TO THE SOUTHWEST)

A fault hazard investigation was performed by Kleinfelder in 1995 for Home Depot, for the area immediately southwest of the subject site. The northeastern edge of the Home Depot site was within the A-P Earthquake Fault Zone. Kleinfelder's evaluation was based on several adjacent fault investigations, and the report concluded it was unlikely that an active fault trace existed at the Home Depot site. The property has been developed into the Home Depot store since then.

POTENTIAL FOR ACTIVE FAULT TRACE AT THE SITE

Based on the findings above, we are of the opinion the previous fault investigations have provided sufficient evidence that the existence of an active fault trace at the subject site is unlikely. The investigation for Crow Canyon Court (adjacent property to the northeast) determined that the active trace of Calaveras fault is located approximately 100 feet northeast of the eastern corner of the subject site. The investigations for the subject site and the Home Depot store (adjacent property to the southwest) found no evidence for active faulting. On this basis, we believe the potential for surface fault rupture at the subject site is low.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

We conclude that, from a geotechnical engineering standpoint, the proposed project can generally be constructed as planned, provided that the conclusions and recommendations contained in this report are incorporated into the project design and construction.

EXISTING FILL

As noted earlier, the site was previously graded with cuts and fills perhaps up to 10 feet in depth. It appears that the existing fill was placed in connection with the development of the existing office buildings on site. There are no available records on the construction of the existing fill. However, the soil data obtained from our investigation (including blow counts, laboratory dry densities and direct shear tests) have indicated that the existing fill is generally in a firm condition. Therefore, it is our opinion that, from a geotechnical engineering standpoint, the existing fill can generally be left in place.

EXISTING TIERED RETAINING WALLS ALONG SOUTHEASTERN SITE BOUNDARY

As mentioned in the "*Site Conditions*" section, some major signs of distress were observed at the existing tiered retaining walls along the southeastern site boundary. Based on our observations, it is anticipated that these distresses will continue to worsen. Therefore, it is our opinion that these existing tiered retaining walls (on both sides of Ryan Industrial Court) should be removed and replaced with new retaining walls.

SETBACK OF WATER QUALITY POND ON SOUTHWEST SIDE

During our site visits, we noted that the southern corner of the site (adjacent to Home Depot) is bordered by an approximately 3 feet high site retaining wall over a dry-stacked concrete unit wall feature, which is approximately 14½ feet high and inclined at an angle of approximately 60 degrees with the horizontal. The dry-stacked concrete unit wall feature is located within Home Depot's property. The wall thickness and structural details are unknown. We recommend that a minimum setback of 20 feet be established between the water quality pond and the southwestern property line.

EXPANSIVE SOILS

As indicated by the results of the Atterberg limits tests presented in Appendix B, the existing on-site soils generally have moderate expansion potential. Typically, expansive soils are sensitive to moisture changes. To reduce the potential impacts of swelling and shrinking of expansive soils to shallow foundations, concrete slab-on-grade floors, exterior concrete flatwork and asphalt pavement, the following special measures should be performed:

1. Moisture conditioning the expansive soils to higher moisture content during site preparation and grading,
2. Supporting buildings with post-tensioned slab foundations designed to withstand potential movement of expansive soils,
3. Presoaking the subgrade soils in building pad areas prior to constructing post-tensioned slab foundations, and
4. Providing surface drainage away from building foundations and directing rainwater collected on roofs through pipes connecting to the adjacent storm drains.

SITE PREPARATION AND GRADING

Our general site preparation and grading recommendations are as follows:

1. The areas to be graded should be cleared of debris, significant surface vegetation, existing asphalt concrete, abandoned utilities and buried structures.
2. If zones of soft or saturated soils are encountered during excavation and compaction, deeper excavations may be required to expose firm soils. This should be determined in the field by the soil engineer.
3. Following the stripping and clearing operations, the exposed subgrade should be scarified to a depth of about 12 inches. The scarified material should be properly moisture conditioned to at least 5 percent above optimum moisture content and compacted to between 85 and 90 percent relative compaction.

   Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density determined by ASTM D1557 compaction test procedure. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.
4. The building pad areas should be overexcavated to a minimum depth of 3 feet below the "design pad grade" and backfilled with compacted engineered fill per the recommendations presented below.
5. The on-site soils are generally suitable for engineered fill, provided that they are clean of debris, significant vegetation, rocks greater than 4 inches in largest dimension and other deleterious matter.
6. Import fill should contain no deleterious matter and rock greater than 4 inches in largest dimension, and have Plasticity Index (PI) less than 20. Fill and backfill materials (on-site

soils and import fill) should be subject to the evaluation by this office prior to their use. We suggest that the import fill be checked for toxic or hazardous materials prior to importing.

7. Fill and backfill should be placed in thin lifts (normally 6 to 8 inches in loose lift thickness, depending on the compaction equipment), properly moisture conditioned and compacted as below.

On-site soils	Between 85 and 90 percent relative compaction at not less than 5 percent above optimum moisture content.
Import Fill (PI less than 20)	At least 90 percent relative compaction at not less than 3 percent above optimum moisture content.

Modification of these grading recommendations may be required depending on the quality of the import soil used on this site.

8. Observations and soil density tests should be carried out during grading and backfill operations to assist the contractor in obtaining the required degree of compaction and moisture content. Where compaction and moisture content are outside our recommended ranges, additional compaction effort should be made with adjustment of moisture content as necessary until the recommended requirements are obtained.

9. The soil engineer should be notified at least 48 hours prior to any grading and backfill operations. The procedure and methods of grading may then be discussed between the contractor and the soils engineer.

POST-TENSIONED SLAB FOUNDATIONS

It is our opinion that, from a geotechnical engineering standpoint, the proposed 6-plex buildings can generally be supported on post-tensioned slabs founded on compacted engineered fill or firm on-site soils. We recommend that the following criteria be incorporated in the design of the post-tensioned slab foundations:

Allowable Bearing Capacity (may be increased by one-third for seismic and/or wind loads to be used at the discretion of the structural engineer)	1,500 psf
Allowable Passive Equivalent Fluid Pressure	Not applicable due to the shallow PT slabs
Allowable Base Friction Coefficient	0.3
Edge Moisture Variation Distance Center Lift Edge Lift	 9.0 feet 4.5 feet
Differential Swell Center Lift Edge Lift	 0.92 inches 1.85 inches

During utility trench excavation and backfilling, previously compacted subgrade soils may become disturbed. The disturbed subgrade soils should be moisture conditioned and recompacted according to the requirements outlined in the *"Site Preparation and Grading"* section.

The upper 12 inches of subgrade soils should be presoaked to at least 7 percent above optimum moisture content. The presoaked pads should not be allowed to dry out to less than the recommended moisture content before concrete is placed. Subgrade moisture should be checked by a BSA representative prior to concrete placement.

Where moisture vapor through the slabs would be objectionable, the use of a vapor retarder and capillary moisture break should be considered by the designer of the slab.

SEISMIC DESIGN PARAMETERS

According to the United States Geologic Survey (USGS), Earthquake Ground Motion Parameters program, Version 5.1.0 dated February 10, 2011, the following 2010 California Building Code (CBC) seismic design criteria should be incorporated into the structural design of the proposed buildings and structures. The subject site is located at approximately 37.7773 degrees north latitude and -121.9834 degrees west longitude.

Mapped Spectral Acceleration for Short Periods, Ss, for Site Class B with 5% damping	1.99g
Mapped Spectral Acceleration for 1-second Period, S_1, for Site Class B with 5% damping	0.75 g
Site Class	D
SMs for Site Class D	1.99 g
SM_1 for Site Class D	1.12 g
SDs for Site Class D	1.33 g
SD_1 for Site Class D	0.75 g

FOUNDATION PERIMETER DRAINAGE

Grading around the proposed buildings should be performed to provide a positive drainage away from the building foundations. The rainwater collected on the roof should be piped away from the buildings to prevent water from perching adjacent to the foundations. Where landscaping strips will be located next to the buildings, perimeter subdrains should be installed adjacent to the outside of the perimeter footings. The perimeter subdrains should generally be constructed according to the recommendations presented on Plate 8. The roof drains and the subdrains should be two separate piping systems.

EXTERIOR CONCRETE FLATWORK

The exterior concrete flatwork such as sidewalks, patios and hardscapes will be subjected to differential soil movements as the expansive soils change volume. The moisture content of the subgrade soils should be presoaked to at least 7 percent above optimum moisture content. Flatwork should be doweled into the foundation at doorways to reduce the potential for tripping hazards that could result from heaving of the underlying expansive soil. Reinforcing steel should be considered to reduce potential tripping hazards caused by expansive soil swell and tree roots. Deep, scored joints spaced no more than 6 feet apart should be considered. Placing aggregate base beneath flatwork is not recommended since the more permeable baserock can become saturated and provide moisture to the underlying expansive soil.

SITE RETAINING WALLS

It is anticipated that site retaining walls will be required for the project. Different types of retaining walls may have applicability at different locations, depending on individual site conditions such as considerations of adjacent slopes, nearby utilities and structures. Below, we present geotechnical design parameters for two likely types of retaining walls: conventional concrete/masonry retaining walls and mechanically stabilized earth (MSE) retaining walls.

CONCRETE AND MASONRY RETAINING WALLS

Concrete and masonry retaining walls can be supported by shallow foundations founded on compacted engineered fill or firm on-site soils. We recommend that the following geotechnical criteria be incorporated in the concrete and masonry retaining wall design:

Active Equivalent Fluid Pressure Level Backfill 3H:1V Backfill 2H:1V Backfill	 60 pcf 70 pcf 80 pcf
Traffic or other Surcharge Loads	To be determined by the structural engineer
Additional Seismic Lateral Pressure	20H psf Rectangular pressure distribution where H is the total height of the backfill
Allowable Bearing Capacity (may be increased by one-third for seismic and/or wind loads to be used at the discretion of the structural engineer)	2,500 psf
Allowable Passive Equivalent Fluid Pressure • neglect the upper 1 foot for level ground condition if the ground surface is not confined by a slab or pavement • neglect upper 3 feet for sloping ground condition	300 pcf
Allowable Base Friction Coefficient	0.3
Minimum Footing Depth (below the lowest adjacent grade)	18 inches
Minimum Footing Width	18 inches

The retaining walls should be provided with permanent backdrains. The above recommended lateral pressures are based on drained conditions to prevent hydrostatic pressure build-up. The backdrain should consist of a blanket of Class 2 Permeable Material and a 4-inch diameter perforated PVC pipe (SDR 35). The permeable materials should be in conformance with Section 68-1.025 of the May 2006 Caltrans "Standard Specifications." The permeable material blanket should be at least 12 inches thick and should be placed from the base of the retaining wall to about 1 foot below the finished grade behind the retaining wall. Alternatively, a geo-composite drain, such as Miradrain 6200 or approved equivalent, may be used in lieu of the Class 2 Permeable Material blanket. The perforated pipe should be placed near the bottom of the wall to carry collected water to a suitable gravity discharge or storm drain system. Backdrains are not required for retaining walls of 2 feet or less in height.

MSE RETAINING WALLS

If MSE walls are used for the retaining walls, we recommend that the following additional geotechnical criteria be incorporated in the retaining wall design:

Reinforced Fill, Retained Fill and Foundation Materials	
Unit Weight	125 pcf
Friction Angle	28 degrees
Cohesion	0 psf

The base of the MSE walls should be at least 6 inches (level ground) and 18 inches (sloping ground) below the lowest adjacent finished grade.

Subdrains should be installed behind the MSE walls to prevent the buildup of hydrostatic pressure. Subdrains should consist of a vertical blanket of Class 2 Permeable Material (conforming to Section 68-1.025 of State of California Standard Specifications) a minimum of 1 foot thick and a 4-inch diameter perforated pipe (SDR 35). Subdrain pipes should be set at the level of the base of the wall's gravel pad. The perforated pipes should have two rows of holes and be placed holes-down. The permeable material blanket should extend up to about 1 foot of finished ground surface at the top. Subdrain pipes from behind walls should be connected to solid collector pipes that outlet to drainage inlets, storm drains, or concrete-lined ditches.

UTILITY TRENCH EXCAVATION AND BACKFILL

Excavations should conform to applicable State and Federal industrial safety requirements. Where trench excavations are more than 5 feet deep, they should be sloped and/or shored. Trench walls should be sloped no steeper than 1½ H:1V in dry granular soils, and no steeper than 1H:1V in dry, cohesive soils. Flatter trench slopes may be required if seepage is encountered during construction or if exposed soil conditions differ from those encountered by the test borings. If full-sloped trench walls cannot be excavated due to site constraints, shoring should be provided to ensure trench stability and safety. We can provide soil parameters for shoring design on request.

Materials quality, placement procedures and compaction operations for utility line bedding and shading materials should meet the City of San Ramon and/or other applicable agency requirements. Utility trench backfill above the shading materials may consist of native soils, processed to remove rubble, rock fragments over 4 inches in largest dimension, rubbish, vegetation and other undesirable substances. Backfill materials should be placed in level lifts about 8 to 12 inches in loose thickness, moisture conditioned and mechanically compacted according to the requirements contained in the *"Site Preparation and Grading"* section. No jetting is permissible on this project.

PRELIMINARY PAVEMENT SECTIONS

Based on an assumed R-value of 5 for the subgrade soils and Design Method for Flexible Pavement, we recommend the following preliminary asphalt pavement sections for the project. We have assumed that the assigned "T.I.s" include provisions for heavy truck traffic related to construction activities.

Traffic Index (T.I.)	Thickness (inches)	
	Asphalt Concrete Type B	Aggregate Base Class 2
4	2½	8
4½	2½	10
5	2½	11
5½	3	12
6	3	14
6½	3½	15
7	4	16

Prior to subgrade preparation, utility trench backfill should be properly placed and compacted. The pavement subgrade should be rolled to at least 95 percent relative compaction to provide a smooth, unyielding surface. Subgrade soils should be maintained in a moist and compacted condition until covered with the complete pavement section.

Class 2 aggregate base should conform to the requirements in Section 26, Caltrans "Standard Specifications," (May 2006). The aggregate base should be placed in thin lifts in a manner to prevent segregation, uniformly moisture conditioned, and compacted to at least 95 percent relative compaction to provide a smooth, unyielding surface.

To provide relief for water that is likely to infiltrate into the aggregate base layer, roadway pavement edge drains should be installed at the bottom of the aggregate base and below the curb and gutter, as shown on Plate 9, Pavement Edge Drain.

CORROSIVITY TESTING

BSA has obtained a soil sample (from Boring B-4 at 2 to 2½ feet) for corrosivity testing. The corrosivity test was performed by CERCO Analytical, Inc. and the test results are included in Appendix C. It is noted that this sample is classified as "corrosive." The corrosivity test results should be transmitted to your structural engineer and underground utility consultants, and should be incorporated in the design of structures to be placed directly against on-site soils and underground utilities.

SEISMIC HAZARDS

We performed an evaluation of the seismic hazards that may have an impact on the proposed development at the site. As discussed under the *"Fault Hazard Review"* section, the potential for surface fault rupture at the site is low. Discussion of other seismic hazards is presented below.

GROUND SHAKING

Because of the close proximity to the Calaveras fault and other active faults in the area, it is likely that the site will be subjected to strong ground shaking from at least one moderate to severe earthquake during the life span of the project. According to the USGS Probabilistic Seismic Hazard Analysis (PSHA) Interactive Deaggregation website, the peak ground acceleration at the site may be up to 0.62 g for a 10 percent probability of exceedance in 50 years.

LIQUEFACTION

Liquefaction is the temporary transformation of saturated, loose cohesionless soils into a viscous liquid during strong ground shaking from a major earthquake. The subsurface conditions encountered at the site generally consist of stiff to hard clayey/silty soils and very dense clayey sand. Also, groundwater was not encountered in the borings during our field exploration. Therefore, the risk of liquefaction at the site is considered to be low.

SEISMICALLY INDUCED GROUND SUBSIDENCE

Ground subsidence can occur as a result of "shakedown" when dry, loose cohesionless soils are subjected to earthquake vibrations of high amplitude. In general, significant deposits of loose sandy soils do not exist at the sites; therefore, seismically induced ground subsidence is not considered a geologic hazard at the site.

ADDITIONAL SOIL ENGINEERING SERVICES

Prior to construction, our firm should be provided the opportunity to review the plans and specifications to determine if the recommendations of this report have been implemented in those documents.

To a degree, the performance of the proposed project is dependent on the procedures and quality of the construction. Therefore, we should provide observations of the contractor's procedures and the exposed soil conditions, and field and laboratory testing during site preparation and grading, placement and compaction of fill, underground utility installation, and foundation and pavement construction. These observations will allow us to check the contractor's work for conformance with the intent of our recommendations and to observe any unanticipated soil conditions that could require modification of our recommendations. In addition, we would appreciate the opportunity to meet with the contractors prior to the start of site grading, underground utility installation and pavement construction to discuss the procedures and methods of construction. This can facilitate the performance of the construction operation and minimize possible misunderstanding and construction delays.

LIMITATIONS

The conclusions and recommendations of this report are based upon the information provided to us regarding the proposed project, subsurface conditions encountered at the boring locations, the results of the laboratory testing and professional judgment. This study has been conducted in accordance with current professional geotechnical engineering standards; no other warranty is expressed or implied.

The locations of the borings were determined by pacing from the existing features and should be considered approximate only. Site conditions described in the text are those existing at the time of our field exploration in May 2012, and are not necessarily representative of such conditions at other locations and times.

In the event that changes in nature, design and location of the proposed project are planned, or if it is found during construction that subsurface conditions differ from those described on the boring logs, then the conclusions and recommendations in this report shall be considered invalid, unless the changes are reviewed, and the conclusions and recommendations are modified or approved in writing.

Respectfully submitted,

BERLOGAR STEVENS & ASSOCIATES

Steve K. Tsang
Principal Engineer
GE 2162

REGISTERED PROFESSIONAL ENGINEER
STEVE K.S. TSANG
No. GE 2162
GEOTECHNICAL
STATE OF CALIFORNIA

Frank Berlogar

SKT/FB:jmb

Attachments:

- Plate 1 – Vicinity Map
- Plate 2 – Site Plan
- Plate 3 – Earthquake Fault Zone
- Plates 4 through 7 – Views of Tiered Retaining Walls Along Southeastern Site Boundary
- Plate 8 – Typical Subdrain Detail
- Plate 9 – Pavement Edge Drains
- Appendix A – Boring Logs
- Appendix B – Laboratory Test Results
- Appendix C – Soil Corrosivity Test Results

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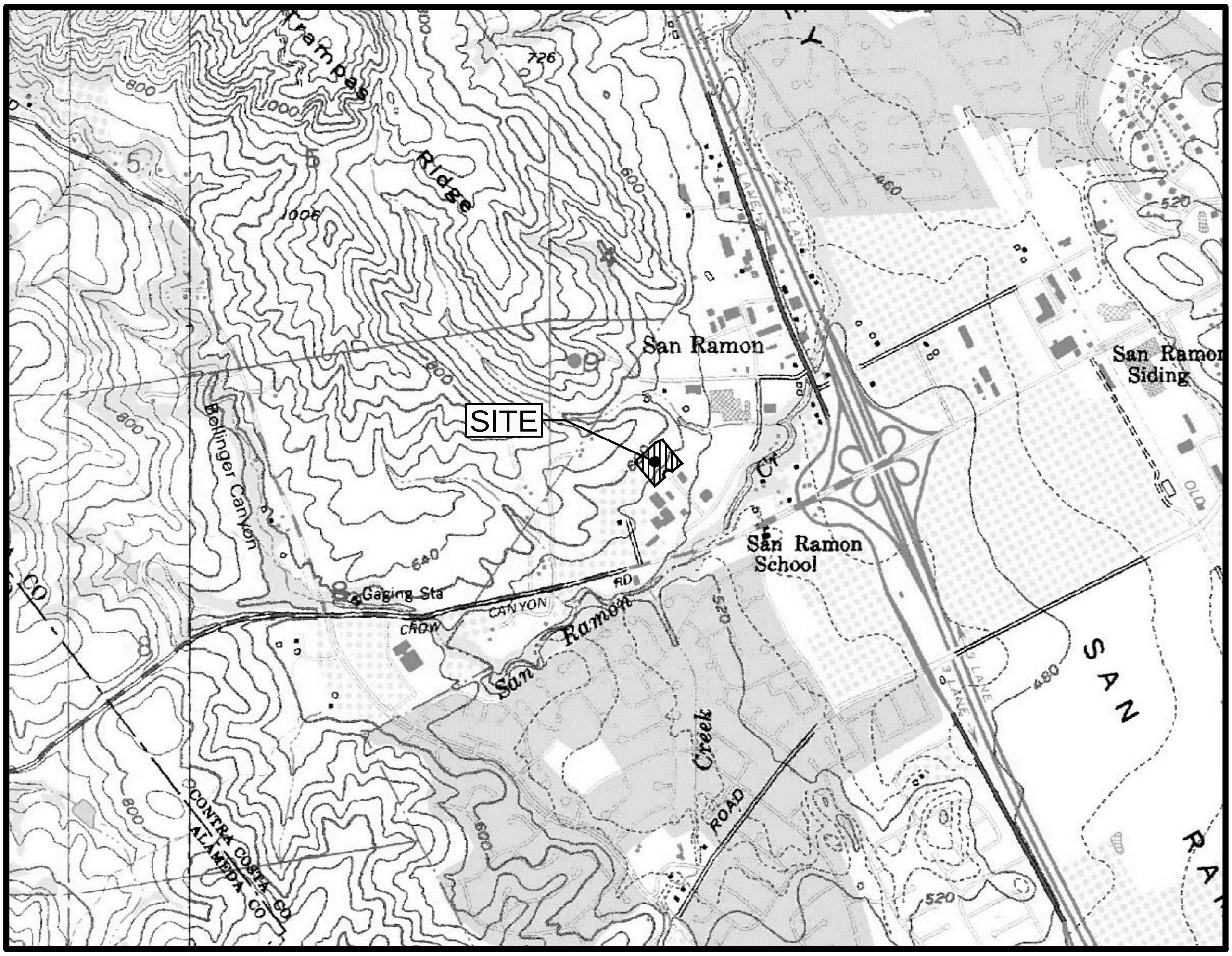
JOB NUMBER: 3405.100 DATE: 5-14-12 BY: CC



SCALE: 1" = 2000'

VICINITY MAP

48-UNIT TOWNHOUSE PROJECT

RYAN INDUSTRIAL COURT

SAN RAMON, CALIFORNIA

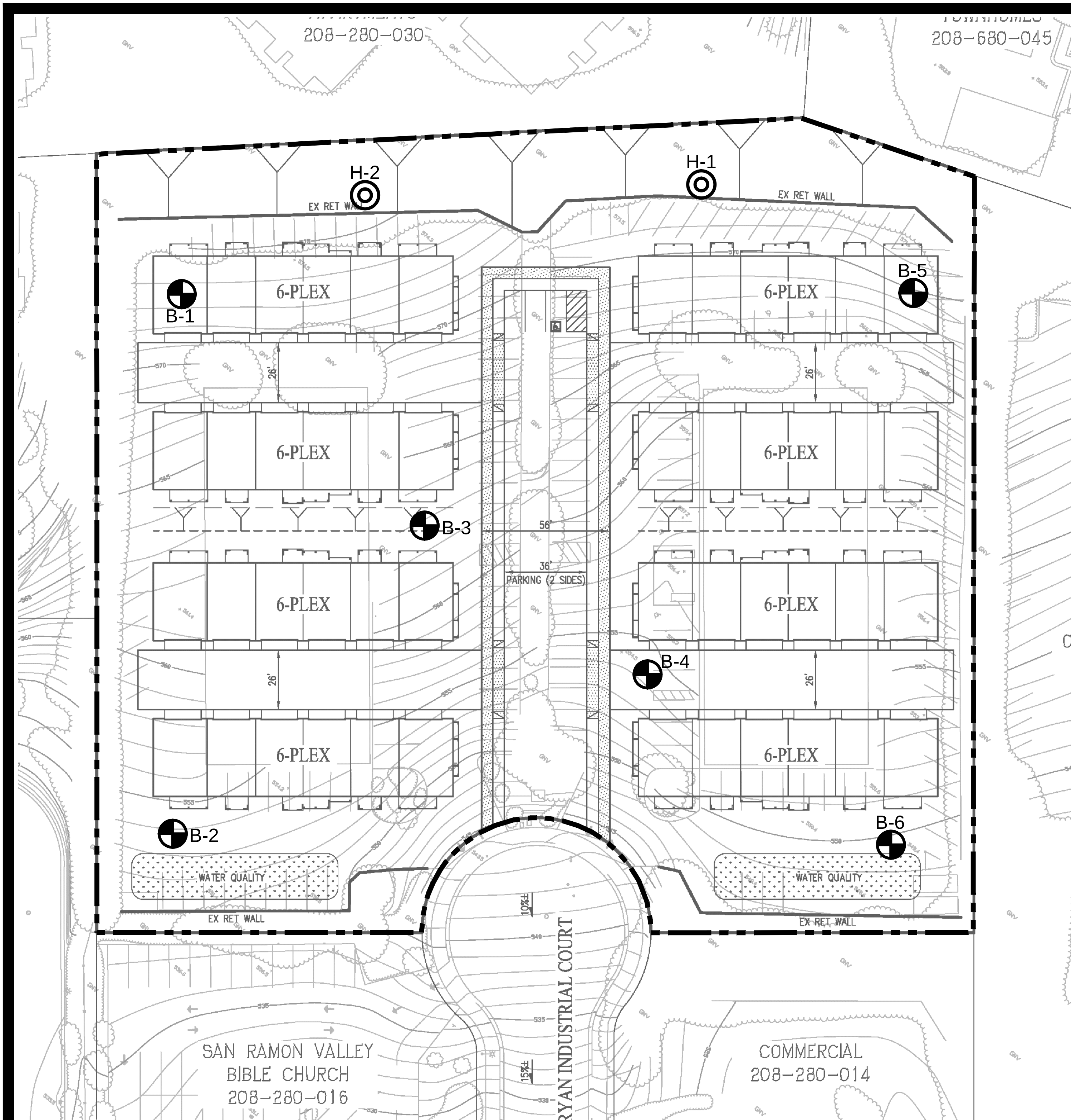
FOR

SC SERVICES

BASE: PORTION OF U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, DIABLO AND LAS TRAMPAS RIDGE, CALIFORNIA, AT A SCALE OF 1:24,000.

PLATE 1

JOB NUMBER: 3405.100 DATE: 5-18-12 DRAWN BY: CC CHECKED BY:



SITE PLAN

48-UNIT TOWNHOUSE PROJECT

RYAN INDUSTRIAL COURT
SAN RAMON, CALIFORNIA
FOR
SC SERVICES

EXPLANATION

B-6 — APPROXIMATE BORING LOCATION

H-2 — APPROXIMATE HAND AUGER LOCATION

N

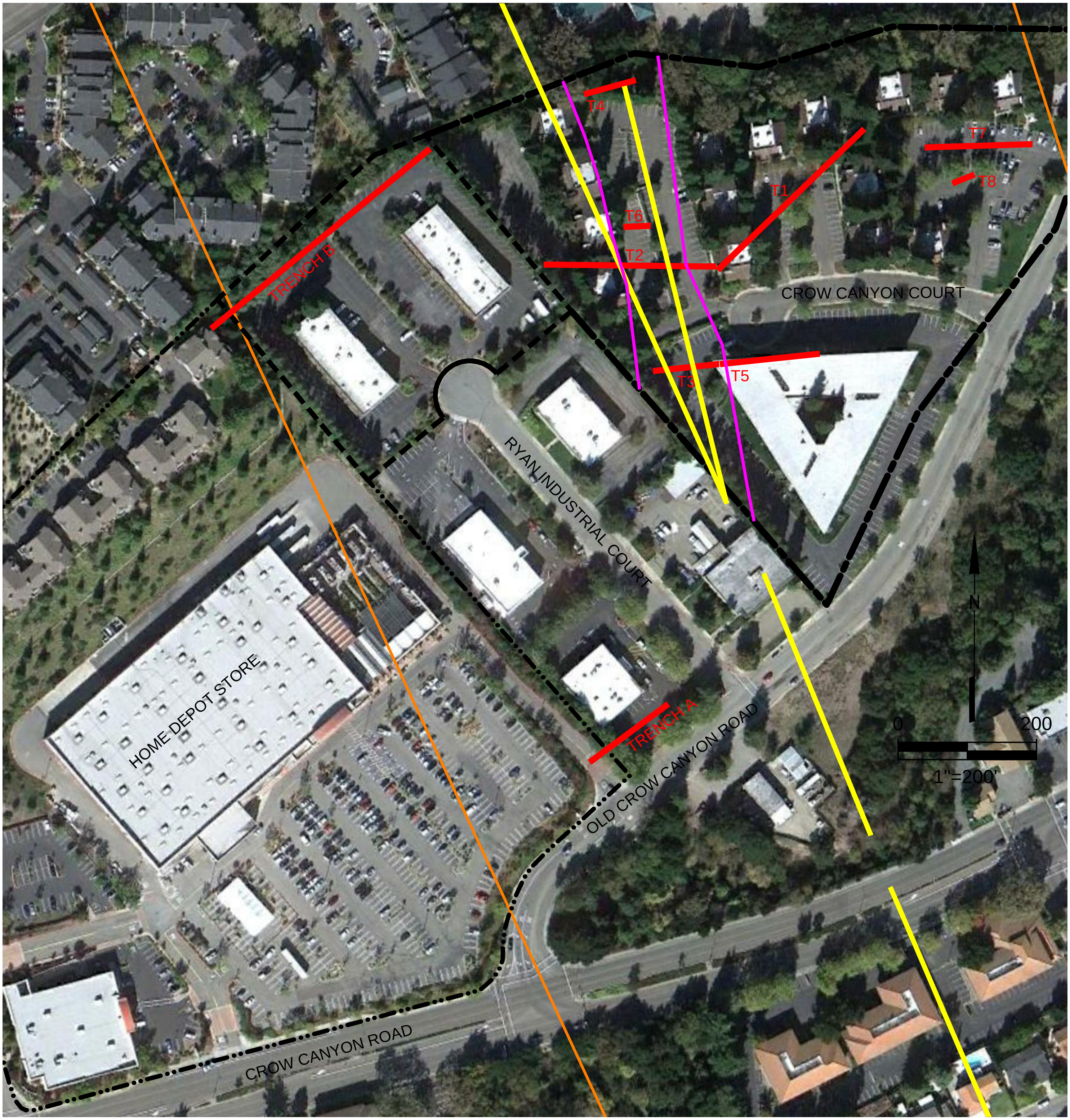
0 60

1"=60'

BASE: PRELIMINARY LAND PLAN, PREPARED BY CBG, DATED 1-30-12

Berlogar Stevens & Associates

SOIL ENGINEERS * ENGINEERING GEOLOGISTS



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DATE: 5-25-12

JOB NUMBER: 3405.100

EXPLANATION

RYAN INDUSTRIAL COURT SITE LIMIT

CROW CANYON COURT SITE LIMIT (ENGEO, AP-619)

HOME DEPOT SITE LIMIT (KLEINFELDER)

BUILDING SETBACK

EARTHQUAKE FAULT ZONE BOUNDARY

FAULT TRACE SHOWN ON 1982 AP MAP
(SOLID LINE WHERE ACCURATELY LOCATED;
LONG DASH WHERE APPROXIMATELY LOCATED)

TRENCH B — APPROXIMATE EXPLORATORY TRENCH LOCATION

EARTHQUAKE FAULT ZONE

48-UNIT TOWNHOUSE PROJECT

RYAN INDUSTRIAL COURT
SAN RAMON, CALIFORNIA
FOR
SC SERVICES

Berlogar Stevens & Associates

SOIL ENGINEERS * ENGINEERING GEOLOGISTS

JOB NUMBER: 3405.100 DATE: 5-25-12 DRAWN BY: CC CHECKED BY:

VIEW OF RETAINING WALL ON RIGHT SIDE OF RYAN INDUSTRIAL COURT
(PHOTO 1)

JOB NUMBER: 3405.100 DATE: 5-25-12 DRAWN BY: CC CHECKED BY:

VIEW OF RETAINING WALL ON RIGHT SIDE OF RYAN INDUSTRIAL COURT
(PHOTO 2)

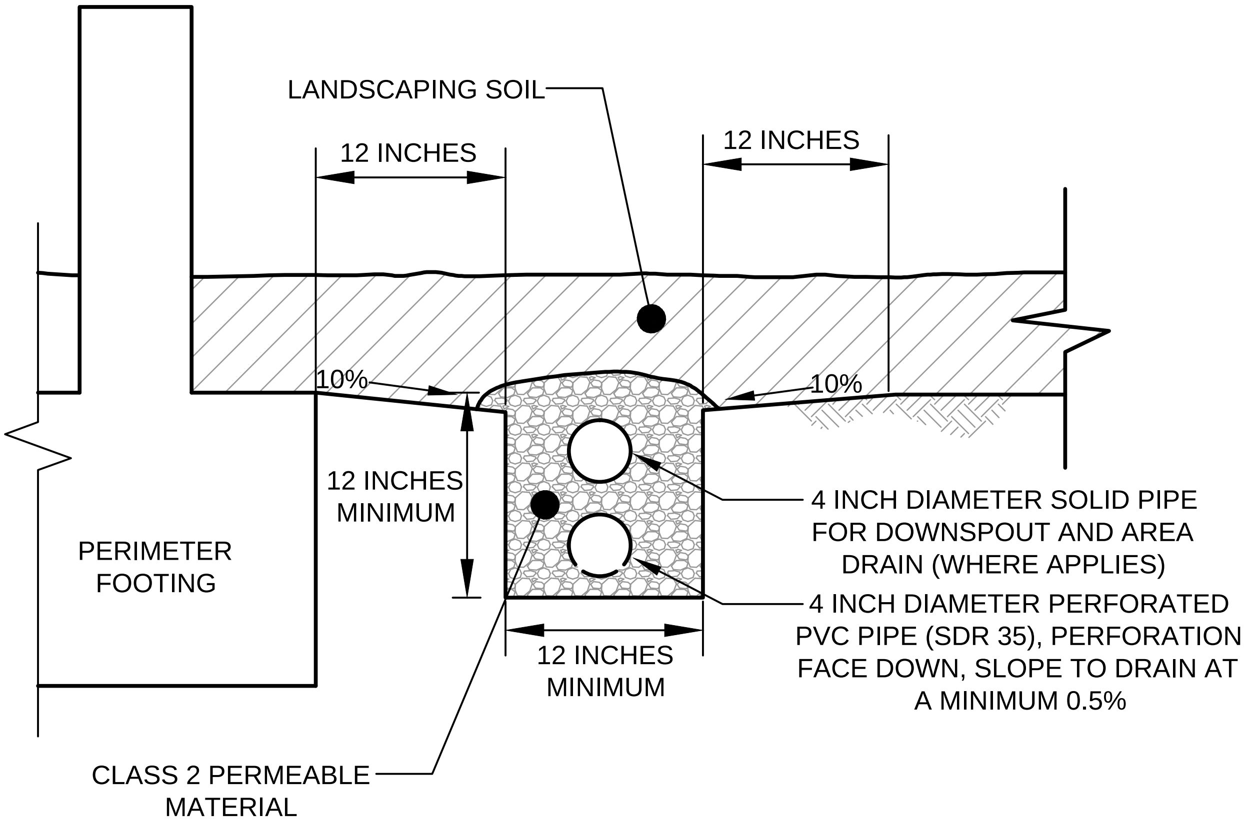
JOB NUMBER: 3405.100 DATE: 5-25-12 DRAWN BY: CC CHECKED BY:

VIEW OF RETAINING WALL ON RIGHT SIDE OF RYAN INDUSTRIAL COURT
(PHOTO 3)

JOB NUMBER: 3405.100 DATE: 5-25-12 DRAWN BY: CC CHECKED BY:

VIEW OF TIERED RETAINING WALL ON LEFT SIDE OF RYAN INDUSTRIAL COURT (PHOTO 4)

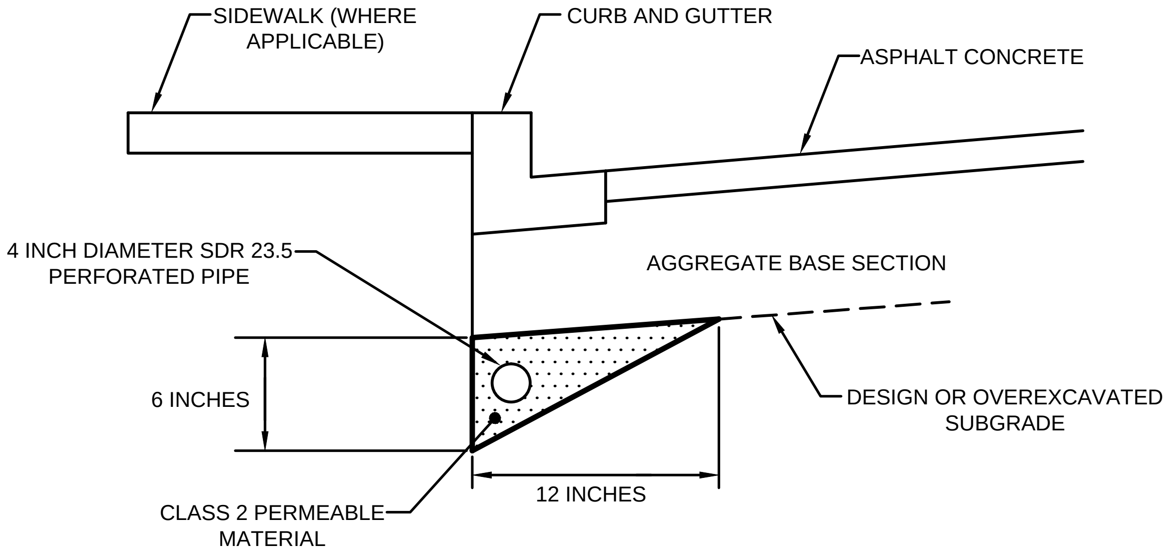
CHECKED BY:
DRAWN BY: CC
DATE: 5-25-12
JOB NUMBER: 3405.100



SCALE N.T.S.

TYPICAL SUBDRAIN DETAIL

JOB NUMBER: 3405.100 DATE: 5-25-12 DRAWN BY: CC CHECKED BY:



NOTES:

1. 4 INCH DIAMETER PERFORATED PIPE TO BE SURROUNDED BY AT LEAST 2 INCHES OF CLASS 2 PERMEABLE MATERIAL.

2. 4 INCH DIAMETER PERFORATED PIPE TO DISCHARGE INTO CATCH BASIN/DRAIN INLET.

3. PERFORATED PIPE TO BE LOCATED BELOW EXISTING SHALLOW UNDERGROUND UTILITIES WHERE THEY CROSS.

SCALE N.T.S.

PAVEMENT EDGE DRAIN

APPENDIX A

Boring Logs

BORING LOG B-1

Job No.: 3405.100	**Client:** SC Services	**Elevation:** 573-1/2 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	**Drill Method:** Hollow-stem Auger	**Date Drilled:** 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
		19	-		CL	SANDY CLAY, gray-brown, moist, stiff, fine-to coarse-grained sand, some rock fragments, some fine subangular gravel
			-			
		42	-		CL	SILTY CLAY, orange-brown, moist, very stiff, trace fine-grained sand
			-		CL	SANDY SILTY CLAY, yellow-brown, moist, very stiff, fine-grained sand, some fine subrounded gravel
			5			
		42	-			below 5-1/2 feet, dark brown
			-			SANDSTONE, mottled orange and red-brown, highly weathered, friable, crushed thinly bedded, abundant fine angular and subangular gravel
		45	-			
			-			
			10			
			-			
		50/6”	-			
			-			
			-			Boring terminated at 13-1/2 feet No groundwater encountered
			15			
			-			
			-			
			-			
			-			
			20			

BORING LOG B-2

Job No.: 3405.100	Client: SC Services	Elevation: 554 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hollow-stem Auger	Date Drilled: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
		18		■	CL	SILTY CLAY, dark brown, moist, stiff, some fine angular gravel (fill)
16.6	111	18		■		below 3 feet, yellow-gray and brown
13.5	110	23	5	■		below 5 feet, trace gravel
					ML	SANDY SILT, yellow-brown, moist, hard, coarse-grained sand
		51		■		SANDSTONE, yellow-brown, highly weathered, friable, crushed, poorly cemented, thinly bedded, abundant subrounded gravel
			10			
		53		■		
			15			
		70		■		
						Boring terminated at 17-1/2 feet No groundwater encountered
			20			

BORING LOG B-3

Job No.: 3405.100	Client: SC Services	Elevation: 563 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hollow-stem Auger	Date Drilled: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
■ 2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
19.5	105	38		■	CL	SANDY CLAY, gray-brown, moist, stiff (fill)
19.8	98	29		■	CL	SILTY CLAY, yellow-brown, moist, stiff, fine-to coarse-grained sand
		25	5	■		SILTSTONE, yellow-brown, highly weathered, friable, crushed, poorly cemented, thinly bedded
		24		■		
			10			SANDSTONE, yellow-brown, moist, very highly weathered, very fine-grained sand, iron oxide staining on fracture surfaces
		37		■		
			15			SILTSTONE, yellow-brown, highly weathered, friable, crushed, poorly cemented, thinly bedded
		50		■		
			20			Boring terminated at 19-1/2 feet No groundwater encountered

BORING LOG B-4

Job No.: 3405.100	**Client:** SC Services	**Elevation**: 554-1/2 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	**Drill Method**: Hollow-stem Auger	**Date Drilled**: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
23.1	97	22	-	■	CL	SILTY CLAY, gray-brown, moist, stiff, trace coarse-grained sand
22.0	99	21	-	■		
		57	5	■	CL	CLAY, black-brown, moist, hard
					ML	SANDY SILT, gray, moist, stiff, fine-grained sand
		22	-	■		
			10			
		50	-	■		
			15			SANDSTONE, yellow-orange, highly weathered, friable, crushed, poorly cemented, thinly bedded, lenses of fine subangular to subrounded gravel
		50/4"	-	■		
			20			Boring terminated at 19-1/2 feet No groundwater encountered

BORING LOG B-5

Job No.: 3405.100	Client: SC Services	Elevation: 570 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hollow-stem Auger	Date Drilled: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
		39		■	CL	SANDY SILTY CLAY, orange-brown, moist, very stiff, fine-to coarse-grained sand (fill)
		66		■	SC	CLAYEY SAND, yellow-gray-brown, moist, very dense, predominately fine-grained sand, some medium-to coarse-grained sand
		68	5	■		
		57		■	CL	SILTY CLAY, yellow-brown, moist, hard, fine-to coarse-grained sand, subangular fine gravel
						SANDSTONE, red-brown, highly weathered, friable, crushed, thinly bedded, fine-to coarse-grained sand, lenses of fine subrounded to subangular gravel
			10			
		50/3"		■		
						Boring terminated at 13-1/2 feet No groundwater encountered
			15			
			20			

BORING LOG B-6

Job No.: 3405.100	Client: SC Services	Elevation: 550 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hollow-stem Auger	Date Drilled: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
			0			asphalt concrete approximately 2 inches
						aggregate base approximately 6 inches
		23		■	CL	SANDY CLAY, gray-black, moist, very stiff, coarse-grained sand, trace subangular fine gavel (fill)
		20		■		
16.3	108					below 4 feet, very stiff
		33	5	■		below 5 feet, stiff
17.2	110	16		■		
			10			
					CH	CLAY, black, moist, very stiff, trace fine-to coarse-grained sand
		25		■		
			15			
						below 17 feet, gray, trace subangular fine gravel
		40		■		
			20			

BORING LOG B-6

Job No.: 3405.100	**Client:** SC Services	**Elevation**: 550 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	**Drill Method**: Hollow-stem Auger	**Date Drilled**: 5-11-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
■ 2.5-inch I.D. Split Barrel	140	30

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Symbol	USCS Classification	DESCRIPTION AND REMARKS
					CH	CLAY, gray, moist, very stiff, fine-to coarse-grained sand, trace subangular fine gravel
			20			
			-		CL	SILTY CLAY, yellow-brown, moist, very stiff, trace fine-grained sand
			-			
		35	-	■		
			-	■		
			25			Boring terminated at 24-1/2 feet No groundwater encountered
			-			
			-			
			-			
			-			
			30			
			-			
			-			
			-			
			-			
			35			
			-			
			-			
			-			
			-			
			40			

BORING LOG H-1

Job No.: 3405.100	Client: SC Services	Elevation: 575 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hand Auger	Date Drilled: 5-17-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
Bulk Sample	-	-

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Type	USCS Classification	DESCRIPTION AND REMARKS
			0		SM	SILTY SAND, light brown, moist, medium dense to dense, coarse-grained sand, fine gravel
			-			
			1			SANDSTONE, orange-brown, highly weathered, friable, crushed
			-	Bulk Sample		
			2			Boring terminated at 2 feet No groundwater encountered
			-			
			3			
			-			
			4			
			-			
			5			
			-			
			6			
			-			
			7			
			-			
			8			
			-			
			9			
			-			
			10			

BORING LOG H-2

Job No.: 3405.100	Client: SC Services	Elevation: 578 feet
Job Name: 48-Unit Townhouse Project Ryan Industrial Court	Drill Method: Hand Auger	Date Drilled: 5-17-12

SAMPLER TYPE:	DRIVE WEIGHT (LBS.)	HEIGHT OF FALL (IN.)
Bulk Sample	-	-

Moisture Content (%)	Dry Unit Weight (PCF)	Penetration Resistance (blows/foot)	Depth (feet)	Sample Type	USCS Classification	DESCRIPTION AND REMARKS
			0		SM	SILTY SAND, light brown, moist, medium dense to dense, coarse-grained sand, fine gravel
			-			
			1	Bulk Sample		SANDSTONE, red-brown, highly weathered, friable, crushed
			-			
			2			Boring terminated at 2 feet No groundwater encountered
			-			
			3			
			-			
			4			
			-			
			5			
			-			
			6			
			-			
			7			
			-			
			8			
			-			
			9			
			-			
			10			

UNIFIED SOIL CLASSIFICATION SYSTEM

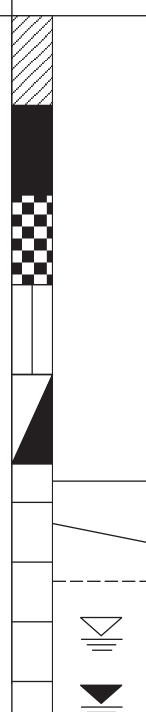
MAJOR DIVISIONS			CLASSIFICATION SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF OF THE MATERIAL IS LARGER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE TO NO FINES	GW	WELL GRADED GRAVELS, GRAVEL/SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL/SAND MIXTURES
		GRAVEL WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL/SAND/SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL/SAND/CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE TO NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND/SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND/CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF OF THE MATERIAL IS SMALLER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SILTS

BY: CC

DATE: 5-18-12

KEY TO BORING LOG SYMBOLS

Depth in Feet	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per foot	Unified Soil Classification System	



Bulk Sample

2.5-inch I.D. Split Barrel Sample

2.8-inch I.D. Shelby Tube Sample

No Sample recovered

Standard Penetration Test interval

Well-defined stratum change

Gradual stratum change

Interpreted stratum change

Apparent ground water level measured at date noted; seasonal weather conditions, site topography, etc., may cause fluctuations in water level indicated on boring logs

Stabilized ground water level measured at date noted

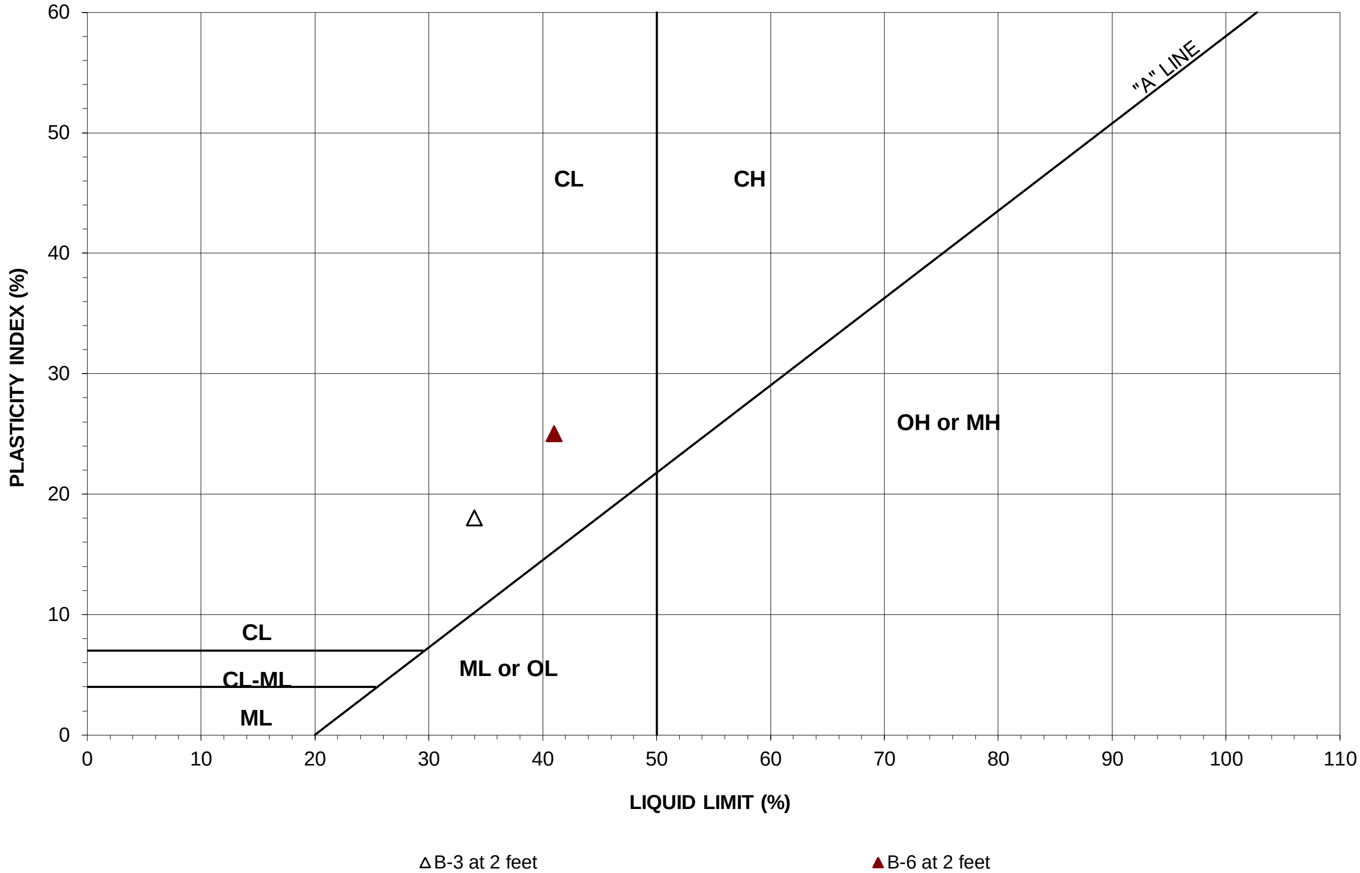
Note: Soils described as dry, moist, and wet are estimated to be dry of optimum, near optimum, and more wet than optimum moisture content, respectively. Saturated soils are estimated to be within areas of free groundwater.

JOB NUMBER: 3405.100

APPENDIX B

Laboratory Test Results

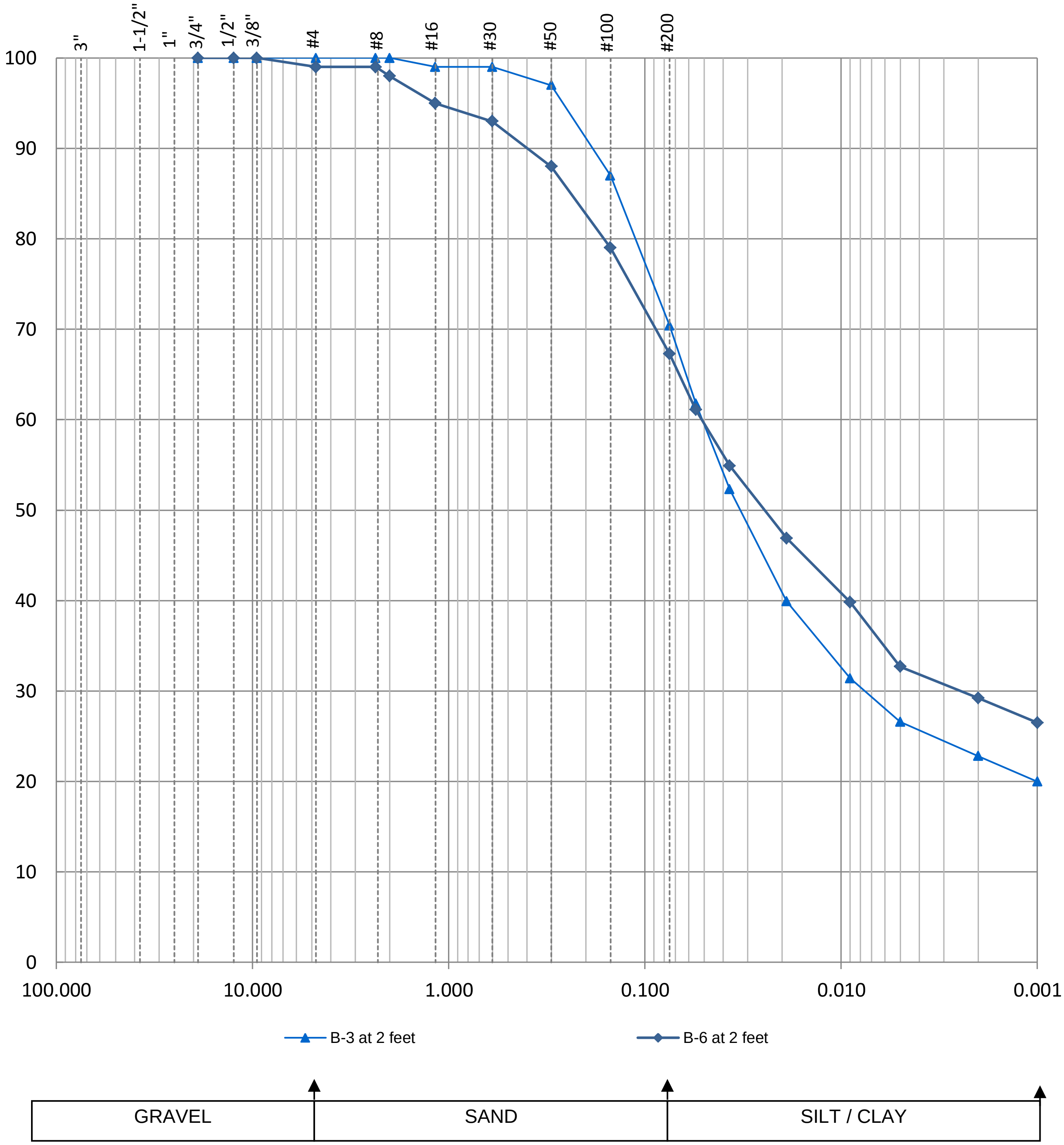
JOB NUMBER: 3405.100 DATE: 5-18-12 BY: CC



LOCATION	LIQUID LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION
B-3 at 2 feet	34	18	**C L**
B-6 at 2 feet	41	25	**C L**

ATTERBERG LIMITS TEST

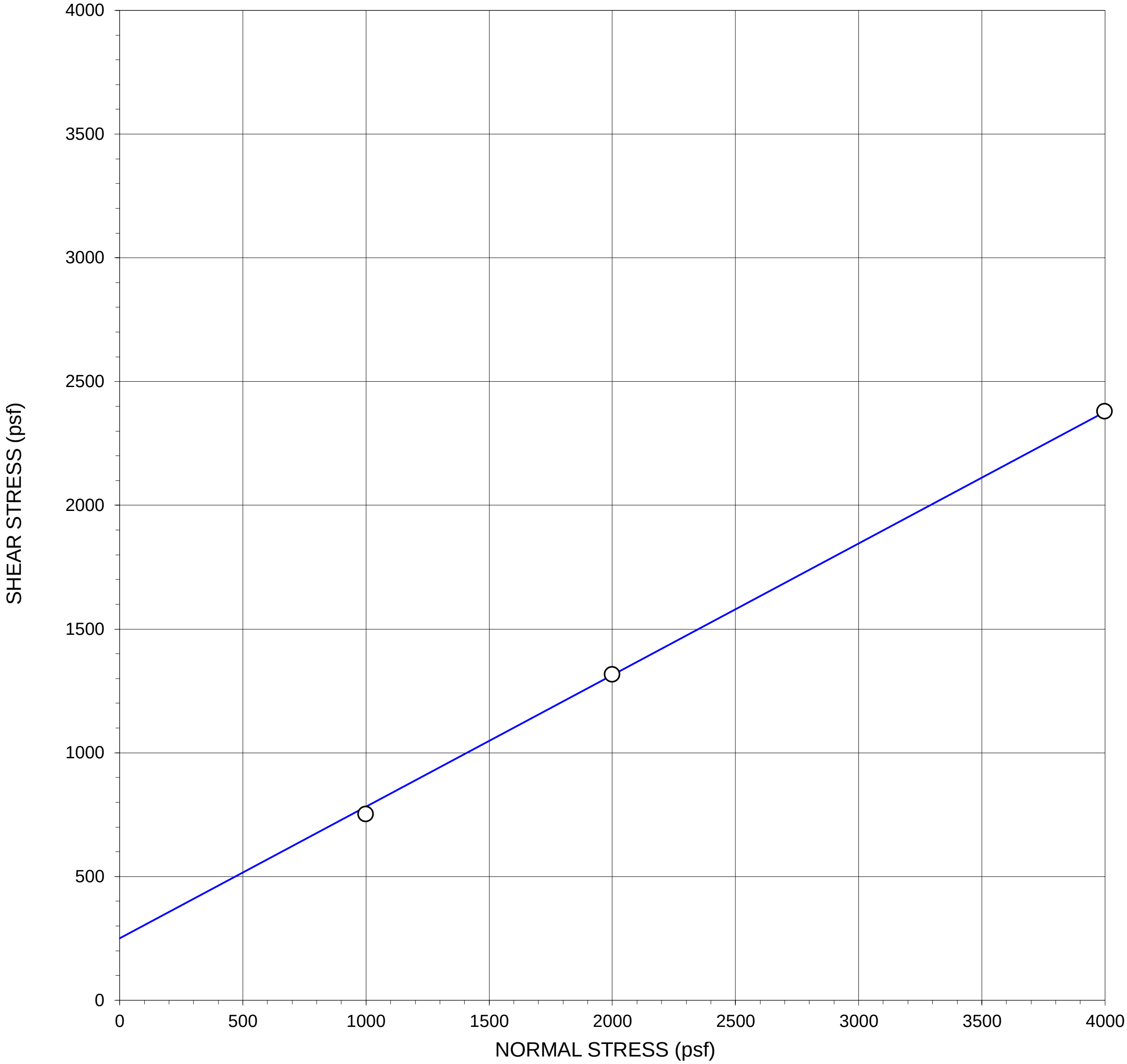
JOB NUMBER: 3405.100 DATE: 5-16-12 BY: CC



LOCATION	DESCRIPTION
B-3 at 2 feet	SANDY CLAY, light gray-brown
B-6 at 2 feet	SANDY CLAY, dark gray-brown

GRADATION TEST DATA

JOB NUMBER: 3405.100 DATE:5-18-12 BY: CC



LOCATION: B-3 at 3-1/2 to 4 feet

SAMPLE: SILTY CLAY, light olive-gray

TEST TYPE: Consolidated Drained

RATE OF SHEAR (in/min): 0.00099

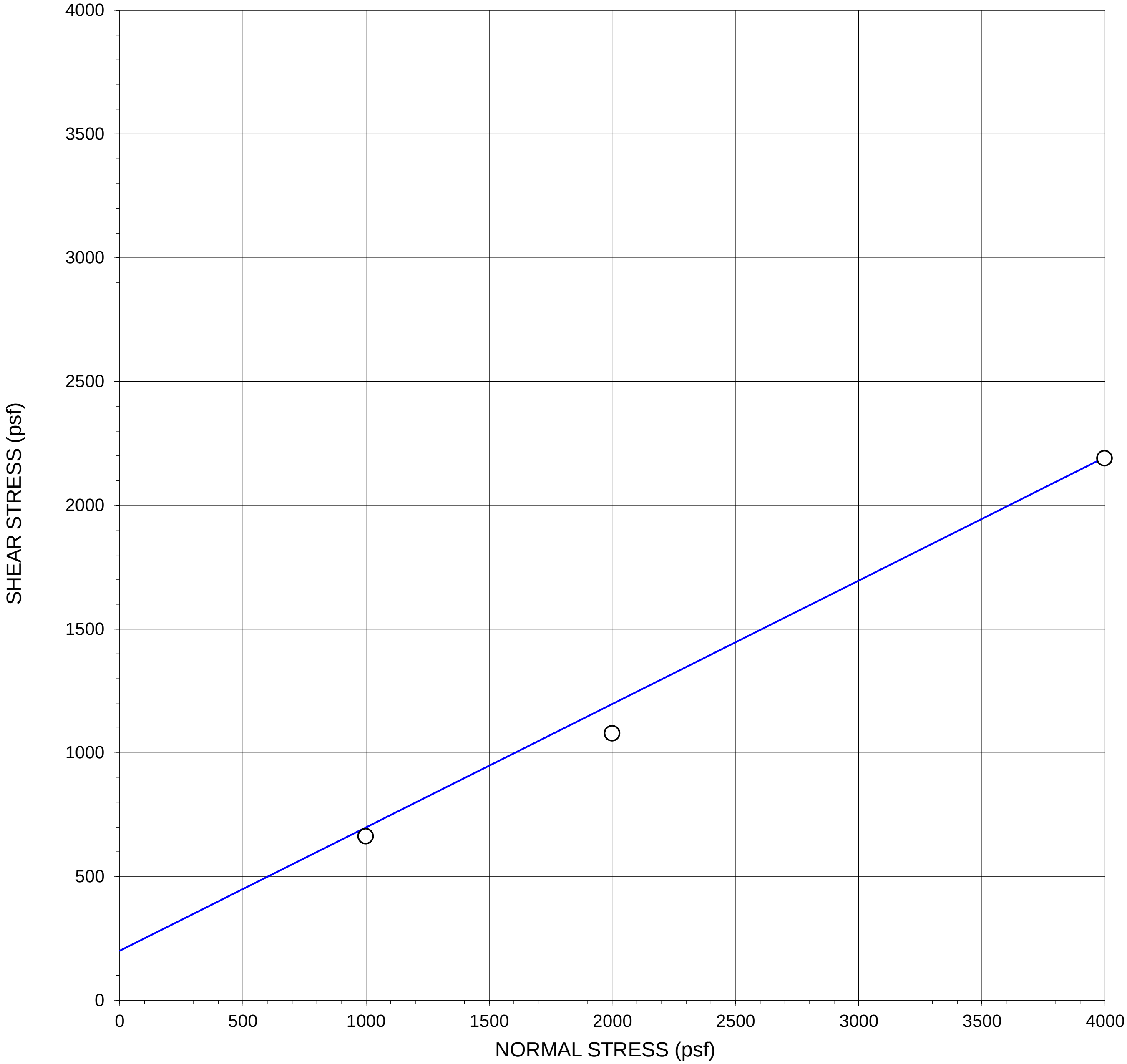
FRICTION ANGLE: 28

COHESION (psf): 250

SPECIMEN	A	B	C
DRY DENSITY (psf)	101.4	97.2	96.4
INITIAL WATER CONTENT (%)	19.8	19.8	19.8
FINAL WATER CONTENT (%)	21.9	22.4	20.9
NORMAL STRESS (psf)	1000	2000	4000
MAXIMUM SHEAR (psf)	751	1315	2379

DIRECT SHEAR TEST

JOB NUMBER: 3405.100 DATE:5-18-12 BY: CC



LOCATION: B-6 at 4 to 4-1/2 feet

SAMPLE: SILTY CLAY, dark gray

TEST TYPE: Consolidated Drained

RATE OF SHEAR (in/min): 0.00099

FRICTION ANGLE: 26.5

COHESION (psf): 200

SPECIMEN	A	B	C
DRY DENSITY (psf)	112.5	106.7	104
INITIAL WATER CONTENT (%)	16.3	16.3	16.3
FINAL WATER CONTENT (%)	17.8	17.6	16.6
NORMAL STRESS (psf)	1000	2000	4000
MAXIMUM SHEAR (psf)	661	1077	2188

DIRECT SHEAR TEST

APPENDIX C

Soil Corrosivity Test Results

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

22 May 2012

Job No.1205126
Cust. No.10598

Mr. Steve Tsang
Berlogar Stevens & Associates
5587 Sunol Blvd.
Pleasanton, CA 94566

Subject: Project No.: 3405.100
Project Name: Ryan Industrial Court
Corrosivity Analysis – ASTM Test Methods with Brief Evaluation

Dear Mr. Tsang:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on May 15, 2012. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this sample is classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration reflects none detected with a detection limit of 15 mg/kg.

The sulfate ion concentration reflects none detected with a detection limit of 15 mg/kg.

The sulfide ion concentration reflects none detected with a detection limit of 50 mg/kg.

The pH of the soil is 8.3, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 480-mV, which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMillen, for

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client:	Berlogar Stevens & Associates
Client's Project No.:	3405.100
Client's Project Name:	Ryan Industrial Court
Date Sampled:	14-May-12
Date Received:	15-May-12
Matrix:	Soil
Authorization:	Signed Chain of Custody

Date of Report: 22-May-2012

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1205126-001	B-4 @ 2-2.5'	480	8.3	-	1,700	N.D.	N.D.	N.D.
Method:		ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:		-	-	10	-	50	15	15
Date Analyzed:		18-May-2012	21-May-2012	-	18-May-2012	18-May-2012	21-May-2012	21-May-2012

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits