FAULT RUPTURE HAZARD INVESTIGATION

1801 AVENUE OF THE STARS, 10250 SANTA MONICA BOULEVARD, 1930 CENTURY PARK WEST CENTURY CITY-LOS ANGELES, CALIFORNIA

PREPARED FOR

WESTFIELD LOS ANGELES, CALIFORNIA

PROJECT NO. A8929-06-02

OCTOBER 18, 2013



GEOTECHNICAL ENVIRONMENTAL MATERIALS



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Project No. A8929-06-02 October 18, 2013

Westfield 2049 Century Park East, 41st Floor Los Angeles, CA 90067

Attention: John Marshall

Subject: FAULT RUPTURE HAZARD INVESTIGATION WESTFIELD CENTURY CITY MALL 1801 AVENUE OF THE STARS, 10250 SANTA MONICA BOULEVARD, AND 1930 CENTURY PARK WEST CENTURY CITY -LOS ANGELES, CALIFORNIA

Dear Mr. Marshall:

Geocon West, Inc. is pleased to submit this report summarizing our fault rupture hazard investigation for Westfield Century City Mall in the Century City District of Los Angeles, California. The fault investigation is part of our on-going geologic consultation services for Westfield.

As you know, numerous prior geotechnical investigations that included drilling of over 50 borings, were performed for the Westfield Century City Mall, including those in 2007 and 2008, by Mactec Engineering and Consulting. The northern portion of the site is located within a City of Los Angeles Fault Rupture Study Zone and, in conformance with requirements for sites located within the city-designated zone, the potential for faulting at the site was addressed as part of the previous investigations. These investigations concluded that "active or potentially active faults with the potential for surface fault rupture are not known to be located directly beneath or projecting toward the site. Therefore, the potential for surface rupture due to fault plane displacement propagating to the surface at the site during the design life of the proposed development is considered low." These reports and this conclusion were approved by the City of Los Angeles for the entitlement of the New Century Plan project. Since Westfield has now begun the process of permit applications to implement that project in the vicinity of Avenue of the Stars and Century Park West, to be conservative in light of additional recent investigations in the area, this report provides further evaluation of seismic conditions on the Site.

In 2011, the LA County Metro Transportation Authority initiated an investigation of potential faulting in the Century City area solely for the purpose of determining an optimal site for location of the proposed Westside Subway Extension in Century City. The METRO investigation postulated the existence of potential faults south of Santa Monica Boulevard, but due to METRO's lack of site-specific evidence and investigation in these areas, marked the potential locations of these faults with question marks (as shown later in this report). The METRO investigation also concluded these postulated faults are not active but lacked specific soil development analysis and relative age estimates of stratigraphic units to completely rule out Holocene activity. Therefore, these faults were designated "Holocene Activity Undetermined" in the METRO study.

The purpose of the attached fault investigation is to further evaluate the postulated faults south of Santa Monica Boulevard identified as part of the METRO investigation and confirm Holocene inactivity. Active faults have not been identified at this location and the area is not within an Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards per the Alquist-Priolo Earthquake Fault Zoning Act. The Act regulates the construction of buildings used for human occupancy on active faults, and provides that such buildings must be set back from an active fault, generally by 50 feet. However, as noted above, the City of Los Angeles has designated a portion of this area as a Fault Rupture Study Zone (2010). Accordingly, it is useful to determine whether any potential faults on the Site would be considered, under the definitions in the Act, as an active fault, which is defined is one that has had surface displacement within the last 11,000 years (Holocene time). The Alquist-Priolo Earthquake Fault Zoning Act does <u>not</u> prohibit construction on faults determined to be inactive (surface displacement of Pleistocene age sediments [older than 11,000 years]). Therefore, it is important to establish the relative age of the sediments at the Site, particularly if they are suspected to be affected by faulting, to establish the age of the potential faults.

We have investigated the postulated faults south of Santa Monica Boulevard and, based on the results of our investigation, the evidence clearly supports the conclusion that these faults are not active. These results are consistent with the results of the METRO investigation and are supported by multiple lines of evidence, as discussed in detail in the attached report. Therefore the conclusions of Westfield's 2007 and 2008 Geotechnical Investigations with respect to the potential for active faults at the Site remain accurate.

The results of our investigation confirm active faults are not present at the site and no restrictions on future development of the Westfield Site are necessary with respect to potential faulting, beyond the standard seismic engineering requirements for all buildings in California.

We appreciate the opportunity to be of service to you. Please contact us if you have any questions regarding this report, or if we may be of further service.

Very truly yours,

Susan F. Kirkgard, CEG 1754 Senior Geologist



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Gerald A. Kasman, CEG 2251 Senior Geologist/Associate

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FAULT RUPTURE HAZARD INVESTIGATION

1. EXECUTIVE SUMMARY

1.1 Background

This report presents the results of our site-specific fault rupture hazard investigation for the Westfield Century City Mall in the Century City District of Los Angeles, California. Numerous prior geotechnical investigations that included drilling of over 50 borings, were performed for the Westfield Century City Mall, including those in 2007 and 2008, by Mactec Engineering and Consulting. The northern portion of the site is located within a City of Los Angeles Fault Rupture Study Zone and, in conformance with requirements for sites located within the city-designated zone, the potential for faulting at the site was addressed as part of the previous investigations. These investigations concluded that "active or potentially active faults with the potential for surface fault rupture are not known to be located directly beneath or projecting toward the site. Therefore, the potential for surface rupture due to fault plane displacement propagating to the surface at the site during the design life of the proposed development is considered low." These reports and this conclusion were approved by the City of Los Angeles for the entitlement of the New Century Plan project. Since Westfield has now begun the process of permit applications to implement that project in the vicinity of Avenue of the Stars and Century Park West, to be conservative in light of additional recent investigations in the area, this report provides further evaluation of seismic conditions on the Site.

In 2011, the LA County Metro Transportation Authority initiated an investigation of potential faulting in the Century City area solely for the purpose of determining an optimal site for location of the proposed Westside Subway Extension in Century City. The METRO investigation postulated the existence of potential faults south of Santa Monica Boulevard, but due to METRO's lack of site-specific evidence and investigation in these areas, marked the potential locations of these faults with question marks (as shown later in this report). The METRO investigation also concluded these postulated faults are not active but lacked specific soil development analysis and relative age estimates of stratigraphic units to completely rule out Holocene activity. Therefore, these faults were designated "Holocene Activity Undetermined" in the METRO study.

The purpose of this fault investigation is to further evaluate the postulated faults south of Santa Monica Boulevard identified as part of the METRO investigation and confirm Holocene inactivity. Active faults have not been identified at this location and the area is not within an Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards per the Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Act regulates the construction of buildings used for human occupancy on active faults, and provides that such buildings must be set back from an active fault, generally by 50 feet. However, as noted above, the City of Los Angeles has designated a portion of this area as a Fault Rupture Study Zone (2010). Accordingly, it is useful to determine whether any potential faults on the Site would be considered, under the definitions in the Act, as an active fault, which is defined is one that has had surface displacement within the last 11,000 years (Holocene time). Faults that have not moved

in the last 11,000 years (Pleistocene age) are not considered active. The Alquist-Priolo Act does <u>not</u> prohibit construction on faults determined to be inactive (surface displacement greater than 11,000 years old [Pleistocene age or older]). Therefore, it is important to establish the relative age of the sediments at the Site, particularly if they are suspected to be affected by faulting, to establish the age of the potential faults.

1.2 Previous Site Investigations

Numerous prior geotechnical investigations have been performed at the Westfield Century City Mall over the last 60 years. The soil, groundwater, and geologic conditions have been thoroughly investigated by various forms of exploration that have included drilling over 50 borings up to 110 feet in depth at the site. The most recent of these (excluding this investigation) include the 2007 and 2008 investigations by Mactec Engineering and Consulting, Inc. that utilized the extensive site-specific data to evaluate geologic-seismic hazards in conformance with the City of Los Angeles regulations current at that time.

1.3 METRO Investigation

The METRO investigation was performed by AMEC on behalf of Parsons Brinkerhoff (Parsons) for the purpose of evaluating faults associated with the Santa Monica Fault Zone (SMFZ) and the West Beverly Hills Lineament (WBHL) that may impact the proposed Westside Subway Extension Project in the Century City area (Parsons, 2011). AMEC is the successor to Mactec, which performed the geotechnical investigations for Westfield in 2007 and 2008.

The Parsons (2011) investigation included geophysical surveys and subsurface explorations consisting of continuous-core borings and cone penetration tests (CPTs). Numeric or relative agedating analysis of geologic units encountered was not performed as part of the Parsons (2011) fault investigation.

Parsons (2011) interpreted two zones of faulting: 1) a zone of east-west trending faults, generally parallel to Santa Monica Boulevard, that define the Santa Monica Fault Zone (SMFZ) and 2) a zone of north-south trending faults that define the West Beverly Hills Lineament (WBHL). The WBHL faults and the faults identified as part of the SMFZ north of Santa Monica Boulevard were considered active based on geomorphic evidence and interpreted association with known active faults.

The faults identified south of Santa Monica Boulevard were not considered active based on the Pleistocene age (11,000 to 1.6 million years) of sediments offset by these faults and the lack of geomorphic expression on historic topographic maps from the 1920s. The inactive SMFZ faults south of Santa Monica Boulevard are interpreted by Parsons (2011) as traversing the Westfield Century City Mall and the existing office building at 1801 Avenue of the Stars and are the subject of our investigation.

1.4 Current Investigation

The purpose of the current investigation was to provide better control on the locations of postulated faults identified in the METRO investigation and to provide multiple lines of evidence to determine whether or not these faults are active. The criteria used in our investigation to evaluate fault activity are the same criteria used by the California Geological Survey (CGS) that defines an active fault as one that has had surface displacement within Holocene time (about the last 11,000 years). These criteria for defining an active fault are based on standards developed by the CGS (Bryant and Hart, 2007) for the Alquist-Priolo Earthquake Fault Zoning Program. Faults that have not moved in the last 11,000 years (Pleistocene age) are not considered active.

Explorations utilized in the METRO investigation included continuous-core borings and CPTs that were spaced an average of 40 feet apart. Borings which provide a higher quality of data compared to CPTs for the purpose of evaluating fault activity were spaced approximately 80 feet to 180 feet apart by METRO's consultants. The spacing of the explorations in the METRO investigation allows for locating general areas of faulting but not precise fault locations. Also, the METRO investigation did not utilize age-dating techniques to evaluate the age of unfaulted sediments so the activity of faults could not be confidently determined.

To provide better control on fault locations, our investigation utilized data from 55 closely-spaced explorations that were spaced an average of 15 feet apart. Borings in areas of suspected faulting were spaced as close as 5 feet apart. To evaluate the presence of faults, we used two methods of analysis: 1) correlation of primary stratigraphic units and 2) correlation of buried soils. If primary stratigraphic units or buried soils were not vertically and laterally continuous between borings, they were assumed to be faulted. The age of the oldest unfaulted units indicates the minimum age of faulting and based on that age, we could evaluate fault activity.

We used two primary lines of analysis to determine if the identified faults are active and the conclusions of each are consistent. First, soil development analysis and "minimum" relative age estimates of soils encountered in explorations along Transect A (Avenue of the Stars) indicates the age of the unfaulted soils are estimated to be 34,000 to 127,000 years old. Faults are considered active only if they have moved in the last 11,000 years (Holocene time); therefore the age of these unfaulted soils indicates the inactivity of these faults (since they have not moved in at least 34,000 years). Second, this investigation used a geomorphic expert to develop a geomorphic model to evaluate the time the buried soils along Transect A were formed. Based on the geomorphic model, discussed in Section 10.0 and presented in Appendix E, the unfaulted soils along Transect A developed on a stable surface formed approximately 80,000 to 120,000 years ago. This interpretation corroborates the estimated age of the oldest unfaulted buried soil and provides a second line of evidence that the faulting observed along Transect A is much older than 11,000 years and not considered active.

We documented continuous, unfaulted Pleistocene age (>11,000 to 1.6 million years old) soils along Transect A and Transect B. The faults identified along Transect A and Transect B can be correlated across both transects based on observed relative movement and magnitude of displacement, indicating these faults are the same faults. We have constrained the location of the zone of faulting identified by Parsons (2011) by correlation of stratigraphic units between closely-spaced explorations. The location is similar in width and orientation to the zone identified in the Metro investigation (Parsons, 2011). The correlation of stratigraphic units, soil development analysis and relative age estimates of the soils encountered in our borings, and geomorphic analysis all clearly demonstrate that the faults investigated are not active. The following summarizes our conclusions:

- 1. The faults we have identified are not active based on documented continuous, unfaulted Pleistocene age (>11,000 years to 1.6 million years) primary stratigraphy along both Transect A and Transect B.
- 2. The faults we have identified are not active based on soil development analysis along Transect A (Avenue of the Stars), which indicates that the faults have not moved in at least 34,000 to 58,000 years, based on the estimated minimum age of unfaulted sediments.
- 3. The faults we have identified are not active based on geomorphic analysis, which constrains the estimated age of the stable geomorphic surface on which the continuous, unfaulted Pleistocene age soils along Transect A developed to approximately 80,000 to 120,000 years and corroborates the soil development analysis by Helms (2013).
- 4. The faults identified along Transect B can be correlated to the inactive faults identified along Transect A based on observed similarities of relative movement and magnitude of displacement and provides a second line of evidence that faults identified along Transect B are not active.
- 5. The Site is considered free of hazards associated with potential faulting.

Based on the results of our investigation, we conclude active faults are not present at the Site. Therefore, the conclusions of Westfield's 2007 and 2008 Geotechnical Investigations with respect to the potential for active faults at the Site remain accurate. The results of our investigation are consistent with the results of the METRO investigation and provide multiple lines of evidence to support the conclusion that the faults identified south of Santa Monica Boulevard are not active.

Based on the results of our investigation, it is our opinion that no restrictions on future development of the Westfield Site are necessary with respect to potential fault hazards, beyond the standard seismic engineering requirements for all buildings in California.

2. PURPOSE AND SCOPE

The purpose of this fault investigation is to further evaluate the postulated faults south of Santa Monica Boulevard that may traverse the Westfield Century City Mall and the existing office building at 1801 Avenue of the Stars (Site) and provide multiple lines of evidence to determine whether or not these faults are active. These postulated faults were identified as part of the METRO Fault Study (METRO investigation) for the Westside Subway Extension (Parsons, 2011). The location of the Site relative to the Century City area is shown in Figure 1, Vicinity Map. Figure 2, Location Map shows the site and surrounding topography.

Our scope of services included the following main tasks:

- Review of available technical publications, geologic maps, topographic maps, and aerial photographs pertinent to the Site
- Review of prior investigations at the Site and in the Site vicinity to provide background information for the current evaluation
- Independent interpretation of Parsons (2011) exploration data that included continuous core borings and CPTs
- Review of core samples from six borings drilled as part of the Parsons (2011) investigation
- Drilling and logging of 15 continuous-core hollow stem auger borings
- Stratigraphic analysis and correlation of primary stratigraphic units in recovered core samples
- Stratigraphic analysis and relative age estimates of buried soils in six recovered cores
- Geomorphic analysis
- Preparation of this report that includes the results of our evaluation as well as our recommendations based on our findings.

Initial feasibility studies were carried out for this investigation by examining continuous core samples from select borings drilled as part of the Metro investigation for the Westside Subway Extension by AMEC. AMEC borings T1-B2, T1-B3, and T1-B8 along Transect A, and AMEC borings T3-B5, T3-B6, and T3-B7 along Transect B were reviewed on June 12 and June 13, 2012 for the presence and continuity of soils. Although no detailed descriptions were generated from the AMEC core samples, our review indicated that young Holocene age sediments are present along Transect 1 (Avenue of the Stars) and distinct stratigraphic units are present that could be used for evaluating the continuity of stratigraphic units and the location and activity of identified faults.

Our field exploration included drilling and logging of 15 continuous-core hollow-stem auger borings in two transects along the east and west Site boundaries, perpendicular to the trend of the Parsons (2011) fault zone interpreted as traversing the site. A description of our exploration program is presented in Section 7.0 of this report. We incorporated pertinent exploration data from the METRO investigation into our analysis that include four borings along Transect A and three borings along Transect B drilled by AMEC in 2011. Also, 23 cone penetration tests (CPTs) performed by Kehoe Testing and Engineering as part of the previous Metro investigation were utilized in our analysis.

In total, 22 borings were analyzed as part of this investigation in addition to 23 CPT's. The logs of our explorations are presented in Appendix A. The logs of the previous borings are presented in Appendix B. The results of the previous CPTs are presented in Appendix C.

Soil stratigraphic analyses and relative age estimates were performed by Mr. John Helms, CEG, to assist with evaluating activity of the faults encountered in this investigation. The results of the soil-age analysis are presented in Appendix D.

Lettis Consultants International, Inc. (Lettis) provided geologic consultation services to Geocon during this investigation that included an assessment of the local geomorphology to assist in understanding the landforms, site geology, and soil age estimates of the of fluvial deposits encountered in borings along Transect A (Avenue of the Stars). A letter report summarizing the Lettis geomorphic assessment is presented in Appendix E.

Lettis also provided technical oversight and peer review services during this investigation that included: 1) review of seven core samples from borings along Transect A and six core samples from borings along Transect B, 2) review of preliminary geologic interpretations and correlations, and 3) review of draft cross sections.

The data reviewed may be summarized as follows:

- Detailed data from approximately 50 borings conducted over a 60 year period on the Westfield property
- Results of 7 borings and 23 CPTs by AMEC as part of Metro investigation (Parsons, 2011)
- Review of recovered core samples from 6 borings by AMEC as part of Metro investigation (Parsons, 2011)
- Design of additional exploration program along two transects, with exploration spacing an average of 15 feet and as close as 5 feet in areas of potential faulting
- Drilling of 15 additional continuous-core borings along the two transects
- In addition to our firm, independent core data review and analysis was performed by Mr. John Helms, CEG, and Lettis Consultants International who also performed professional peer review services.

In total, data from 95 separate explorations on and immediately adjacent to the Site have been utilized as part of this investigation.

3. SITE CONDITIONS

The Westfield Century City Mall, located at 10250 Santa Monica Boulevard, was constructed in 1964 as an open-air mall with surface parking. The Site is bounded by Santa Monica Boulevard on the north, Avenue of the Stars and existing commercial developments on the east, Constellation Place on the south, and Century Park West on the west. The mall was expanded in 1976 and again in 1987. More recently, Westfield initiated a renovation that took place from 2004 to 2007 that converted the former Marketplace and movie theaters to new retail shops catering to upscale clientele.

Currently, the Site is developed with one- and two-story retail buildings, an AMC theater, Gelson's market, and two anchor stores, Macy's and Bloomingdales. A 2½-level below-grade parking structure is located beneath the majority of the mall. An existing 13-story office building with 2 levels of below grade parking at 1801 Avenue of the Stars is included as part of this investigation. The current Site conditions are shown in Figure 3, Site Plan.

Topography at the Site has been altered by grading and construction activities associated with the current development. Current elevations range from approximately 272 feet in the northwest corner of the Site to approximately 281 feet above mean sea level in the west-central portion of the Site as indicated on Figure 2. As indicated on Figure 4, Historical Geologic and Topographic Map, Site elevations in the 1920s ranged from 270 to 280 feet above mean sea level. The former topographic high was located in the west-central portion of the Site and the topography sloped gently toward the northwest, north, northeast and east. A stream channel was present at the northeast corner of the Site, near the present-day intersection of Avenue of the Stars and Santa Monica Boulevard, and trends in a southerly direction across the eastern portion of the Site.

The entitled redevelopment includes provision for a new 39-story tower at the 1801 Avenue of the Stars location above retail uses and parking. Only minor grading is planned.

4. GEOLOGIC SETTING

4.1 General

The Site is located in the Century City area, within the uplifted and dissected Cheviot Hills. The sediments exposed in the area consist of primarily older dissected Pleistocene age alluvial sediments at the ground surface underlain by Pleistocene age terrestrial fan sediments, and interbedded terrestrial fan and marine sediments of the Lakewood Formation. The marine sediments of the San Pedro Formation (Qsp) underlie the Lakewood Formation sediments at depth. Younger alluvial and fluvial sediments are present in local drainages such as the Brown Canyon drainage located near the

intersection of Avenue of the Stars and Santa Monica Boulevard and the Benedict Canyon drainage near the boundary of Beverly Hills and City of Los Angeles. The Benedict Canyon drainage defines the eastern boundary of the Cheviot Hills.

The general geologic conditions in the vicinity of the Site are shown in Figure 5, Regional Geologic Map.

As indicated on Figure 4, Historic Topographic and Geologic Map, Hoots (1930) maps the sediments in the Site vicinity as older terrace deposits with younger alluvial sediments present in local drainages, including the Brown Canyon drainage that trends across the eastern portion of the Site in a southerly direction. As indicated on Figure 5, Dibblee (1991) indicates the sediments at the Site are primarily older alluvium derived from the Santa Monica Mountains. Dibblee's map also indicates younger alluvial deposits are present in local drainages.

The majority of the Site is situated on an older degrading fan surface that slopes predominantly to the north and east. The western portion of the Site is located on a topographic high and is underlain by Pleistocene age older alluvial sediments. The eastern portion of the Site is underlain by Holocene age and latest Pleistocene age alluvial and fluvial sediments associated with the former Brown Canyon drainage. Pleistocene age older alluvial sediments underlie the younger sediments at depth in this area.

Uplift and erosion of the Santa Monica Mountains, located less than 2 miles north of the Site, has provided a source for much of the younger sediments in the Cheviot Hills. Channels eroded during low sea level stands were backfilled with sediments as sea level rose and base levels were reached. Locally, there could be a comingling of sediments from the local drainages and the degrading fan surface as in the area near the intersection of Avenue of the Stars and Santa Monica Boulevard.

Uplift in the Cheviot Hills has been thought to be related mainly to faulting. However, the recent study by Kenney (2012) proposes that deformation and uplift of the hills may be a result of folding and faulting.

Regionally, the Site is located near the boundary between the Transverse Ranges and Peninsular Ranges geomorphic provinces. The Transverse Ranges geomorphic province is bounded by the Big Pine fault on the north, the San Andreas Fault Zone on the east, the Pacific Ocean on the west, and the Santa Monica, Hollywood, Raymond, Sierra Madre, and Cucamonga faults on the south. The province is characterized by east-west trending mountain ranges that include the Santa Ynez, San Gabriel, San Bernardino, and Santa Monica Mountains, and associated valleys. The southern boundary of the province is coincident with the northern boundary of Peninsular Ranges geomorphic province. In contrast to the Transverse Ranges geomorphic province, the Peninsular Ranges geomorphic province is characterized by elongate northwest-trending mountain ridges separated by straight-sided sediment-filled valleys. This province is bounded by the San Jacinto fault zone on the east, the Pacific Ocean coastline on the west, and the Transverse Ranges geomorphic province on the north.

4.2 Santa Monica Fault Zone

The Santa Monica Fault Zone (SMFZ) trends east-west from the Santa Monica coastline on the west to the Hollywood area on the east and is part of a regional fault system that extends for nearly 125 miles along the southern boundary of Transverse Ranges. This fault system is referred to as the Malibu Coast-Santa Monica-Raymond-Cucamonga fault system by Crook et al. (1983) and as the Transverse Ranges Southern Boundary fault system (TRSB) by Dolan et al. (2000). This complex system of east-west trending faults accommodates north-south shortening and uplift, and concurrent westward motion of the Western Transverse Ranges. Individual faults within the TRSB fault system exhibit varying degrees of both left-lateral strike-slip and contractional dip-slip faulting and related folding (Hill, 1979; Crook et al., 1983; Jones et al., 1990; Dolan et al., 2000). All faults within the system show evidence for Quaternary activity and several, including the Santa Monica and Hollywood faults, have been demonstrated by site-specific paleoseismic studies to be active during the Holocene (Jones et al., 1990; Weaver and Dolan, 2000; Dolan et al., 2000).

The Santa Monica Fault Zone is an oblique-reverse, left-lateral fault that is thought to be a surface expression of tectonic deformation related to Pliocene-Quaternary structural development of the Santa Monica Mountains. Integration of subsurface oil and gas exploration seismic data and well logs with surficial mapping indicate the mountains are underlain by a large southward-vergent asymmetric anticline formed over a regional north-dipping thrust ramp at a depth of 6 to 9 miles. Davis and Namson (1994) have interpreted the Santa Monica anticlinal structure as a regional-scale fault propagation fold with a steep south-facing forelimb. The SMFZ is shown in their model as an out-of-sequence high-angle fault that branches upward from the main fault ramp (Santa Monica Mountains blind thrust), breaches the forelimb, and extends to the near-surface. Geophysical studies conducted at the Veteran's Administration (VA) property in West Los Angeles indicate the SMFZ is a gently dipping thrust fault with secondary near-vertical faults extending from the primary basal fault toward the ground surface (Pratt et al., 1998; Dolan et al., 2000). These secondary hanging-wall faults exhibit normal displacement and are thought to be primarily left-lateral strike slip.

Studies by Dolan et al. (2000) at the VA property represent the most complete paleoseismic study to date of the SMFZ. A detailed trench stratigraphy with carbon-14 (14C) numerical age-control provided the basis for evaluating total slip, slip rate and the number and age of displacement events yielded a history of ground-rupturing events between about 50,000 years and 1,000 to 3,000 years. Dolan et al. (2000) identify five to six faulting events in the stratigraphic record. These events, listed below, suggest a recurrence interval for the SMFZ of about 7,000 to 8,000 years.

- Event A (prior to 50,000 years);
- Events B and C (approximately 50,000 to 19,000 years);
- Event D (17,000 to 10,000 years);
- Event E (10,000 to 16,000 years); and

• Possible Event F (1,000 to 3,000 years).

The surface expression of the SMFZ is limited to fault-related geomorphic features, many which have been destroyed by urbanization and development within the greater Los Angeles area. This has resulted in a poor understanding of the lateral extent, location, and rupture history of the SMFZ. Dolan et al. (2000) identified the fault location based on topographic scarps shown in Figure 6.

Both trenching studies and seismic reflections profiles at the VA property (Crook et al., 1983; Pratt et al., 1998; Dolan et al., 2000; Catchings et al., 2001) reveal that the SMFZ topographic scarp contains a series of steeply dipping to sub-vertical faults that offset late Quaternary age sediments. In the Site vicinity, the topographic scarp is best preserved on the Mormon Temple property north of Santa Monica Boulevard, approximately 0.8 mile west of the Site. The topographic scarp is generally coincident with the northern limit of the secondary faults associated with the primary basal rupture surface of the SMFZ.

In 2010, the City of Los Angeles Department of Building and Safety revised the Fault Rupture Study Zone maps for the Santa Monica Fault Zone, the Hollywood Fault Zone, and other known active faults that do not yet have state-designated Alquist-Priolo Earthquake Fault Zones. The locations of the city-designated zones are based on information regarding fault locations by the CGS and US Geological Survey, researchers, and private consultants and the zones are continually being updated as new data becomes available. Fault investigations, in conformance with same criteria as required for sites within state-designated Alquist-Priolo Earthquake Fault Zones, are required for construction of habitable structures located within these zones. The northern portion of the Site is located within a City of Los Angeles Fault Rupture Study Zone.

4.3 Santa Monica Fault Zone Studies in West Los Angeles

Prior to 2011, studies that specifically addressed the location and activity of the SMFZ were confined to the paleoseismic studies at the VA property in West Los Angeles. The location of the fault in the Century City area was based on geomorphic maps (Dolan et al., 2000) that identified topographic scarps on historical topographic maps. However, there were no studies that produced subsurface stratigraphic data and numeric or relative age-dating of sediments to evaluate specific fault locations and activity of individual fault strands. The location of the SMFZ was presumed to be constrained within the area of the topographic scarp and individual fault strands within the fault zone were presumed to be active based on the site-specific studies to the west.

4.3.1 METRO Fault Study

In 2011, Parsons-Brinkerhoff (Parsons) completed a fault study for the METRO Westside Subway Extension for the purpose of locating potential subway station and tunnel alignments (Parsons, 2011).

Their study generated new subsurface data for the Century City-Beverly Hills area that includes continuous-core borings, cone penetration tests (CPTs), and geophysical surveys. Numeric or relative age-dating analysis of geologic units encountered was not performed as part of the Parsons (2011) fault investigation.

Parsons (2011) interpreted two zones of faulting: 1) a zone of east-west trending faults, generally parallel to Santa Monica Boulevard, that define the Santa Monica Fault Zone (SMFZ) and 2) a zone of north-south trending faults that define the West Beverly Hills Lineament (WBHL). The WBHL faults and the faults identified as part of the SMFZ north of Santa Monica Boulevard were considered active based on geomorphic evidence and interpreted association with known active faults.

The faults identified south of Santa Monica Boulevard were not considered active based on the age of sediments offset by these faults (Pleistocene age) and lack of geomorphic expression on historic topographic maps from the 1920s. The SMFZ faults south of Santa Monica Boulevard are interpreted by Parsons (2011) as traversing the Westfield Century City Mall and the existing office building at 1801 Avenue of the Stars. The location of faults identified in the Metro investigation (Parsons, 2011) are shown on Figure 7.

4.3.2 Other Studies

Leighton Consultants Inc. (Leighton) performed a fault investigation at Beverly Hills High School that investigated WBHL and SMFZ faults indicated by Parsons (2011) as traversing or projecting toward the campus. In the northern portion of the campus, Leighton investigated a strand of the SMFZ (south of Santa Monica Boulevard) that is interpreted by Parsons (2011) as the western extension of the same fault they interpret as traversing the Westfield Site. Based on the Pleistocene age of unfaulted soils overlying the fault, Leighton concluded this fault is not active. The California Geological Survey (CGS) approved the Leighton report and agreed that none of the investigated faults were active (CGS, 2013).

Kenney GeoScience (Kenney) performed geomorphic, structural, and stratigraphic analysis using the available subsurface data from the Metro investigation (Parsons, 2011), the Beverly Hills High School fault investigation (Leighton, 2012), the fault investigation at 10000 Santa Monica, and other data generated from recent fault studies in the Beverly Hills/Century City area to evaluate the regional geomorphology and pedochronology of the area to understand the tectonic regime and to evaluate the location and activity of suspected faults in the area.

Based on available subsurface data and geophysical studies, Kenney interprets the SMFZ faults identified by Parsons (2011) as secondary upper plate faults related to the primary basal left-lateral reverse SMFZ that likely daylights south of the METRO investigation area. Kenney (2012) labels these faults as the "Santa Monica Boulevard Fault Zone" (SMBFZ), distinguishing them from the primary basal SMFZ that underlies the Century City area at depth. Kenney (2012) indicates that many of the

faults identified by Parsons (2011): 1) likely exist, 2) are in similar locations proposed by Parsons (2011), and 3) are not active. In particular, Kenney concluded that the faults interpreted by Parsons (2011) south of Santa Monica Boulevard, part of the SMBFZ, are likely inactive based on apparent continuation of unfaulted Pleistocene age geologic units overlying the faults (Kenney, 2012).

4.3.4 Summary of Prior Investigations

Based on the results of these recent investigations, the faults subject to this investigation are part of the Santa Monica Boulevard Fault Zone (SMBFZ) and thought to be constrained within the area of the topographic low or graben that trends generally parallel to and south of Santa Monica Boulevard (Parsons, 2011; Kenney, 2012). These faults are considered secondary faults related to the primary basal reverse fault that is thought to underlie the Century City area at depth (Kenney, 2012; Lettis, 2013). Faults associated with the SMBFZ dip steeply to the north and are thought to exhibit left lateral displacement.

Both Kenney (2012) and Parsons (2011) indicate there is no direct evidence that SMFZ faults south of Santa Monica Boulevard are active. Furthermore, Leighton investigated a strand of the SMFZ (south of Santa Monica Boulevard) in the northern portion of the Beverly Hills high school campus and, based on the Pleistocene age of unfaulted soils overlying the fault, this strand of the SMFZ is not active. The California Geological Survey agreed with Leighton's findings regarding fault activity (CGS, 2013).

The results of this investigation indicate the locations of the SMFZ faults south of Santa Monica Boulevard, interpreted to be associated with the SMBFZ, are in close agreement with the locations interpreted by Parsons (2011). Both Kenney (2012) and Parsons (2011) conclude these faults are not active but suggest additional studies be performed to provide direct evidence of inactivity. Based on the results of our investigation, we have multiple lines of evidence that support the conclusion that the faults investigated by this study (south of Santa Monica Boulevard) are not active as discussed further in Sections 10.0 and 11.0.

5. GEOMORPHOLOGY

The geomorphology in the Site vicinity is largely influenced by the uplift of the Cheviot Hills, the Brown Canyon drainage, and location of the Santa Monica Fault Zone (SMFZ) that trends through the area in a roughly east-west direction.

Uplift of the Cheviot Hills has been ongoing for hundreds of thousands of years as evidenced by deep incision from fluvial processes and erosion (Kenney, 2012). Remnant fan terrace surfaces are exposed in areas of deep incision. The western portion of the Site, including Transect B along Century Park West, is located on an older degrading fan surface. Based on historic topographic maps (Figure 4), the eastern portion of the Site, prior to grading and development, is an area of deep fluvial incision associated with the Brown Canyon drainage. Remnant fluvial terrace surfaces are identified

on both sides of the incised channel and young fluvial deposits are present within the channel. Geomorphic mapping suggests that Transect A, located along Avenue of the Stars, is situated on a young (Qt1) terrace surface as shown on Figure 8 (Lettis, 2013). Based on the elevation and position of this young terrace surface with respect to the incised Brown Canyon, the age is likely mid-Holocene to late-Pleistocene (Lettis, 2013). This age interpretation is also supported by the estimates of soil ages discussed later in this report.

As previously discussed, the locations of the primary Santa Monica Fault Zone (SMFZ) and the secondary Santa Monica Boulevard Fault Zone (SMBFZ), are mostly based on geomorphic interpretation. The fairly well-preserved south-facing geomorphic scarp first identified by Dolan et al. (2000) is generally coincident with the northern limit of the SMBFZ in the site vicinity that is expressed both as a shallow, narrow trough and a swale in the topography (generally parallel to Santa Monica Boulevard). Recent studies (Kenney, 2012; Lettis, 2013) infer that the primary basal rupture surface of the SMFZ daylights in the southern Cheviot Hills. The general locations of the SMBFZ and the SMFZ, based on geomorphic interpretation, are shown of Figure 8 (Lettis, 2013).

6. FAULT ACTIVITY CRITERIA

The criteria used in our investigation to evaluate fault activity are the same criteria used by the California Geological Survey (CGS) that defines an active fault as one that has had surface displacement within Holocene time (about the last 11,000 years). These criteria for defining an active fault are based on standards developed by the CGS (Bryant and Hart, 2007) for the Alquist-Priolo Earthquake Fault Zoning Program. Faults that have not moved in the last 11,000 years are not considered active.

7. METHODS OF INVESTIGATION

7.1 General

Our investigation was performed in accordance with CGS Guidelines for Evaluating the Hazard of Surface Fault Rupture (CGS Note 49) and included several methods of analysis and field exploration for the purpose of providing multiple lines of evidence to support our conclusions regarding fault locations and activity.

We performed a document review that included pertinent geologic maps, technical reports, historic topographic maps and aerial photographs for evaluating faulting in the area. We also independently interpreted the previous data generated as part of the METRO investigation (Parsons, 2011). Our interpretation of the previous CPT data and recovered core sample data was utilized to evaluate the continuity of primary stratigraphy. Our stratigraphic interpretation was used to scope the field exploration program for this investigation that was focused on collecting additional data in areas of interpreted faults, to provide better control on the fault locations and to provide clear evidence that these faults are not active.

Our field exploration program included drilling and logging of 15 continuous-core hollow-stem auger borings in two transects along the east and west Site boundaries, perpendicular to the trend of the Parsons (2011) fault zone interpreted as traversing the site. This was in addition to the 7 borings and 23 CPT's performed for the METRO investigation, which we also reviewed as part of this investigation. The average spacing of the explorations was on the order of 15 feet. We assessed the relative age of the sediments from the recovered cores of six borings based on soil development and corroborated the relative age estimates with geomorphic analysis.

To add an additional level of confidence in our results, we retained Lettis Consultants International to provide technical oversight and peer review services that included: 1) review of seven core samples from borings along Transect A and six core samples from borings along Transect B, 2) review of preliminary geologic interpretations and correlations, and 3) review of draft cross sections.

Trenching was not considered practical as the primary method of our subsurface investigation at the Century City Mall because of unfavorable geologic conditions. In the eastern portion of the site, trenching is not practical because the base of the young Holocene age sediments are on the order of 25 feet below grade and groundwater is shallow. These adverse conditions were confirmed by drilling 2 borings to a depth of approximately 10 feet within a potential trench location in the 1801 Avenue of the Stars basement. The borings encountered shallow groundwater and soft, massive silt that were not favorable for trenching. In the western portion of the site, Holocene age sediments were not known to be present and trench excavations are anticipated to expose older Pleistocene age sediments that would not allow evaluation of Holocene activity. The below grade parking structure at the Site also precluded drilling continuous-core borings to give us further data to evaluate the postulated faults as described in detail below.

7.2 Previous Core Sample Review

Prior to beginning our field exploration program, we reviewed recovered core samples from six select borings drilled as part of the Metro investigation (Parsons, 2011) for the Westside Subway Extension by AMEC. AMEC borings T1-B2, T1-B3, and T1-B8 along Transect A, and AMEC borings T3-B5, T3-B6, and T3-B7 along Transect B were reviewed on June 12 and June 13, 2012 specifically for the purpose of identification of soils that could be used for soil stratigraphic assessment and relative age estimates of buried soils. Detailed descriptions were not generated from review of the AMEC core samples because the cores were in poor condition from prior review by AMEC and other consultants; however, based on the degree of soil development observed in the cores, we identified Holocene age soils in the AMEC borings along Transect A that appeared unfaulted. This information was used to: 1) provide preliminary interpretation of the activity of interpreted faults and 2) focus our field exploration program to specific areas that would constrain fault locations and provide key data regarding fault activity.

7.3 Exploration Transects

Our exploration program was performed in two transects, off-site in the public right-of-way along the east and west property boundaries. Spacing between explorations was an average of 15 feet and as close as 5 feet in areas of potential faulting. The location and planned depth of our subsurface explorations were determined based on the following considerations:

- trend of known faults within the Site vicinity,
- locations of postulated faults from previous investigations,
- locations of prior explorations,
- locations of existing structures and utilities.

Transect A (located along Parsons Transect 1) was explored by drilling nine continuous-core borings between August 22 and August 29, 2012 and on May 9 and 10, 2013. This transect is located immediately east of the Site within the north-bound lanes of Avenue of the Stars and extends for approximately 480 lineal feet from the southern boundary of the crosswalk at Santa Monica Boulevard to approximately 180 feet south of the pedestrian bridge at of the 1801 Avenue of the Stars. The continuous-core borings were advanced to depths between 70 and 115 feet and the cores were retained and subsequently transported to a storage area on the Westfield Century City Mall property. The borings were drilled between previous explorations performed as part of the Metro investigation. The location of Transect A and corresponding explorations are shown on Figure 9, Exploration Plan.

Transect B (located along Parsons Transect 3) was explored by drilling six continuous-core borings between April 29 and May 6, 2013. This transect is located immediately west of the Site within the south-bound lanes of Century Park West, adjacent to the Westfield Century City Mall on the west. The total transect length is approximately 300 lineal feet and traverses the zone of faulting previously identified by METRO. The continuous-core borings were advanced to depths between 54 and 95 feet and the cores were retained and subsequently transported to a storage area on the Westfield Century City Mall property. Like Transect A, the borings were drilled between previous explorations performed as part of the Metro investigation. The location of Transect B and corresponding explorations are shown on Figure 9.

The primary purpose for drilling the borings along Transect B was to constrain locations of faults on the west side of the Site and, if possible, correlate them with faults identified on the east side of the Site by similar relative position, sense of apparent displacement, and magnitude of apparent displacement. Data collected along Transect B was not intended to evaluate the activity of the investigated faults because Pleistocene age soils are exposed at the ground surface along the majority of this transect and this condition would not allow for evaluation of Holocene activity. The following describes the methodology of each of the exploration techniques utilized as part of this investigation.

7.4 Continuous-Core Borings

A total of 15 continuous-core borings were drilled along two transects, A and B, oriented perpendicular to the known local trend of the fault zone identified in the Metro investigation (Parsons, 2011) as traversing the Site in order to observe the maximum apparent vertical offset. The borings were spaced approximately 5 to 50 feet apart and were drilled to depths between 54 and 115 feet. Continuous sampling of the subsurface materials was performed and the recovered core materials were logged in detail prior to removal from the core barrel. The color was included in the description and classification of the soils encountered based on the Munsell color system. The core samples were logged for primary stratigraphy as well as pedogenic horizons (buried soil horizons) indicative of former ground surfaces.

The recovered core samples were placed in boxes and transported to a storage area at Westfield Century City Mall for further evaluation. Upon completion of the field investigation, the core samples from all of the borings were placed side-by-side and primary stratigraphy and secondary soil development was logged in detail a second time. The detailed logging included comparison of primary stratigraphy and secondary soil horizons between borings to develop a record of the subsurface stratigraphy and to evaluate the lateral and vertical continuity of primary stratigraphy between adjacent borings. The soils were correlated between adjacent borings on the basis of composition, color, texture, and secondary soil development. This information was used to develop a detailed stratigraphic profile (cross section) of the subsurface materials.

Logs of our borings are presented in Appendix A. Logs of previous borings by AMEC are presented in Appendix B.

7.5 Cone Penetration Tests

The Cone Penetration Tests (CPTs) yield relatively high-resolution data correlating soil type and engineering properties of the materials penetrated. The CPT consists of hydraulically advancing an electronic cone at the end of a series of rods into the ground at a constant rate and continuously measuring the resistance of the soil to penetration of the cone. Measurements are made of the tip stress and sleeve friction; these resistances, along with the friction ratio (defined as the ratio of sleeve friction to tip stress), can be related to common soil properties and soil classification.

We incorporated a total of a total of 23 CPTs, performed along our exploration transects as part of the METRO investigation to provide additional stratigraphic information between borings. Thirteen CPTs were incorporated along Transect A and ten CPTs were incorporated along Transect B. The

CPTs ranged in depth between 45 and 85 feet beneath the existing ground surface. Logs of the previous CPTs are presented in Appendix C.

Our stratigraphic analysis of the CPT data was based on identification of sediment layers that were vertically well-defined and laterally continuous between CPTs. The CPT data provided detailed stratigraphic profiles; correlations between distinct sediment layers were possible within about 6-inch vertical increments. The lateral correlations were based mainly on groups of sediments with similar tip stress (Q_t), and friction ratio (R_f) signatures, in addition to similar soil type. Each CPT location was excavated by hand-augering to a depth of 5 feet beneath the existing ground surface to clear the location for potential underground utilities (Parsons, 2011). Therefore, the upper 5 feet of the CPT signature is not considered in our evaluation.

7.6 Soil Stratigraphy and Relative Age Estimates

The main line of evidence for evaluating the presence or absence of faulting is the continuity of primary stratigraphy along the exploration transects. An additional line of evidence is the continuity of identified secondary soil horizons along the exploration transects.

As previously discussed, the California Geological Survey, as specified in the Alquist-Priolo Earthquake Fault Zoning Act, defines an active fault as those that have had surface displacement within Holocene time (about the last 11,000 years). Therefore, it is important to establish the relative age of the sediments at the Site, particularly if they are suspected to be affected by faulting, to establish the age of the potential faults.

Numeric age-dating techniques, such as radiocarbon dating, are the most desirable methods to estimate the relative age of the sediments for evaluating fault activity. When numeric age dating methods cannot be used (i.e. due to the absence of carbon for sampling and testing), relative age-dating methods can be used to estimate the minimum age of sediments based on the degree of soil development.

Mr. John Helms, CEG, was retained to assess the relative age of the sediments encountered in the cores based on soil stratigraphy, the degree of weathering of the parent material, and the degree of soil development for the purpose of estimating the relative age of unfaulted soils and evaluating fault activity. Four soil profiles were described from the core samples of Transect A in borings TA-B1, TA-B4, TA-B5, and TA-B7. Two additional soil profiles from were described from the core samples of Transect B in boringsTB-B1 and TB-B3.

The degree of soil development on the parent materials, characteristics of the buried soil horizons, and estimated age of the units are summarized in Section 9.0 and described in detail in Appendix D.

7.7 Geomorphic Analysis

Lettis Consultants International, Inc. (Lettis) provided geologic consultation services that included an assessment of the local geomorphology to assist in understanding the landforms, site geology, and soil age estimates of the fluvial deposits encountered in borings along Transect A (Avenue of the Stars). The geomorphic assessment focused on the Brown Canyon drainage and the assessment provided observations pertaining to 1) fault zones expressed in the landscape of the Cheviot Hills, 2) mapping of terrace deposits along Brown Canyon, 3) possible capture of Benedict Canyon Wash by Brown Canyon, and 4) geomorphic context for the origin and age of fluvial deposits encountered in Transect A borings. The results of the geomorphic analysis are discussed in Section 10.0 and presented in Appendix E.

8. SUBSURFACE CONDITIONS

8.1 General Geologic Units

The surficial geologic units encountered in our explorations are Younger Alluvial and Fluvial Deposits of Holocene and latest Pleistocene age, Older Alluvial Deposits of Pleistocene age, and terrestrial and marine sediments of the Pleistocene age Lakewood Formation. Marine sediments of the San Pedro Formation (Qsp) were not encountered in our borings but were encountered in the previous AMEC borings T1-B8 and T3-B6.

The primary geologic units are described in detail in the boring logs and summarized below. A generalized cross section showing the stratigraphic relationship of the units is depicted on Figures 10.1 and 10.2. A generalized stratigraphic column is shown below.

STRATIGRAPHIC COLUMN

| Epoch | Time Scale | Geologic Symbol | Stratigraphic Unit |
|-----------------------------------|--------------------------------|--------------------|--|
| to Latest ocene | Present to 11,000+ years | af | <u>Artificial Fill</u> Varying composition, locally containing concrete, asphalt and other debris |
| Holocene to Latest Pleistocene | | Qal/Qoal | Younger Alluvial and Fluvial Deposits Primarily sand with some silt and clay; some channel deposits consisting of sand and gravel. |
| | 11,000 – 1.6 million years ago | Qoal | Older Alluvial Deposits Primarily fine-grained sand, silt, and clay. Some laminated sand and varved clay. Local gravel zones and clay-rich zones. |
| Pleistocene | | Qlw | <u>Lakewood Formation</u> Interbedded sand, silt and clay deposits, primarily fine- grained with some marine sands and minor gravel zones. |
| | | Qsp | San Pedro Formation Primarily unoxidized sands, fine- to coarse-grained, some silt. |

8.2 Artificial Fill (af)

Artificial fill was encountered in the majority of borings along Transect A (Avenue of the Stars). The fill was identified by construction debris (concrete, wire, wood, plastic) and observation of obvious mixtures or layers of soil that were not characteristic of natural alluvial processes. Transect A is located across a former stream terrace associated with the Brown Canyon drainage and historic topographic maps show this area was topographically lower than the surrounding area. Significant thicknesses of fill were placed along the northern portion of Transect A (Avenue of the Stars) during development of Century City. Borings along Transect A encountered fill ranging in thickness from approximately 9 to 20 feet.

Artificial fill was not encountered in the borings along Transect B. However, these borings were hand augered to a depth of five feet beneath the existing ground surface and it is likely minor amounts of fill are present at the boring locations and in an area of existing utilities between borings TB-B2 and TB-B3.

8.3 Younger Alluvial and Fluvial Deposits (Qal/Qoal)

The Younger Alluvial and Fluvial Deposits are comprised of predominantly stream terrace and fluvial deposits originating from the Brown Canyon drainage. The primary stratigraphy consists of interfingering silt, fine- to coarse-grained sand, and gravel beds that are friable, and highly oxidized. Minor silt and clay is present except where secondary clay has developed in argillic horizons. This unit is identified along all of Transect A and possibly in the northernmost portion of Transect B.

The Younger Alluvial and Fluvial Deposits are characterized by a series of scour-and-fill sequences. The lower portion of this unit is bedded fine- to coarse-grained sand and gravel and interpreted to be of fluvial origin. Soil development in this unit is not as strong as in the underlying Older Alluvial Deposits, likely due to fluvial action locally eroding or disrupting soil development. The basal contact is mostly distinct and abrupt defined by scour zones eroding the top of the underlying Older Alluvial Deposits. Generally, these sediments are laterally continuous between two or more explorations but are not continuous for long distances due to the fluvial origin of these deposits characterized by localized cut and fill (scour) sequences.

8.4 Older Alluvial Deposits (Qoal)

The Older Alluvial Deposits are comprised of distal fan deposits, terrace deposits, stream deposits and at depth may include some low energy deposits associated with stream or near-shore environments such as estuary or lagoon environments. Primary stratigraphy consists of predominantly fine- to medium-grained sand with varying amounts of silt and gravel. Sequences of laminated finegrained sands, silty sand and sand with gravel beds are common. Clay beds are locally present and are both massive and varved.

Varying degrees of oxidation are present in these deposits and localized carbonate and caliche stringers are common. Locally, manganese nodules and manganese staining is present. Buried soils with moderate to strong pedogenic development, secondary clay films on ped faces were observed. Most basal contacts are sharp and defined by scour zones eroding the unit below. Localized scour zones are prominent, eroding into the top of the Lakewood Formation. Generally, these sediments are laterally continuous between explorations and many of the units have characteristic color, texture, or depositional sequence that provides a high level of confidence in correlation of units between borings.

Along Transect A, the Older Alluvial Deposits are interpreted to be primarily stream terrace and stream channel deposits with some well stratified or bedded sequences, fan deposits, and low energy deposits that may be associated with an estuary environment. Two distinct buried soils are preserved that appear undeformed and continuous across the entire transect except locally where the upper buried soil has been completely stripped away by scouring associated with the overlying basal unit of the Younger Alluvial and Fluvial Deposits. This distinct buried soil package is shown in Figure 10.1 as the "marker buried soil". Below this distinct buried soil are primarily laminated fine-grained sand

and silty sand. The sand unit coarsens with depth and the basal contact of this unit is abrupt along Transect A, locally defined by scour zones eroding the top of the underlying Lakewood Formation.

Along Transect B, the Older Alluvial Deposits are interpreted to be primarily distal fan deposits with localized stream deposits and some near-shore, low energy deposits, such as massive silts and clays that may be associated lagoon environments and locally some varved clays characteristic of estuary environments. The base of the unit as observed in Transect B borings is typically silt, clay, or fine-grained laminated sands near the contact with the underlying Lakewood Formation sediments. There is at least one buried soil that can be correlated across the entire length of Transect B as illustrated in Figure 10.2.

The Older Alluvial Deposits are characterized by a series of stacked fining upward sequences with varying degrees of strong soil development. The stratigraphic sequence is suggestive of successive episodes of deposition in an alluvial environment that was undergoing uplift at the time of deposition. The stacked buried soil horizons suggest enough time elapsed between episodes of deposition to allow soil development at the surface.

8.5 Lakewood Formation (Qlw)

The Lakewood Formation sediments are comprised of predominantly fine-grained deposits of shallow marine, near-shore and estuary environments and some terrestrial deposits. The primary stratigraphy consists of interfingering silt, fine-grained sand, and clay. The units are massive to well-bedded and include laminated sands and varved clay sequences. Gravel zones are locally present and gravel is predominantly well-rounded. The sand and gravel beds are typically loose and friable and are locally highly oxidized. Locally, distinct beds of shells and varying concentrations of calcium carbonate nodules are present. A distinctive marine sand unit is present in the Lakewood Formation in Transect A borings. Also, a distinctive calcium carbonate-rich clay bed is present above the marine sand in Transect A borings.

In Transect B borings, the Lakewood Formation was not encountered in borings TB-B1 and TB-B2 but where encountered, consists primarily of marine sands with some gravel beds. The Lakewood Formation encountered in Transect B borings appear to coincide with a deeper stratigraphic section compared to the Lakewood Formation encountered in Transect A borings. Correlations of Lakewood Formation units across the two transects was not possible.

8.6 San Pedro Formation (Qsp)

Sediments of the San Pedro Formation were not observed in our borings but were encountered in two previous AMEC borings T1-B8 and T3-B6. As observed during our preliminary core review and described in the AMEC logs (Parsons, 2011), these sediments consist of fine- to coarse-grained sand, silty sand, clayey silt, and clay with some calcium carbonate nodules, shell fragments and localized gravel beds. The San Pedro Formation sediments are predominantly unoxidized and moderately to well cemented.

9. SOIL STRATIGRAPHY AND RELATIVE AGE ESTIMATES

9.1 General

The main line of evidence for evaluating the presence or absence of faulting at the Site is the continuity of primary stratigraphy. An additional line of evidence is the continuity of identified soil horizons.

As previously discussed, the California Geological Survey, as specified in the Alquist-Priolo Earthquake Fault Zoning Act, defines an active fault as those that have had surface displacement within Holocene time (about the last 11,000 years). Therefore, it is important to establish the relative age of the sediments at the Site, particularly if they are suspected to be affected by faulting, to establish the age of the potential faults.

Numeric age-dating techniques, such as radiocarbon dating, are the most desirable methods to estimate the relative age of the sediments for evaluating fault activity. When numeric age dating methods cannot be used (i.e. due to the absence of carbon for sampling and testing), relative age-dating methods can be used to estimate the minimum age of sediments based on the degree of soil development.

As previously described, Mr. John Helms, CEG was retained to assess the relative age of the sediments encountered in the cores based on soil stratigraphy, the degree of weathering of the parent material, and the degree of soil development for the purpose of estimating the age of unfaulted soils and evaluating fault activity. Four soil profiles were described from the core samples of Transect A in TA-B1, TA-B4, TA-B5, and TA-B7. Two additional soil profiles were described from the core samples of Transect B in boringsTB-B1 and TB-B3.

9.2 Summary of Stratigraphy and Relative Age Estimates

The soils observed along Transect A are Holocene to Pleistocene in age. The buried and stacked soils display soil horizons that have strong argillic horizon development. The soils observed along Transect B are Pleistocene in age. The buried and stacked soils display soil horizons that also have strong argillic horizon development.

The thickness of the alluvial stratigraphic section in both transects thickens to the north and increases in relative age to the north across the Site vicinity. Relative age estimates range from 58,000 to 135,000 years for the younger and thinner alluvial stratigraphic section studied along the southern portion of Transect A (borings TA-B5 and TA-B7). An older and thicker alluvial section along the northern portion of Transect A (borings TA-B1 and TA-B4) has relative age estimates that range from 137,000 to 322,000 years in age. This relationship carries across to Transect B where the thicker and older alluvial stratigraphic section in the northern portion of the transect (boring TB-B1) has relative age estimates that range from 165,000 to 371,000 years. Along the southern section of Transect B (boring TB-B3), a younger and thinner alluvial stratigraphic section has relative age estimates that range from 92,000 to 191,000 years.

The older alluvium is characterized by clay-rich, hard to very hard, very fine-grained sand that is plugged with illuvial clay. Most of the surface soils encountered in this study classify as Alfisols, and relative age estimates range from 8,000 to 15,000 years at the surface across a majority of the study area. In the northern portion of the study area the surface soils encountered classify as Entisols and relative age estimates range from 1,000 to 8,000 years for these surface soils. Soil relative age estimates have broad ranges, dependant upon the pool of comparative data used. Most of the buried soils across the study area fall into a great group classification (Soil Conservation Service, 2000) of Typic Haploxeralfs.

9.3 Correlation of Buried Soils

Two distinct buried soils can be correlated with a high degree of confidence along the entire length of Transect A. These soils correspond with the "marker buried soil" developed on top of the Older Alluvial Deposits as shown in Figure 10.1 and described in Section 8.4. The buried soils that make up the "marker buried soil" are a well developed and truncated buried argillic soil profile. Age estimates for the "marker buried soil ranges from 34,000 to 124,000 years and minimum age estimates range from 34,000 to 58,000 years.

One buried soil (buried soil 1) can also be confidently correlated along the entire length of Transect B as indicated on Figure 10.2 and described in Section 8.4. This soil is a near surface, moderately well developed, and truncated buried argillic soil profile that ranges in relative age from 9,000 to 30,000 years. Also, the top of the underlying buried argillic soil (buried soil 2) also appears to correlate across the entire length of Transect B, which is a well developed, truncated buried argillic soil profile that ranges in relative age from 31,000 to 89,000 years. Correlation of the lower portion of this soil across the site is with a lesser degree of confidence and could indicate the lower portion of this soil is faulted or locally eroded.

Generally, there is a lesser degree of confidence in correlation of buried soils along Transect B compared to Transect A. This is mostly due to the greater distance between some Transect B borings compared to Transect A. Also, the near-surface soils encountered along Transect B generally appear much older than those encountered along Transect A yet yield cumulative relative age estimates that are younger than seem appropriate. This could be related to localized stripping of the upper soils due to normal fan degradation or the lack of recovery in the upper five feet of the soil profile because of hand augering of the upper soils in each boring for utility clearance. The outcome is the upper five feet of the stratigraphic profile was not included in calculation of the section age estimate resulting in a younger cumulative age estimate of these soils.

The following table shows buried soil horizons that could be correlated between borings across the entire length of both transects and the estimated relative age. These buried soil horizons are designated on Figures 10.1 and 10.2.

| Transect | Boring | Soil Horizon | Profile Relative Age (ka) | Unit Relative Age (ka)* |
|----------|--------|--------------------------------|------------------------------|-------------------------|
| | 1 | Buried soil 1 and 2 | 34-68 | |
| А | 4 | Buried soil 3 and 4 | 58-127 | 34 – 127 |
| | 5 | Buried soil 2 and 3 | 54-119 | |
| | 7 | Buried soil 3 and 4 | 58-127 | |
| В | 1 3 | Buried soil 1 Buried soil 1 | 9 - 30 16 - 30 | 9 - 30 |
| В | 1 3 | Buried soil 2 Buried soil 2 | 39 - 89 31 - 60 | 31 - 89 |

CROSS SECTIONAL UNIT RELATIVE AGES

*ka= thousands of years before present

The correlation of these unfaulted Pleistocene age buried soils between borings along the length of both transects provides clear evidence that the investigated faults are not active.

Detailed stratigraphic analysis and relative age determinations and soil correlations are presented in Appendix E.

10. GEOMORPHIC ANALYSIS

10.1 General

Lettis Consultants International, Inc. (Lettis) performed a geomorphic assessment that was intended to assist our evaluation of the recency of faulting along Transect A by providing observations that may help understand the context of the Site geology and better constrain the age of the buried, undeformed, distinct soil horizon ("marker buried soil") observed along the boring transect. The geomorphic assessment provides observations grouped into the following areas: (1) fault zones expressed in the landscape of Cheviot Hills, (2) mapping of terrace deposits along Brown Canyon, (3) possible capture of Benedict Canyon Wash by Brown Canyon, and (4) geomorphic context for origin and age of fluvial deposits encountered in Transect A borings. It should be noted that the Lettis geomorphic assessment was performed prior to drilling borings TA-B1 and TA-B9 and do not include data generated from those borings.

10.2 Methodology

To perform this geomorphic interpretation, contours from 1926 Hollywood and 1934 Sawtelle 5-Minute U.S. Geological Survey topographic maps (surveyed in 1923-1924) were digitized. Contours depicted on these maps represent the landscape prior to mechanized grading and significant development that escalated in the 1930s. The digitized contours were used to create a 5-m-resolution digital elevation model (DEM) and derivative hillshade, color shaded relief, and slope images. In addition to interpretation of these images, topographic profiles were extracted from the DEM and aided in the identification and correlation of surfaces.

10.3 Observations

The following summarizes some of the key observations by Lettis (2013) pertinent to the geomorphology and fault activity in the area of Transect A. The complete letter report by Lettis (2013) is included in Appendix E.

Transect A along Avenue of the Stars is located on a Qt1 terrace surface. Based on the elevation and position of this Qt1 surface with respect to the incised Brown Canyon, the age is likely mid-Holocene to late-Pleistocene. This age interpretation is also supported by the estimates of soil ages (mid-Holocene to late Pleistocene) provided by Helms (2013) for the strata recovered in borings above a distinct buried Pleistocene soil ("marker buried soil") encountered at depths of approximately 30 feet. This distinct buried soil was found in each of the borings along Transect A. The continuous distinct buried soil is developed into a package of fluvial deposits cut on top of the Pleistocene Lakewood Formation and does not appear faulted. The soil represents a period of landscape stability and may have been associated with a sea level low stand.

The estimated age of the unfaulted soil (when considering overlying deposition and soil development) is approximately 58,000 to 127,000 years. This age estimate suggests that the stable surface and soil development formed sometime between the MIS 5e sea level high stand (~120,000), or as young as the MIS 5a sea level high stand (~80,000). Both of these high stands were followed by regressions that would have driven incision in Brown Canyon, and led to the development of stable terrace surfaces and soils on prior fluvial deposits.

The geomorphic interpretation of the age of the stable terrace surface, created by incision in Brown Canyon drainage related to low sea level stands, is approximately 80,000 to 120,000 years old. This interpretation corroborates the estimated age of the continuous unfaulted buried soil (58,000 to 127,000 years) by Helms (2013) and provides a second line of evidence that the faulting observed along Transect A is much older than 11,000 years and not considered active.

11. DATA INTERPRETATION

11.1 General

Our interpretation of the presence of faults is based on multiple lines of analysis including correlations of primary stratigraphy, groundwater levels, and buried soils. Our interpretation of the activity of identified faults is based on the age of unfaulted geologic units determined by stratigraphic analysis and soil-age estimates and supported by geomorphic interpretations.

The primary stratigraphy is interpreted as gently dipping to near horizontal. Based on correlation of sediments encountered in the explorations, some of the deeper sediments are interpreted as folded. However, where data does not support folding or the general inclination of bedding, the stratigraphy is interpreted as horizontal. Correlation of buried soils (based on soil development, estimated age, and elevation) generally supports this interpretation. Faults are interpreted to be present where primary stratigraphy and distinct marker beds do not correlate between borings and an apparent vertical displacement of distinct stratigraphic units is observed.

Based on our analysis, we identified a zone of closely spaced, near-vertical to steeply dipping faults in both Transect A and Transect B. The fault zone includes five steeply-dipping strike-slip faults with a component of normal offset. The fault zone trends generally parallel to Santa Monica Boulevard and ranges in width from 110 feet along Transect A and 160 feet along Transect B. Three of the faults are considered primary faults where the total vertical separation of stratigraphic units across these faults is on the order of 45 to 55 feet. Two of the faults are considered secondary or minor faults where stratigraphic displacement is on the order of 10 feet or less.

The identified faults are designated Fault A, B, C, D and E (from north to south) and can be confidently correlated across both transects based on apparent relative movement and magnitude of displacement. The location of the faults and our interpretation of the fault projections across the Site are shown on Figure 9.

11.2 Transect A

The most distinct primary stratigraphic contact is the top of the marine Lakewood Formation encountered along Transect A in borings TA-B1,TA-B2, TA-B3, TA-B4, TA-B5, TA-B6, TA-B7, and TA-B8. The top of the Lakewood Formation in these borings consists of fine-grained units generally consisting of silt and clay with distinctive oxidation pattern. The basal unit of the overlying alluvial sequence is predominantly sand with varying amounts of gravel that has appeared to have locally scoured the top of the Lakewood Formation units. Elevation of the top of the Lakewood Formation is undulatory due to localized scouring. This unit is faulted down to the north in a successive series of steps north of boring TA-B5. The Lakewood Formation was not observed in boring TA-B9 but interpreted to be present either in the zone of no recovery at the bottom of the boring or just below the boring based on the relationship of overlying units and their correlation to units in boring TA-B1 to the north.

Other distinctive units that can be correlated and were used to establish relative vertical offsets of units include the following:

• Carbonate-rich bed that correlates well between Borings TA-B5, TA-B6, TA-B7, TA-B8, and AMEC boring T1-B8. This bed is truncated by Fault D.

- Top of a marine sand unit that correlates well between borings TA-B5, TA-B6, TA-B7, TA-B8, and AMEC boring T1-B2. This unit is truncated by Fault D and may be offset by Fault E.
- Laminated sands below the distinct "marker buried soil" correlate well between borings TA-B9, TA-B3, TA-B2, TA-B4, TA-B6, TA-B7, and TA-B8. The base of this unit is offset by Faults B, C, and D.
- Distinct series of stacked argillic soils can be correlated between TA-B2, TA-B3 TA-B4, and TA-B9. These soils are offset by Faults A, B, and C.

The oldest, unit that can be correlated along the length of Transect A that is interpreted to be undeformed and unfaulted is a "marker buried soil" that correlates very well across Transect A explorations. The thickness and continuous nature of this deposit over the length of the transect suggests this soil developed on a stable surface for a considerable time, representing a hiatus in deposition, prior to deposition of the overlying younger alluvial and fluvial sediments that have locally eroded or scoured the upper surface.

The age of the unfaulted "marker buried soil" is estimated to be a minimum of 34,000 to 58,000 years old. The age of "marker buried soil" indicates faults identified along Transect A are older than this soil and are not active. Figure 11, Schematic of Faulting-Transect A, shows the general relationship of the geologic units encountered along Transect A, interpreted faults, and the unfaulted "marker buried soil".

11.3 Transect B

The primary purpose for drilling the borings along Transect B was to constrain locations of faults on the west side of the Site and, if possible, correlate them with faults identified on the east side of the Site by similar relative position, sense of apparent displacement, and magnitude of apparent displacement. Data collected along Transect B was not intended to evaluate the activity of the investigated faults because Pleistocene age soils are exposed at the ground surface along the majority of the transect and this condition would not allow evaluation of Holocene activity.

The most distinct primary stratigraphic contact along Transect B is the top of the marine Lakewood Formation observed in borings TB-B3, TB-B4, TB-B5 and TB-B6. The upper Lakewood Formation units are very sandy, lighter in color, and oxidized. This contact is similar in elevation and correlates well between borings TB-B5 and TB-B6 but is interpreted to be faulted down to the north in a successive series of steps north of Boring TB-B5. The Lakewood Formation was not encountered in borings TB-B1 or TB-B2 drilled to depths of approximately 95 feet and 85 feet, respectively.

The upper soils observed in the borings along Transect B were difficult to correlate. Stacked soils in Borings TB-B1 and TB-B2 appeared generally darker and more clay-rich and the parent material appeared more fine-grained than the other borings. However, there were some marker sand beds that correlated well between borings TB-B1 and TB-B2 and various buried soils could be correlated between many of the borings, including at least one buried soil that could be confidently correlated across the entire transect.

The following summarizes distinctive soils or primary stratigraphic units that can be correlated between borings and used to establish relative vertical offsets of units:

- Buried soil 1 correlates along the length of Transect B, except in boring TB-B5 where this soil likely correlates with the surface soil. The bottom of this soil is clearly not deformed and not interpreted to be faulted.
- Top of buried soil 2 correlates along the length of Transect B, except in boring TB-B5 where this soil likely correlates with buried soil 1. The lower portion of this soil may be faulted by Faults A, C, and D.
- Buried soil 4 correlates well between TB-B4, TB-B5 and TB-B6 and likely correlates with buried soil 5 in boring TB-B3 suggesting this soil may be offset between borings TB-B3 and TB-B4 by Fault D.
- Buried soil 3 in boring TB-B4 correlates with buried soil 2 in boring TB-B5. This soil does not correlate well with other soils to the north and may be offset by Fault D.
- Two distinct packages of sand can be correlated between borings TB-B1 and TB-B2. The relative depths of these sand packages indicate that they are offset approximately seven feet up to the north suggesting a north-side-up fault between the two borings.

The correlation of buried soil 1 and the top of buried soil 2 along Transect B strongly suggest these soils are not faulted. Buried soil 2 is estimated to be a minimum of 31,000 years old and indicates faults identified along Transect B are much older than 11,000 years old and are not active.

11.3 Correlation of Interpreted Faults Between Transects

The primary strike-slip displacement of the interpreted faults makes it impossible to accurately determine true magnitudes of lateral offset since the magnitude of horizontal movement cannot be determined. However, faults with similar dip, apparent sense and magnitude of displacement support the conclusion that that the faults identified in Transect A are the same faults identified in Transect B.

Faults B, C, and D are considered primary faults, accommodating the majority of the offset observed in the fault zone. Faults C and D accommodate the largest vertical displacement, ranging on the order of 40 feet along Transects A and B. The apparent vertical offset across Fault B on both Transects A and B is on the order of 12 feet. The total apparent vertical offset across the primary fault zone is on the order of 45 to 55 feet.

Faults A and E are interpreted to be secondary or minor faults based on apparent offsets on the order of 10 feet or less across these faults. Fault E is interpreted as a single strand along Transect A and appears to bifurcate to two strands with apparent vertical offsets on the order of five feet on each strand along Transect B. Fault A is interpreted as a single strand with an apparent vertical offset of approximately 7 feet.

Relative displacement of units across Faults B, C, D and E is north side down. Relative displacement of units across Fault A is south side down. A summary of relative displacement across the interpreted faults is presented in the following table.

| Transect A | | | | | | |
|--|--------------------|--------------------|-----------------|--------------------|--------------------|--|
| Fault | А | В | С | D | E | |
| Relative Displacement | South Side Down | North Side Down | North Side Down | North Side Down | North Side Down | |
| Apparent Vertical Displacement (feet) | 7 | 12 | 8 | 35 | 5 | |
| Transect B | | | | | | |
| Fault | А | В | С | D | E | |
| Relative Displacement | South Side Down | North Side Down | North Side Down | North Side Down | North Side Down | |
| Apparent Vertical Displacement (feet) | 7 | 12+ | 25 | 14 | 10 | |

SUMMARY OF APPARENT FAULT DISPLACEMENT

The similarities in relative displacement and vertical displacement of Faults A, B, and E along both transects supports the conclusion these faults are the same. Faults C and D have similar relative displacement but apparent vertical displacement does not correlate well between the two transects. However, the combined vertical displacement across these two faults is on the order of 40 feet and the combined apparent offset correlates well across both transects.

11.4 Age of Faulting

As previously described, there are two distinct soils, the "marker buried soil", that can be correlated with a high degree of confidence along the entire length of Transect A that have an estimated minimum relative age ranging from 34,000 to 58,000 years and estimated maximum relative age ranging from 68,000 to 127,000 years. The geomorphic assessment by Lettis (2013) corroborate these estimated relative ages of the unfaulted "marker buried soil" and indicate that this soil appears to have formed on a stable surface and soil development formed sometime between the MIS 5e sea level high stand (~120,000 year), or as young as the MIS 5a sea level high stand (~80,000 years). Both of these high stands were followed by regressions that would have driven incision in Brown Canyon, and led to the development of stable surfaces and soils on prior fluvial deposits.

As previously discussed, the primary purpose for drilling the borings along Transect B was to constrain fault locations and width of the fault zone on the west side of the Site. The near-surface soils encountered in these borings do not provide strong age control on faulting, compared to Transect A due to the lack of a thick section of Holocene/latest Pleistocene age soils. However, the Pleistocene age of the unfaulted upper soils along Transect B indicates these faults are not active. Also, the faults identified along Transect B can be correlated to the inactive faults identified along Transect A based on observed similarities of apparent relative movement and magnitude of displacement which provides another line of evidence that the faults along Transect B are not active

12. CONCLUSIONS AND RECOMMENDATIONS

The correlation of primary stratigraphy and buried soils, soil-stratigraphic age estimates, and geomorphic analysis clearly demonstrate that the faults investigated are not active. Based on the results of our investigation, we conclude active faults are not present at the Site. The results of our investigation provide multiple lines of evidence to support this conclusion and generally agree with the results of the Parsons (2011) investigation regarding the Holocene inactivity of the investigated faults. The following summaries our conclusions:

- 1. The faults we have identified are not active based on documented continuous, unfaulted Pleistocene age (>11,000 years to 1.6 million years) primary stratigraphy along both Transect A and Transect B.
- 2. The faults we have identified are not active based on soil development analysis along Transect A (Avenue of the Stars), which indicates that the faults have not moved in at least 34,000 to 58,000 years, based on the estimated minimum age of unfaulted sediments.
- 3. The faults we have identified are not active based on geomorphic analysis, which constrains the estimated age of the stable geomorphic surface on which the continuous, unfaulted Pleistocene age soils along Transect A developed to approximately 80,000 to 120,000 years and corroborates the soil development analysis by Helms (2013).

- 4. The faults identified along Transect B can be correlated to the inactive faults identified along Transect A based on observed similarities of relative movement and magnitude of displacement which means the faults along Transect B are not active.
- 5. The Site is considered free of hazards associated with potential faulting.

The zone of faulting we have identified includes three primary faults where the combined total apparent vertical separation of stratigraphic units is on the order of 45 to 55 feet. Several secondary or minor faults where stratigraphic displacement is on the order of 10 feet or less were also identified.

We have clear evidence supported by multiple investigative techniques that the faults designated by Parsons (2011) as "Holocene Activity Undetermined" are not Holocene active. We can document unfaulted Pleistocene age soils along the entire length of Transect A and Transect B. Soil development analysis along Transect A (Avenue of the Stars) indicates the faults have not moved in at least 34,000 to 58,000 years, based on the estimated minimum age of unfaulted sediments. Therefore the conclusion of Mactec's 2007 and 2008 Geotechnical Investigations remain accurate that: "active or potentially active faults with the potential for surface fault rupture are not known to be located directly beneath or projecting toward the site. Therefore, the potential for surface rupture due to fault plane displacement propagating to the surface at the site during the design life of the proposed development is considered low."

Based on the results of our investigation, active faults are not present at the site and no restrictions on future development of the Westfield Site are necessary with respect to potential faulting, beyond the standard seismic engineering requirements for all buildings in California.

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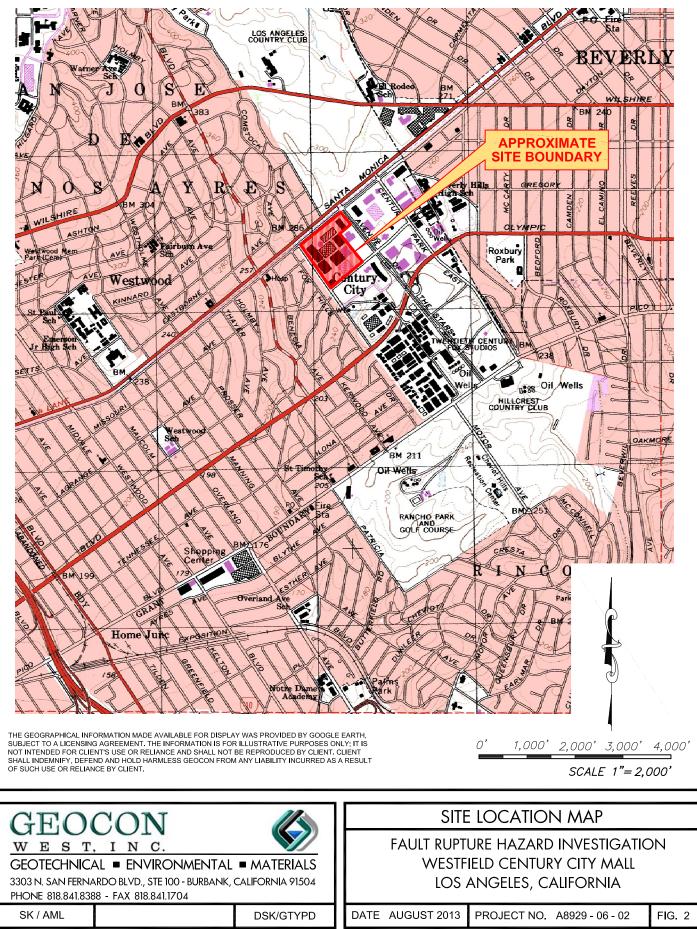
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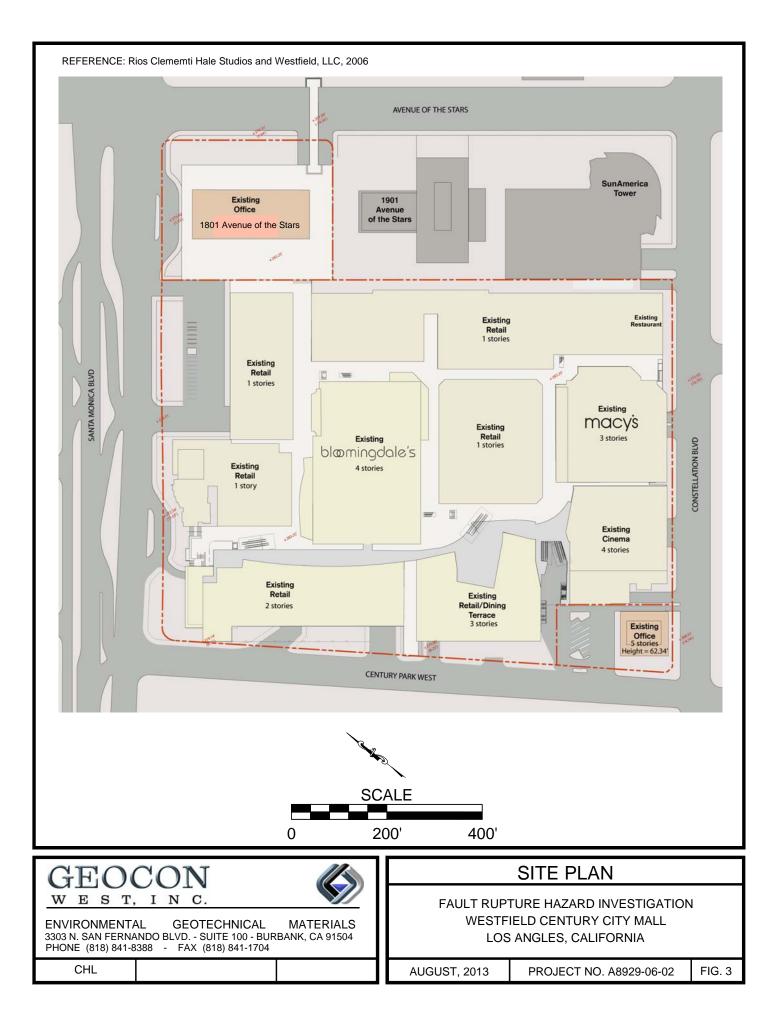
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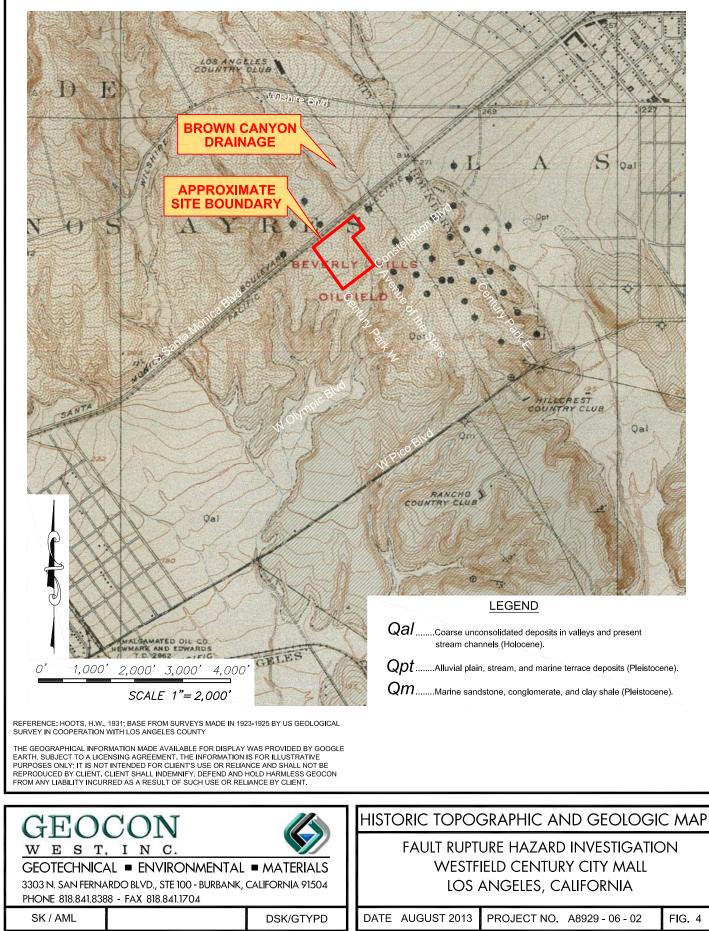
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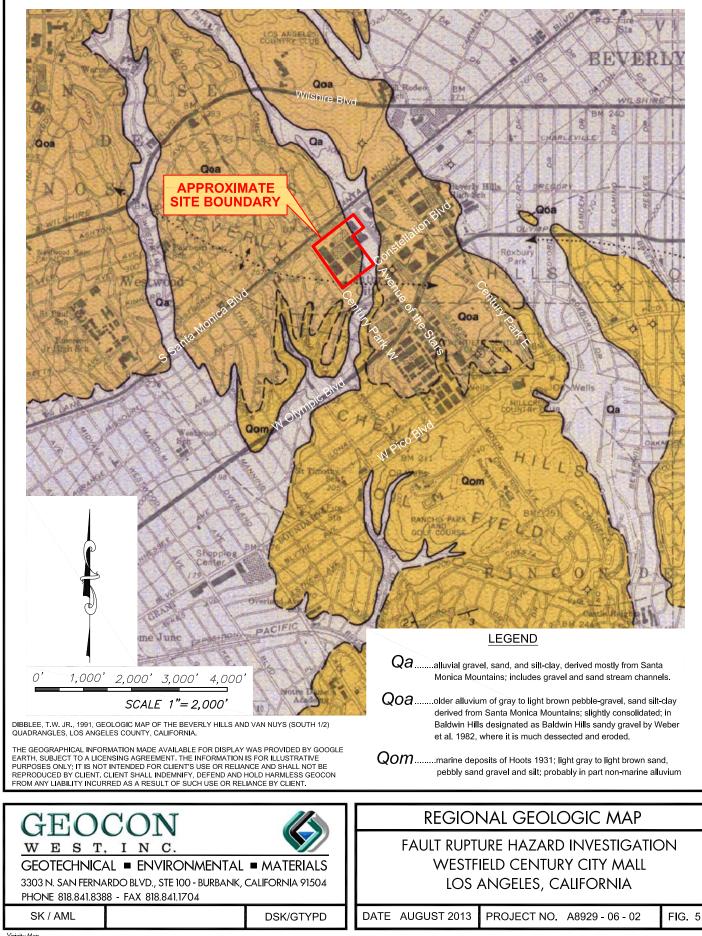
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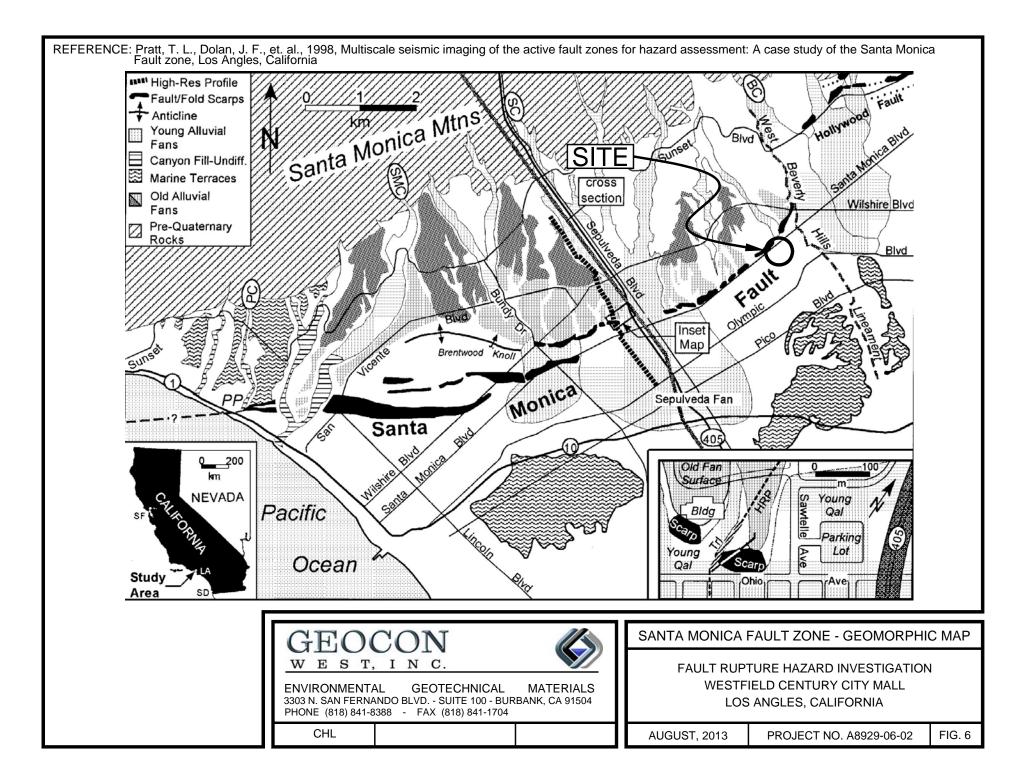


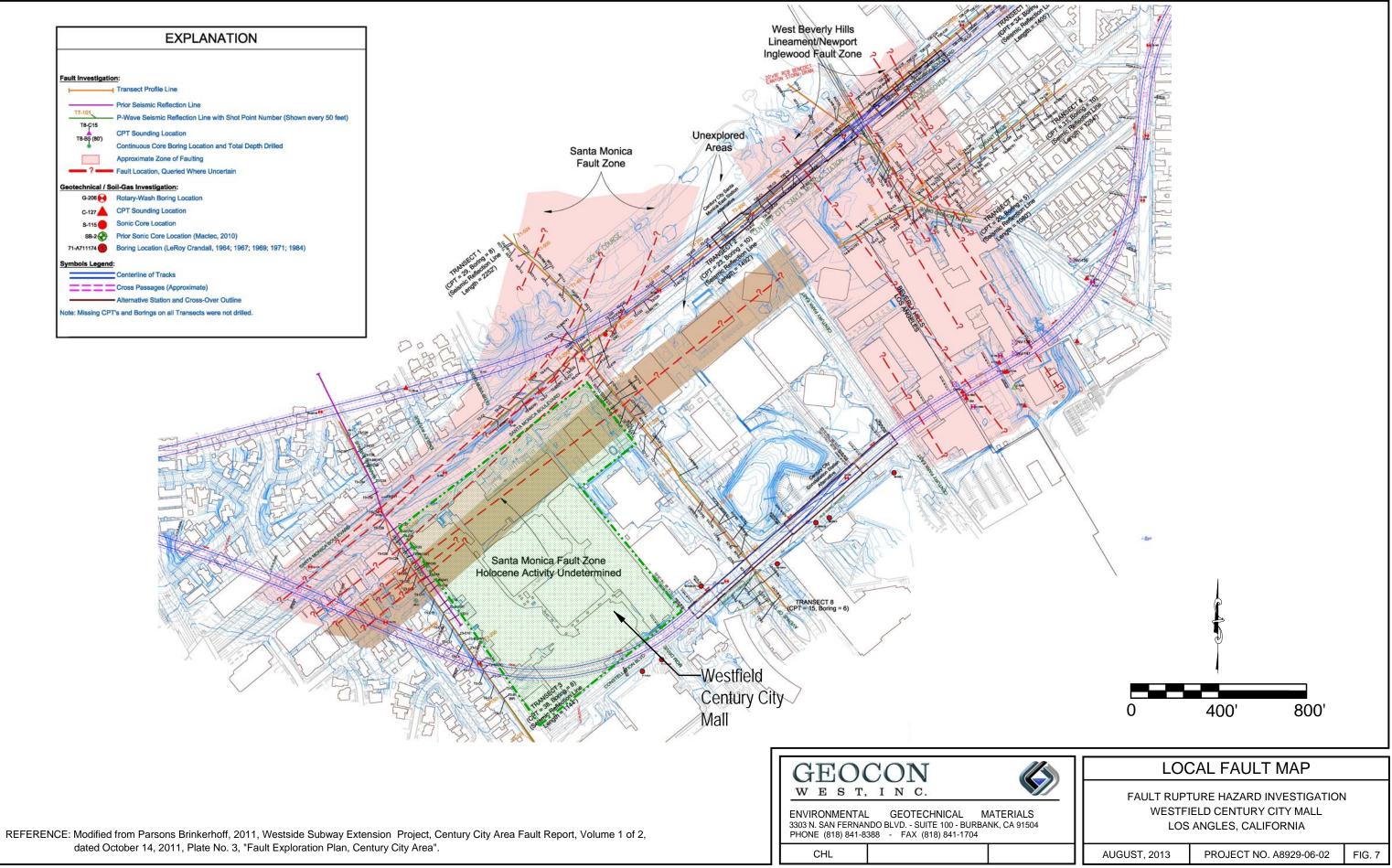


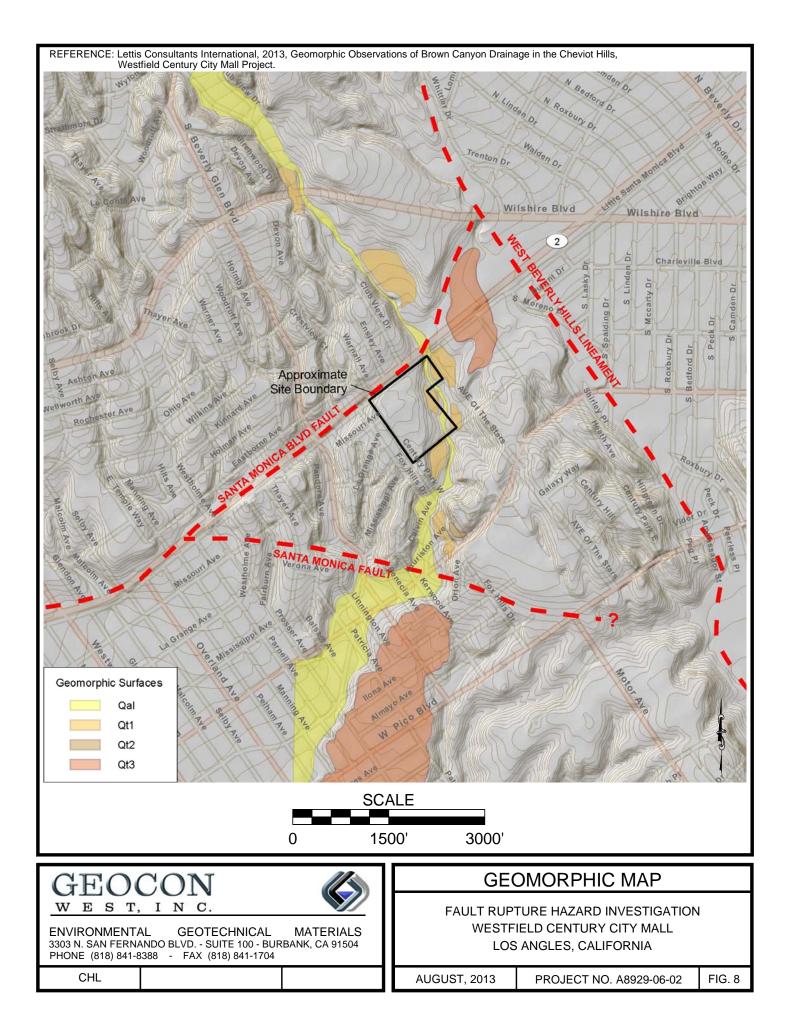


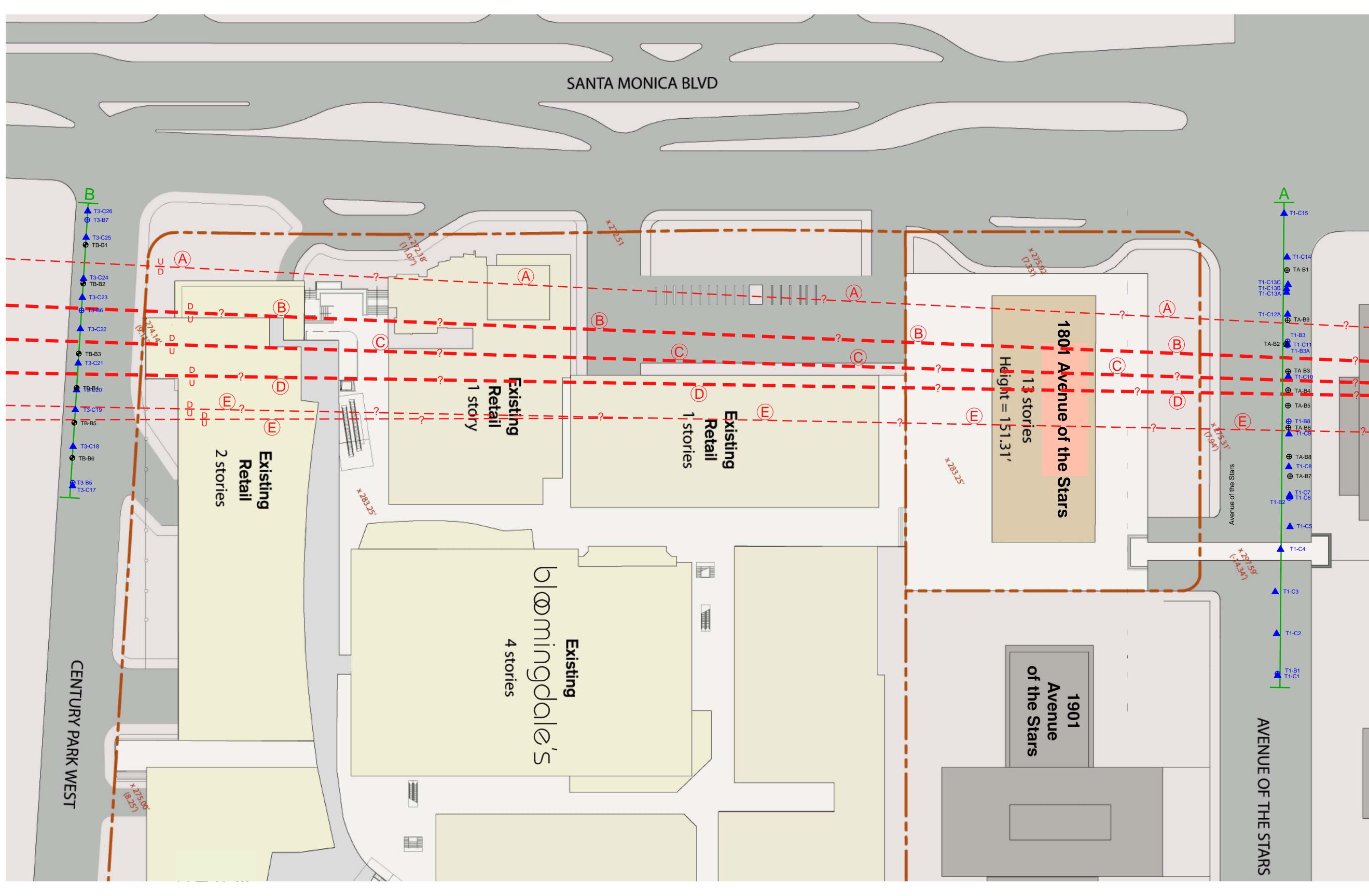


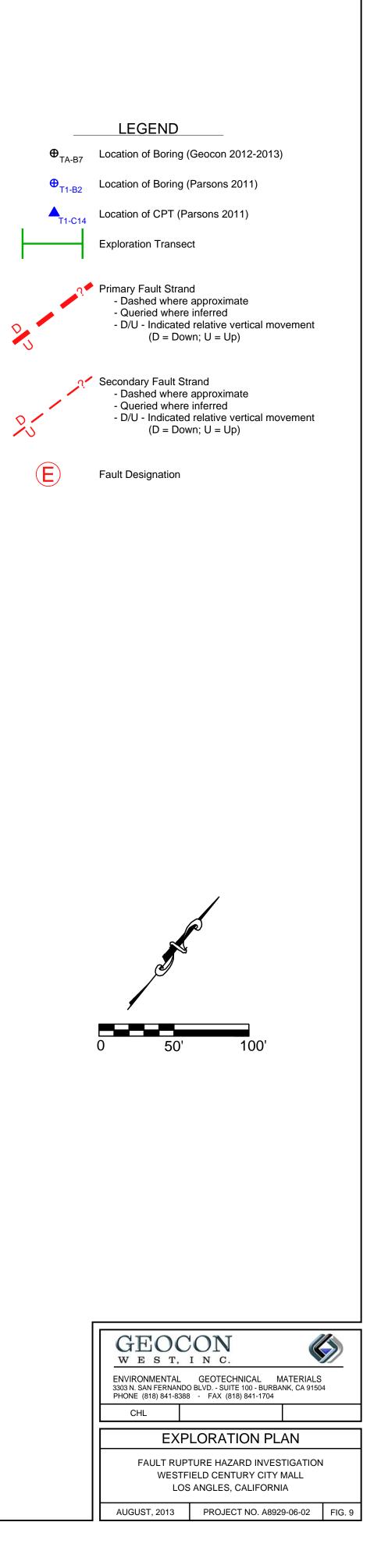


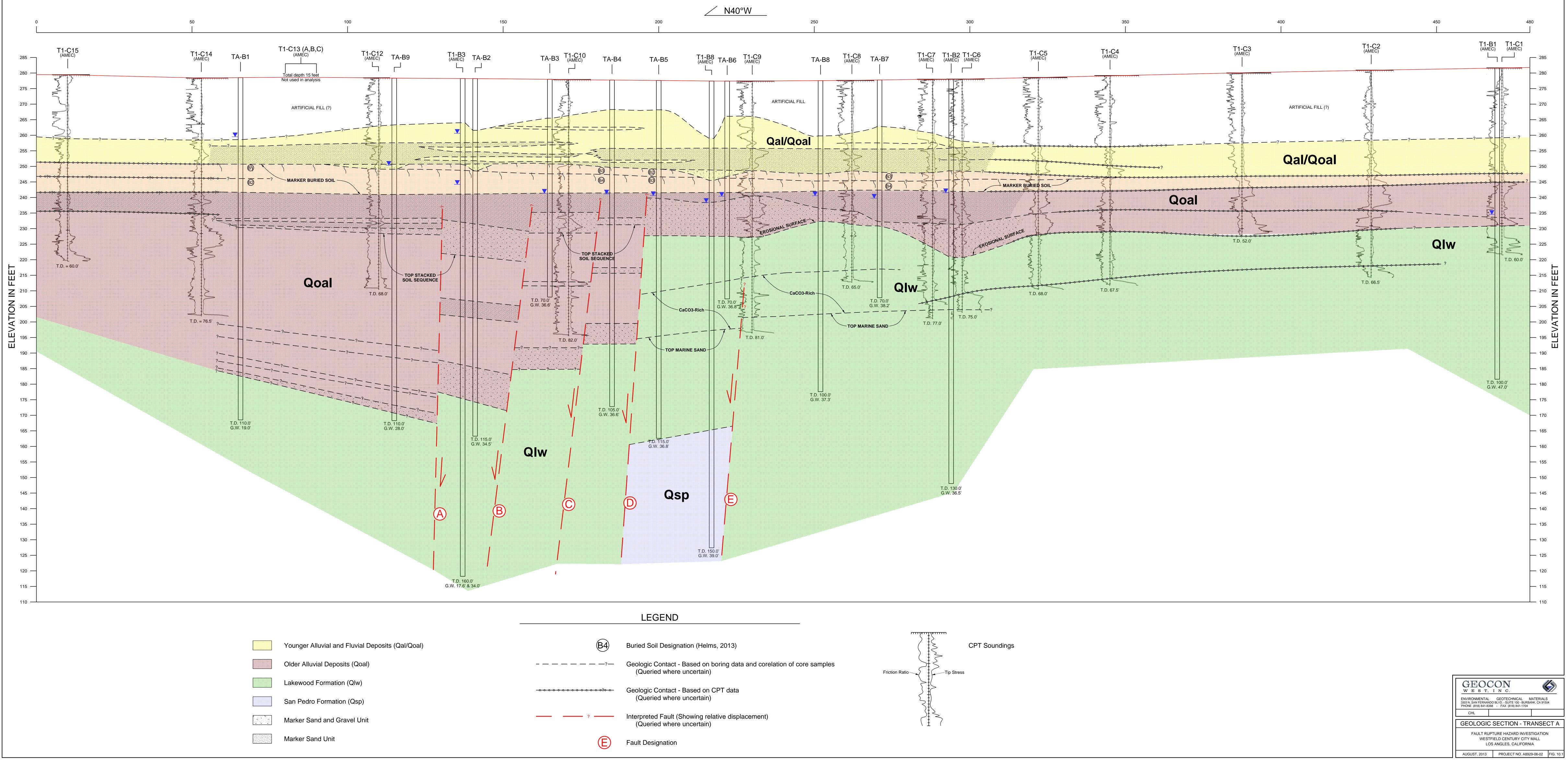




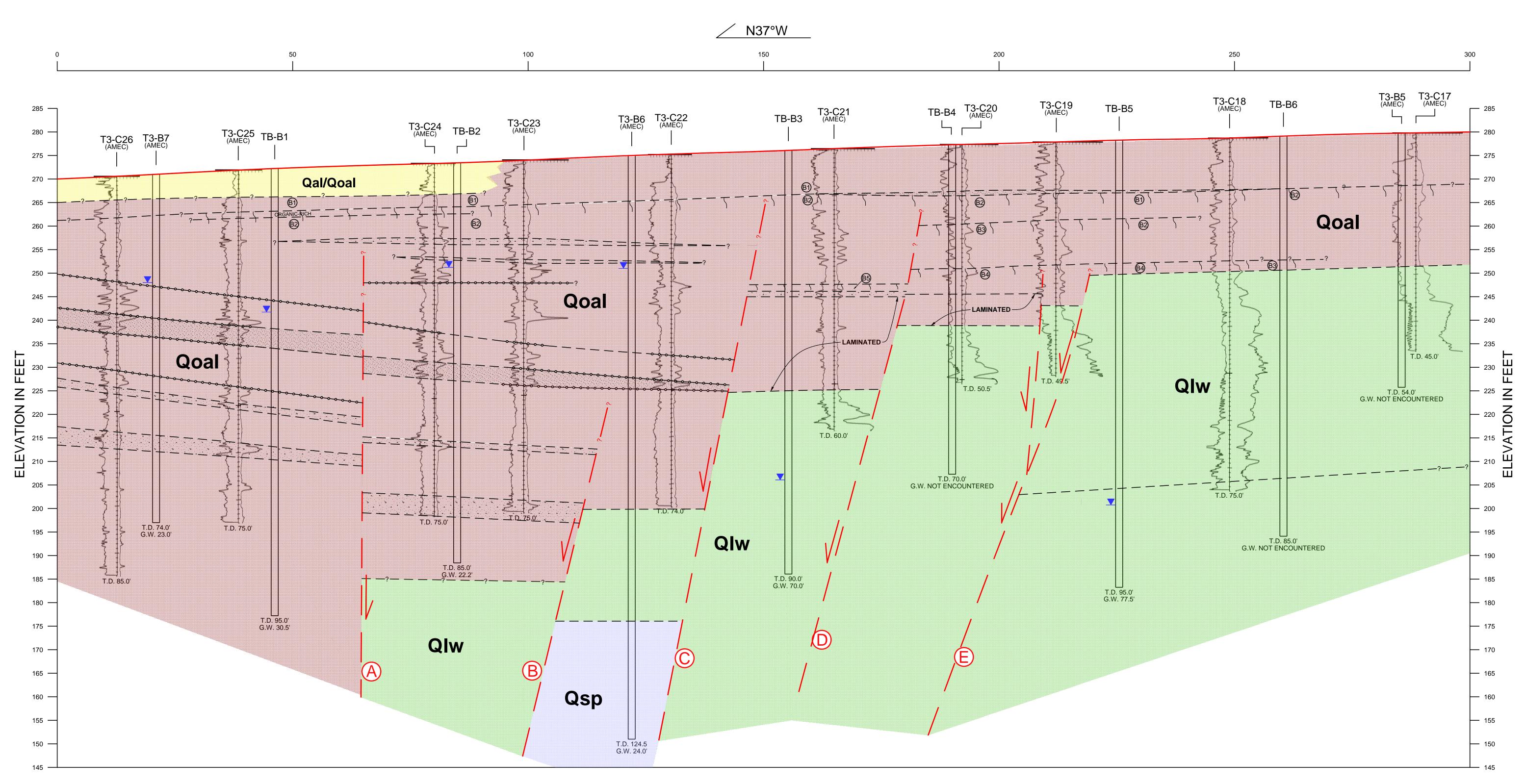








| | | LEGEND |
|--------------|--|---|
| s (Qal/Qoal) | B4 | Buried Soil Designation (Helms, 2013) |
| | ? | Geologic Contact - Based on boring data and corelation of co (Queried where uncertain) |
| | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | Geologic Contact - Based on CPT data (Queried where uncertain) |
| | ? | Interpreted Fault (Showing relative displacement) (Queried where uncertain) |
| | E | Fault Designation |
| | | |



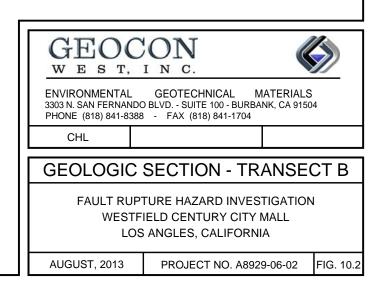
Younger Alluvial and Fluvial Deposits (Qal/Qoal)

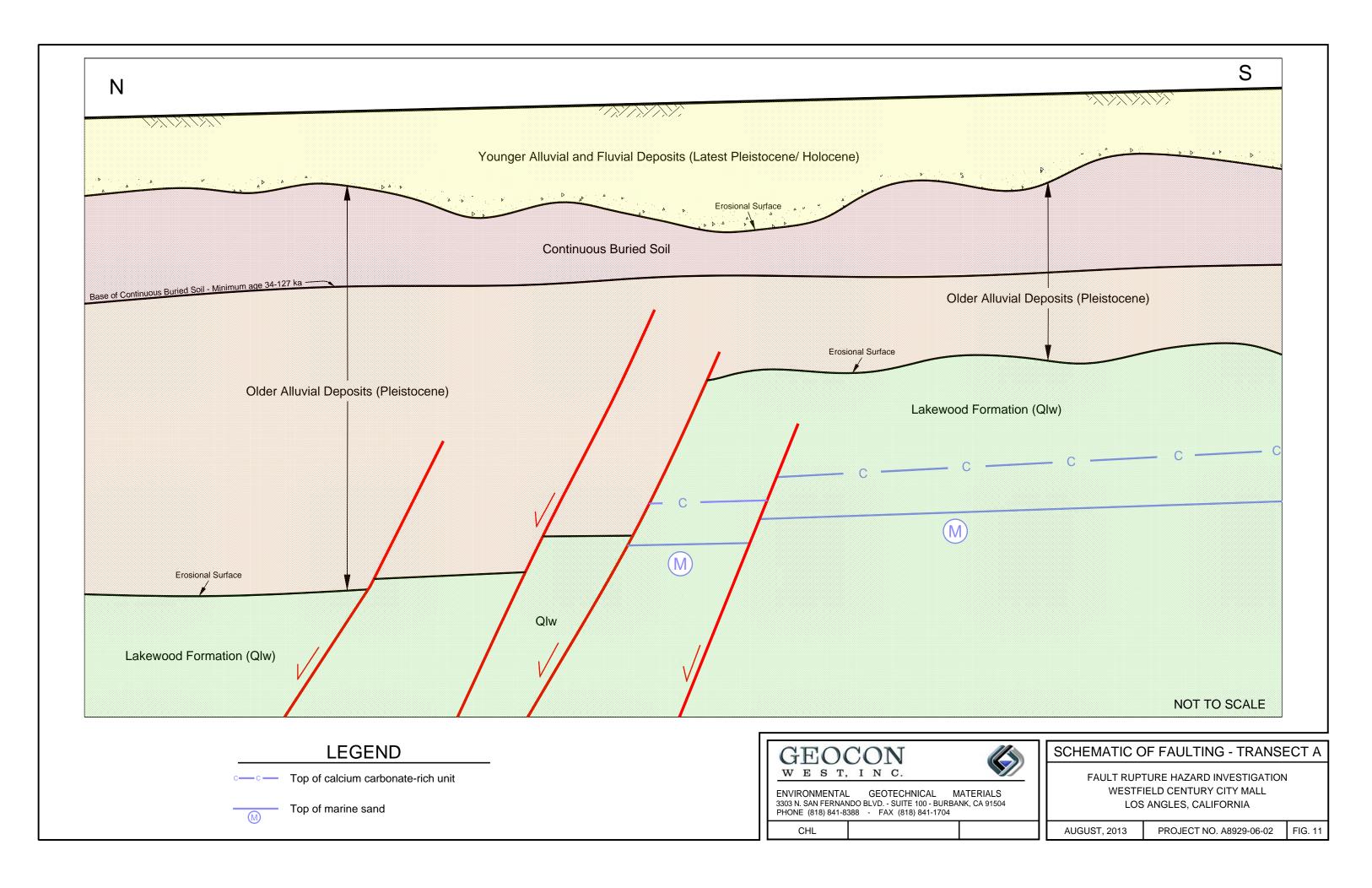
- Older Alluvial Deposits (Qoal)
- Lakewood Formation (Qlw)
- San Pedro Formation (Qsp)
- Marker Sand and Gravel Unit
- Marker Sand Unit

LEGEND

| B4 | Buried Soil Designation (Helms, 2013) | |
|---------------------------------|--|----------------|
| ? | Geologic Contact - Based on boring data and corelation of core samples (Queried where uncertain) | Friction Ratio |
| ~~~~~~~~~~~~~~~~~~~~ | Geologic Contact - Based on CPT data (Queried where uncertain) | |
| ? | Interpreted Fault (Showing relative displacement) (Queried where uncertain) | |
| E | Fault Designation | |

CPT Soundings





APPENDIX A

LOGS OF BORINGS

BORING TA-B1



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 | | Hand Augered to 5 feet Artificial Fill (af) |
| 1 | 1 | 84 | 5 6 7 8 9 - | | Sandy Clay - some layers of of sand, fine-grained, some medium to coarse-grained, minor fine gravel, moist. 8.4 '- 10' - No Recovery |
| 2 | 2 | 68 | 10 11 12 13 14 15 | | 12.6' - mottled olive brown and yellow brown, trace concrete and plastic fragments 13.4' - 15' - No Recovery 15' - large cobble in shoe |
| 2 | 3 | 18 | 15 16 17 18 19 20 | | 15.9' - 20' - No Recovery Younger Alluvial and Fluvial Deposits (Qal/Qoal) Sandy Clay - very dark gray (10YR 3/1), some layers of sand, fine-grained, |
| | | | | CL | some medium to coarse-grained, minor fine gravel, some disseminated organics, moist. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|----------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 20 21 22 | CL SP | Same as previous Sand, dark grayish brown (10YR 4/2), fine-grained, trace medium- to coarse-grained, trace gravel, moist. |
| 3 | 4 | 57 | 23 24 | SW | Sand with Gravel, dark grayish brown (10YR 4/2), fine- to coarse-grained, gravel fine to medium (to 2"), some coarse gravel, increasing in size with depth, moist. 23.1' - 25' - No Recovery |
| | | | 25 26 27 | SP SP | Sand, brown (10YR 4/3), fine-grained, some medium-grained, friable, wet. 25.3' - Abundant fine gravel (to 3/4") Sand, dark yellowish brown (10YR 3/6), fine-grained, trace silt and gravel (to 1- 1/2 "), wet. |
| 3 | 5 | 96 | 27 28 29 30 | | Marker Buried Soil (27.7' - 36.8') Sandy Silt, brown (10YR 4/3), fine-grained, some clay, trace fine gravel (to 1/8"), plastic, massive, wet. 29.8' - 30.0' - No Recovery |
| 4 | 6 | 90 | 31 32 33 34 35 | | Sandy Clay to Sandy Silt, brown (10YR 4/3), fine-grained, massive, wet. 31.5' - some faint oxide mottling Clay, dark grayish brown (10YR 4/2) to dark gray (10YR 4/1), trace sand, fine-grained, wet. 34.5' - 35.0' - No Recovery |
| 4 | 7 | 100 | - 35 - 36 37 - 38 39 - 40 | | Sandy Silt, dark grayish brown (10YR 4/2) to brown (10YR 4/3), fine-grained, trace manganese stringers, faint iron oxide banding. Clay, gray (10YR 5/1), some sand, fine-grained, massive, some weakly developed iron oxide laminations, some manganese staining, wet. Older Alluvial Deposits (Qoal) Sand, yellowish brown (10YR 5/4) to dark gray (10YR 4/1), some clay, fine- to medium-grained, friable, massive. |
| | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth USCS | |
|-----|-------|-------|---|--|
| Box | Run # | % Rec | (feet) Class. | Description |
| 5 | 8 | 95 | 40 SP - 41 42 43 SC - 44 - | Sand, dark gray (10YR 4/1), fine- to medium-grained, friable, uncemented, wet. Clayey Sand, gray (10YR 5/1), fine-grained with trace medium- to coarse-grained, trace fine-gravel, moist to wet. |
| 5 | 9 | 92 | 45 - SW 46 - SC 47 48 SW - 48 - 50 | 44.8' - 45' - No Recovery Sand with Gravel, gray (10YR 5/1), well graded, gravel (to 1/2"), moist to wet. Clayey Sand, yellowish brown (10YR 5/4), fine-grained, minor gravel (to 2"), faintly laminated, wet. Sand with Gravel, yellowish brown (10YR 5/4), gravel (to 2"), moist to wet. Clayey Sand, yellowish brown (10YR 5/4), fine-grained, iron oxide staining, massive, wet. 49.6' - 50' - No Recovery 50' - increase in sand content to 50.9' |
| 6 | 10 | 100 | - CL - CL - 52 53 54 - | Silty Clay, brown (10YR 4/3), some sand, fine-grained, weakly developed fine laminations, faint anaerobic and iron oxide banding, some manganese nodules. 52.5' - grades to dark yellowish brown (10YR 3/4), calcium carbonate nodules (20%), trace manganese nodules I Sand with Silt, yellowish brown (10YR 5/4), fine-grained, massive, wet. |
| 6 | 11 | 100 | 56 CL - 57 58 59 - 60 | Clay, yellowish brown (10YR 5/4), trace to some sand, fine-grained, trace manganese nodules. 58.5' - grades to Clay with Sand, yellowish brown (10YR 5/4), fine-grained, trace fine gravel (to 1/4" in size), trace calcium carbonate and manganese nodules, faint anaerobic banding, iron oxide mottling. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | | USCS | |
|-----|-------|-------|--|--------|---|
| Box | Run # | % Rec | | Class. | Description |
| 7 | 12 | 100 | 60 - 61 62 - 63 - 64 - 65 | CL | Same as previous |
| 7 | 13 | 100 | - 66 - 67 - 68 - 69 - | | Clay with Gravel, brown (10YR 4/3), trace to some sand, fine- to medium-grained, trace gravel (to 1/2" in size), massive to crudely laminated, moist. 69.3' - minor disseminated organics |
| 8 | 14 | 100 | 70 - 71 72 73 74 75 | | Clay, brown (10YR 4/3), minor fine gravel, trace to some fine-grained sand, faint anaerobic banding. 72.2' - grades to yellowish brown (10YR 5/4) 72.5' - trace manganese |
| 8 | 15 | 14 | - 76 - 77 78 78 - 79 - 80 | | Sand with Gravel, brown (10YR 4/3), fine- to coarse-grained, gravel (to 3/4"), well graded, wet. 75.7' - 80' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------|----------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 9 | 16 | 100 | 80 81 82 | CL | Clay, dark grayish brown (10YR 4/2), trace to some fine-grained sand, trace calcium carbonate, distinct manganese staining, anaerobic and oxidation banding, massive. |
| | | | 83 - 84 | SM CL | Silty Sand, dark yellowish brown (10YR 4/6), fine- to medium-grained, distinct manganese staining, anaerobic and oxidation banding, faint laminations, wet. Clay, gray (10YR 5/1) to very dark grayish brown (10YR 3/2), some calcium carbonate |
| | | | 85 | CL | deposits (10-15%), iron oxide staining, faint anaerobic banding. |
| | | | - 86 - | ML/SP | Layered Silt and Sand, moist, dark yellowish brown (10YR 4/6), fine-grained, some manganese nodules, laminated, iron oxide banding. |
| 9 | 17 | 98 | 87 - 88 | | |
| | | | 89 - 90 | | 89.9' - 90' - No Recovery Sand, poorly graded, dark yellowish brown (10YR 4/4), fine- to medium-grained, trace |
| | | | 90 - 91 | SP | gravel (to 1/2" in size), massive, well oxidized at base, moist. 91.9' - trace silt |
| 10 | 18 | 100 | 92 - 93 | ML | Silt, very dark grayish brown (10YR 3/2), trace to some calcium carbonate deposits, slightly some faint iron oxide banding. |
| | | | - 94 | | |
| | | | 95 - | | Silty Sand, gray (10YR 5/1), fine-grained, trace shell fragments, trace calcium carbonate deposits, slightly laminated, wet. |
| | | | 96 - 97 | | Lakewood Formation (Qlw) Clay with Sand, fine-grained, trace calcium carbonate deposits, alternating iron oxide and anaerobic banding, moist. |
| 10 | 19 | 100 | - 98 - | | 97.4' - Sandy Clay, yellowish brown (10YR 5/4), fine-grained, some calcium carbonate deposits (30%), iron oxide and anaerobic banding (inclined approximately 10° from horizontal), moist. |
| | | | 99 - 100 | | |
| | | | - | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 100 | | Same as previous |
| | | | - | | |
| | | | 101 | | Silt with Sand, yellowish brown (10YR 5/6) and brown (10YR 4/3), fine-grained, trace |
| | | | - | | manganese nodules. |
| | | | 102 | | |
| 11 | 20 | 100 | - | | |
| | | | 103 | | |
| | | | - | | 103.7' - increase in sand content |
| | | | 104 | | |
| | | | - | | 104.3' - with clay, increase in manganese nodules. |
| | | | 105 | | |
| | | | - | | |
| | | | 106 | CL | Clay, grayish brown (10YR 5/2), slightly laminated, some manganese |
| | | | - | | banding (horizontal), trace calcium carbonate, moist. |
| | | | 107 | | |
| 11 | 21 | 100 | - | | 107.9' - trace to some sand, no manganese |
| | | | 108 | | |
| | | | - | | |
| | | | 109 | | |
| | | | - | | |
| | | | 110 | | |
| | | | - | | Total depth of boring: 110 feet. |
| | | | 111 | | Artificial Fill to 20.2 feet. |
| | | | - | | Groundwater encountered during drilling at 19 feet. |
| | | | 112 | | Backfilled with bentonite grout. |
| | | | - | | Concrete patched. |
| | | | 113 | | |
| | | | 114 | | |
| | | | 114 | | |
| | | | - 115 | | |
| | | | | | |
| | | | 116 | | |
| | | | - | | |
| | | | 117 | | |
| | | | - | | |
| | | | 118 | | |
| | | | - | | |
| | | | 119 | | |
| | | | - | | |
| | | | 120 | | |
| | | | - | | |

BORING TA-B2



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet Artificial Fill (af) |
| 1 | 1 | 100 | | | Interlayered Clay, Silt and Sand with fine gravel, moist. |
| 1 | 2 | 100 | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | | |
| 2 | 3 | 90 | | ML | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Silt with Sand, dark gray (10YR 4/1) to dark yellowish brown (10YR 4/4); fine-grained, moist. 17.8' - increase in sand, fine- to medium-grained, trace fine slate gravel 18.2' - some fine slate gravel Silty Sand, fine grained, trace fine slate gravel, moist. |
| | | | 20 | | 18.6' - grades to Sand, fine-grained, moist |
| | | | - | | 20.1' - grades to Silty Sand and Sand, fine-grained, trace to some slate gravel (to 2") |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

Excavation Date: August 27, 2012 Drilling Company: Martini Drilling Excavation Method: H.S.A. - Continuous Core Boring Diameter: 8 inches Surface Elevation: Geologist: GAK/CHL

| Box | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|-----|-------|---------|-----------------|----------------|--|
| | Run # | 70 1000 | 20 | SP SP | 20.3' - grades to Sand with gravel, fine-grained, moist. |
| | | | 21 | ML | Silt with Sand, yellowish brown (10YR 5/4), fine-grained, trace slate gravel (to 1"), moist. |
| 2 | 4 | 82 | 22 | | 22.7' - increase in sand content |
| | | | - | | |
| | | | 24 | SP | Sand with Gravel, dark gray (10YR 4/1) to yellowish brown (10YR 4/4), fine- to |
| | | | - 25 | | medium-grained, trace silt and slate gravel (to 1"), moist. Increasing gravel with depth. 24' - 25' - No Recovery |
| | | | 26 | SP-SM | Sand with Silt, yellowish brown (10YR 5/4), fine-grained, increasing gravel with depth (to 1"). |
| 3 | 5 | 24 | 27 - 28 | | 26.3' - 30' - No Recovery |
| | | | 20 29 | | |
| | | | - 30 | | Marker Buried Soil (30.0' - 37.0') |
| 2 | | 100 | - 31 | ML | Sandy Silt with Clay, dark brown (10YR 3/3), fine-grained, moist. 30.8' - increase in clay content |
| 3 | 6 | 100 | 32 | | 32.2' - trace fine slate gravel32.8' - grades to Sandy Silt, fine-grained, moist. |
| 3 | 7 | 100 | 33 - 34 | | |
| | | 100 | 35 | ML | 34.4' - fine gravel layer (1" thick) Sandy Silt, dark brown (10YR 3/3), fine-grained, minor clay, wet. |
| | | | - 36 | | 35.0' - increase in clay content 36.7' - grades to sandy silt, weakly laminated |
| | | | 37 | | Older Alluvial Deposits (Qoal) |
| 4 | 8 | 100 | 38 - 39 | SC/SP | Sand with Clay, olive brown (2.5Y 4/3) to dark yellowish brown (10YR 4/6), trace fine-grained sand, trace gravel, weak sub-horizontal laminations. 38' - increase in sand content |
| | | | - | | 39.9' - grades to Sand, fine-grained, laminated. |
| | | | 40 | SC/SM | Alternating Clayey Sand and Silty Sand beds, laminated. |

Figure A-2b



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 4 | 9 | 54 | 40 41 42 43 44 44 45 | | Same as previous 42.7' - 45' - No Recovery |
| 5 | 10 | 90 | 46 47 48 49 | | Silt to Silty Sand, brown (10YR 4/3) to dark yellowish brown (10YR 4/6), with slate and siltstone gravel (to 2"), fine-grained, wet. 49.5' - 50' - No Recovery |
| 5 | 11 | 100 | 50 51 52 53 54 55 | | |
| 6 | 12 | 100 | 56 57 58 59 60 | ML/SM | Sand, dark grayish brown (2.5Y 4/2), with slate gravel (to 2"), fine- to coarse-grained. Silt to Silty Sand, dark yellowish brown (10YR 4/6) and gray (2.5Y 5/1), fine-grained, trace to some clay, laminations (inclined 5° from horizontal), moist. 50.5' - increase sand content |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Box 6 | Run # 13 | <u>% Rec</u> | (feet) 60 61 62 63 63 64 64 | CL | Description Same as previous Sandy Clay, dark yellowish brown (10YR 4/4), fine- to medium-grained, trace fine gravel. 63.5' - becomes weakly laminated (inclined 5° to 10° from horizontal) |
|-------|-------------|--------------|--|-------|---|
| | 13 | 100 | 61 62 63 64 | CL | Sandy Clay, dark yellowish brown (10YR 4/4), fine- to medium-grained, trace fine gravel. |
| 7 | | | 65 | SM/ML | Silty Sand to Silt with Sand, yellowish brown (10YR 5/4) to dark yellowish brown |
| | 14 | 100 | - 66 - 67 - 68 - 69 - | | (10YR 3/4), massive, manganese and oxidation mottling. Clay with sand, yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2), minor slate gravel (to 2"), fine-grained, laminated, moist. |
| 7 | 15 | 100 | 70 71 72 73 74 75 | | Silty Sand with Gravel, light gray (10YR 7/1) to dark gray (10YR 4/1), trace to some clay, gravel composed of slate and siltstone clasts, subangular (to 2"), moist. |
| 8 | 16 | 100 | - 76 77 78 78 79 80 | SP | Silt, dark yellowish brown (10YR 4/4), some sand, trace gravel (to 1"), fine-grained, moist. Sand, light gray (10YR 7/1), fine- to medium-grained, trace gravel (to 1"), weakly laminated, moist. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|----------|--------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | <u> </u> | 80 | | Same as previous |
| | | | 81 82 | CL | Clay, brown (10YR 4/3), trace to with sand, fine-grained, subhorizontal to horizontal laminations, moist. |
| 8 | 17 | 100 | - 83 - | | |
| | | | 84 - 85 | | |
| | | | - 86 - | | |
| 9 | 18 | 100 | 87 - 88 | | |
| | | | - 89 - 90 | | |
| | | | 90 91 | | |
| 9 | 19 | 100 | 92 - 93 | | |
| | | 100 | - 94 - | SW | Sand with Gravel, dark gray (10YR 3/1) and dark yellowish brown (10YR 4/6), fine- to |
| | | | 95 - 96 | | medium-grained, some coarse, trace silt, gravel mostly slate (to 1"), subrounded, trace manganese nodules, moist. Becomes coarse-grained with depth. |
| | | | - 97 - | | 97.2' - 100' - No Recovery |
| 10 | 20 | 44 | 98 - 99 | | |
| | | | - 100 - | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth USCS | |
|-----|-------|-------|---|---|
| Box | Run # | % Rec | (feet) Class. | Description |
| 10 | 21 | 26 | 100 - 101 - 102 - 103 - 104 - 105 | Same as previous 101.5' - 105' - No Recovery Lakewood Formation (Qlw) |
| | | | | Silt to Silty Sand, light yellow brown (10YR 6/4 - 2.5Y 6/4), fine-grained, some fine gravel, |
| 11 | 22 | 100 | 106 - 107 - | weak oxidation mottling, moist. |
| 11 | 23 | 100 | 108 - 109 - | 108' - 108.9' - weak subhorizontal banding of mangenese minerals 108.9' - yellowish brown (10YR 5/4), with mangenese nodules and minor carbonate nodules, massive. |
| 9 | 24 | 100 | 110 - 111 - 112 - 113 - 114 - 115 | |
| | | | - 116 - 117 - 118 - 119 120 - | Total Depth of Boring 115 feet Artificial Fill to 16.6 feet Groundwater encountered during drilling at 34.5 feet Backfilled with bentonite grout Concrete patched |

BORING TA-B3



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | $\begin{array}{c} (1 < c) \\ 0 \\ - \\ - \\ 1 \\ - \\ 2 \\ - \\ 2 \\ - \\ 3 \\ - \\ 3 \\ - \\ 3 \\ - \\ 4 \\ - \\ 5 \\ - \\ 6 \\ - \\ 7 \\ - \\ 8 \\ - \\ 8 \\ - \\ \end{array}$ | | Hand Augered to 5 feet 5' - 10' - No Recovery |
| 1 | 1 | 100 | 9 9 10 11 12 13 14 15 | CL | Artificial Fill (af) Clay and Sandy Clay, fine-grained, some asphalt, moist. 11.5' - grades to Sandy Silt Younger Alluvial and Fluvial Deposits (Qal/Qoal) Clay, dark yellowish brown (10YR 3/4), trace fine gravel, moist. |
| 1 | 2 | 86 | 15 16 17 18 19 20 | ML/CL | Sand, dark brown (10YR 3/3), fine- to medium-grained, minor gravel, trace clay, moist. Sandy Silt with gravel, dark brown (10YR 3/3), fine-grained, minor clay, moist. 16.6' - grades to Clay, dark brown (10YR 3/3), trace sand, fine-grained, moist. 18.7' - minor Clay, minor Sand, fine- to coarse-grained 19.1' - Clay and Sand, light yellowish brown (2.5Y 6/4), fine- to medium-grained, trace gravel, 19.25' - 20.0' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | D " | 0/ D | Depth | USCS | Description |
|----------|-------|-------|--------|---------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 21 | SP | Sand, light yellowish brown (2.5Y 6/4), fine- to medium-grained, trace fine gravel. |
| | | | - 22 | ML | Silt to Silt with Sand, dark yellowish brown (10YR 4/4) trace clay, fine-grained, moist. |
| 2 | 3 | 84 | - | | 22.6' - 24.2' - grades to Silty Sand |
| | | | 23 | | |
| | | | 24 | | 24.2' - 25' - No Recovery |
| | | | 25 | | |
| | | | - | | 25' - grades to Clayey Sand, fine-grained, trace fine gravel. |
| | | | 26 | | 25.5' - grades to Silty Sand, fine-grained. |
| | | | 27 | SP | Sand, yellowish brown (10YR 5/4), fine-grained. |
| 2 | 4 | 82 | - | | Marker Buried Soil (27.0' - 36.5') |
| | | | 28 | ML | Sandy Silt with Clay, dark brown (10YR 3/3), trace fine gravel, moist. |
| | | | 29 | | 29.1' - 30' - No Recovery |
| | | | 30 | | |
| | | | 31 | SM/ML | Silty Sand, dark brown (10YR 3/3), trace clay, fine-grained, moist. |
| | | | 32 | | |
| 3 | 5 | 96 | - | | |
| | | | 33 | | |
| | | | 34 | | 33.75' - clay content increases, fine-grained, trace gravel (to 1/2"), moist. |
| | | | 35 | | 34.8' - 35' - No Recovery |
| | | | - 36 | | 36.0' - grades to Sandy Silt |
| | | | - 37 | | |
| | | | - | ~ ~ ~ - | Older Alluvial Deposits (Qoal) |
| 3 | 6 | 100 | 38 | SP-SM | Sand with Silt to Silty Sand, olive brown (2.5Y 4/3), trace slate gravel (to 1/2"), fine grained, iron oxide-stained laminations, subhorizontal, moist. |
| | | | 39 | | |
| | | | 40 | | |
| | | | - | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars

Century City, California

| Box | | | | USCS | |
|-----|-------|-------|---------------|--------|---|
| DOA | Run # | % Rec | (feet) | Class. | Description |
| 4 | 7 | 66 | 40 | | 40' - 41.7' - No Recovery Silty Sand to Sand with Silt, dark grayish brown (2.5Y 4/2) and light olive brown (2.5Y 5/6), trace slate gravel (to 1/2"), fine-grained, iron oxide-stained laminations, subhorizontal, moist. |
| | | | 44 45 | SW | Sand with Gravel, dark yellowish brown (10YR 4/6), fine- to coarse-grained, gravel to 1". |
| 4 | 8 | 24 | 46 - 47 | | 45.6' - 47.5' - No Recovery 47.4' - 47.9' - lens of Silt with Sand and Gravel |
| 4 | 9 | 100 | 48 | · ML | Silt, dark yellowish brown (10YR 4/6), trace sand and clay, fine-grained, clay increases with depth, faint anaerobic and iron oxide mottling near base. |
| 5 | 10 | 100 | 50 | | Silt, yellowish brown (10YR 5/6), trace to some clay, faint anaerobic and iron oxide mottling. Silt, dark yellowish brown (10YR 4/6), trace to some clay, trace carbonate nodules, manganese and anaerobic mottling. |
| 5 | 11 | 100 | 56 | ML | 58' - trace fine gravel Silt, yellowish brown (10YR 5/6), trace gravel. 60.0' - Minor gravel (to 2") |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|-------------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 6 | 12 | 100 | 60 61 62 63 64 64 | | Increase in Gravel content below 62' |
| 6 | 13 | 100 | 65 66 67 68 68 69 70 | ML ML/SM | Silty Sand, light olive brown (2.5Y 5/6), fine-grained, with gravel (to 2"). Silt with Sand, dark yellowish brown (10YR 4/4), trace to minor clay, trace gravel, weak oxidation banding, crude laminations. Silt to Silty Sand, fine- to medium-grained. 69.2' - becomes dark brown (10YR 3/3) |
| | | | 71 72 73 74 75 76 | | Total Depth Drilled 70 feet Artificial Fill to 12.3 feet Groundwater encountered during drilling at 36.6 feet Backfilled with bentonite grout Completed with concrete patch |
| | | | 77 - 78 79 80 | | |

BORING TA-B4



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| Box Run # % Rec (feet) Class. Description 0 - Hand Augered to 5 feet - 1 - | 1 |
|--|-----------|
| | |
| | |
| 5 Artificial Fill (af) 1 1 100 - - 1 1 100 - 8 - 9 - - 8.0' - increase in sand content 8.0' - increase in sand content | |
| 1 2 87 10 Younger Alluvial and Fluvial Deposits (Qal/Qoal) 1 - ML Silt, very dark grayish brown (10YR 3/2), trace to minor sand clay, minor slate gravel (to 1/2"), fine-grained, slightly laminated, some organics. 1 2 87 - - 1 2 87 - - 13 - - 14 - - 15 14.4' - 15' - No Recovery | |
| 2 3 65 15 SP Sand, grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/4), fine- to medium with gravel (to 2"). 2 3 65 - SM Silty Sand, brown (10YR 5/3), trace fine gravel (1/4"), fine-grained. 17 - IN SILty Sand, brown (10YR 5/3), trace fine gravel (1/4"), fine-grained. 18 - 17.6' - increase in gravel content 19 18.25' - 20.0' - No Recovery - 20 | 1-grained |
| | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | - | | Depth | USCS | |
|-----|-------|-------|----------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description Same as previous |
| 2 | 4 | 58 | 20 21 22 | SP/SM | Sand to Silty Sand, grayish brown (10YR 5/2) to brown (10YR 5/3), trace to minor gravel to (1/2"). |
| | | | 23 - 24 25 | | 22.9' - 25.0' - No Recovery |
| 3 | 5 | 88 | 26 27 | SM | 25.2' - Gravel content increases Silty Sand, grayish brown (2.5Y 5/2), fine- to medium-grained. Gravel below 26.6'. 27.2' - 27.5' - No Recovery |
| 3 | 6 | 100 | 28 - 29 - 30 | SM/ML | Marker Buried Soil (28.0' - 36.2') Silty Sand to Sandy Silt, dark brown (10YR 3/3) to brown (10YR 4/3), trace to some fine gravel to (1/4"), trace to minor clay, fine-grained, moist. 29.6' - increase in gravel |
| 3 | 7 | 100 | 31 32 33 34 35 | SM/ML | Silty Sand to Sandy Silt, dark brown (10YR 3/3), trace clay and organics. |
| 4 | 8 | 92 | 36 37 38 20 | SP-SM | Older Alluvial Deposits (Qoal) Sand with Silt, dark yellowish brown (10YR 4/4), laminated (subhorizontal to inclined 5° from horizontal). |
| | | | 39 - 40 | | 38.8' - increase in clay content 39.6' - 40.0' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 4 | 9 | 84 | 40 - 41 - 42 - 43 - 44 - 45 | | Sand with Silt, dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4), laminated, subhorizontal to approximtely 5° inclination from horizontal. 44.3' - trace to minor clay, trace gravel, some manganese staining. |
| 5 | 10 | 100 | 43 46 47 47 48 48 50 | SM | Sand and Gravel, brown (7.5YR 5/4), coarse-grained. Silty Sand, yellowish brown (10YR 5/6), trace clay. Silty Sand, dark yellowish brown (10YR 4/4), trace to minor clay, fine-grained. |
| 5 | 11 | 100 | 50 | ML | Silt with Sand, yellowish brown (10YR 5/4), fine-grained, minor clay, trace gravel. |
| 6 | 12 | 100 | - 56 57 58 58 59 60 | | 58' - 59' - increase in gravel content |



Project No.: A8929-06-02

Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|-------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 6 | 13 | 100 | 60 61 62 63 64 | SP-SM ML | Sand with Silt and Gravel, yellowish brown (10YR 5/4), fine- to medium-grained, gravel to 1". Silt, brown (10YR 5/3), trace to some clay, trace sand, fine-grained, moist, laminated. |
| 7 | 14 | 100 | 65 66 67 68 68 69 70 | | Silty Sand, brown (10YR 5/3), minor gravel (to 1/2"), moist. Silt to Silty Sand, grayish brown (10YR 5/2), fine-grained. Sandy Clay, fine-grained, laminated to varve-like, iron oxide mottling, friable. |
| 7 | 15 | 100 | 70 | ML/SM | Silt and Silty Sand, brown (7.5YR 5/4), some clay, fine-grained, laminated, iron oxide mottling. 74.2' - strong iron oxide staining, some mangenese nodules |
| 8 | 16 | 100 | - 76 77 78 79 80 | SP | Sand, dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4), some clay, trace fine gravel, fine-grained, laminated to crudely bedded, friable. |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 8 | 17 | 84 | 80 81 82 83 83 84 85 | | 80.0' - 80.8' - No Recovery Same as previous |
| 9 | 18 | 90 | 86 86 87 88 88 89 90 | CL | 85.0' - 85.5' - No Recovery Lakewood Formation (Qlw) Clay, yellowish brown (10YR 6/8) to light olive brown (2.5Y 5/4), laminated, subhorizontal to approximtely 10° inclination from horizontal, strong manganese staining. Silty Sand, trace clay, mangenese and anaerobic mottling. |
| 9 | 19 | 100 | 91 92 93 | ML/SM | Silt, some sand, very fine-grained, trace clay. Silt with Sand to Silty Sand, yellowish brown (10YR 5/4 - 5/6), very fine-grained, trace clay and gravel (to 1/4"), very weak iron oxide banding and weak mangenese staining. |
| 10 | 20 | 76 | - 96 97 98 98 99 100 | | Interlayered Clay and Silt, yellowish brown (10YR 5/4 - 5/6), laminated. 98.8' - 100.0' - No Recovery |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| Box | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|-----|--------|--------|-----------------|----------------|---|
| DOX | Kull # | 70 KCC | 100 | Class. | Description |
| | | | - 101 - | CL | Clay, grayish brown (10YR 5/2), strong oxidation mottling. |
| 10 | 21 | 100 | 102 - 103 | | |
| | | | - 104 - | | |
| | | | 105 | | |
| | | | - 106 - | | Total Depth Drilled 105 feet Artificial Fill to 9.5 feet |
| | | | 107 | | Groundwater encountered during drilling at 36.6 feet Backfilled with bentonite grout |
| | | | 108 - 109 | | Completed with concrete patch |
| | | | - 110 | | |
| | | | 111 | | |
| | | | 112 - 113 | | |
| | | | - 114 | | |
| | | | 115 | | |
| | | | 116 - | | |
| | | | 117 - 118 | | |
| | | | - 119 | | |
| | | | - 120 - | | |

BORING TA-B5



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet Artificial Fill (af) Silty Sand to Sandy Silt, some slate gravel (to 2"), moist. |
| 1 | 1 | 100 | 6 - 7 8 - 9 - | | Younger Alluvial and Fluvial Deposits (Qal/Qoal) |
| 1 | 2 | 28 | 10 11 12 13 14 15 | SM | Silty Sand, with layers of Silt and Clay, dark brown (7.5YR 3/4), fine-grained, some fine gravel (to 1/4"), some organics, moist. 11.4' - 20.0' - No Recovery |
| 2 | 3 | 0 | 16 16 17 | | |
| 2 | 4 | 0 | 18 - 19 - 20 | | |
| | | | - | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 2 | 5 | 100 | 20 21 22 | SM | Silty Sand, dark brown (10YR 3/3) and yellowish brown (10YR 5/4), weak oxidation. 21.8' - Silty Sand to Sand with gravel (to 1"), yellowish brown (10YR 5/4), fine-grained, friable, weak oxidation, moist. |
| 2 | 6 | 66 | 23 | | 23.5' - grades to Gravel with Sand, dark grayish brown (2.5Y 4/2), gravel (to 1"), trace silt. 24.2' - 25.0' - No Recovery |
| 3 | 7 | 68 | 25 26 27 | | 25.6' - grades to Sand, trace gravel 26.3' - 28.3'- Gravel with Sand, friable 26.7' - 27.5' - No Recovery |
| 3 | 8 | 84 | 28 29 30 | SM/ML | Marker Buried Soil (28.3' - 36.1') Silty Sand to Silt with Sand, yellowish brown (10YR 5/4), very fine-grained, trace gravel (to 1/4") and organics. 29.6' - 30' - No Recovery |
| 3 | 9 | 100 | 31 32 33 33 34 35 | | Silt with Sand, brown (7.5YR 4/4), fine-grained, trace gravel (to 1/4"). Silt with Sand to Silty Sand, brown (7.5YR 4/4), some clay, medium-grained, trace fine gravel. |
| 4 | 10 | 78 | 36 | SW/SM | Older Alluvial Deposits (Qoal) Alternating beds of Sand with Gravel and Silty Sand, brown (10YR 4/3), fine- to medium-grained, some manganese staining. 38.9' - 40' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

Excavation Date: August 24, 2012 Drilling Company: Martini Drilling Excavation Method: H.S.A. - Continuous Core Boring Diameter: 8 inches **Surface Elevation:** Geologist: GAK/CHL

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 4 | 11 | 20 | 40 41 42 43 43 44 44 45 | SM | 41.0' - 45.0' - No Recovery 45.0' - 46.2'- Silty Sand, very dark grayish brown (10YR 3/2), trace clay and gravel (to 2"), |
| 5 | 12 | 24 | 43 46 47 48 49 50 | | 40.2 - Shry Sand, very dark grayish brown (10 1 K 5/2), nace eray and graver (to 2), fine-grained, moist. 46.2' - 50.0'- No Recovery |
| 5 | 13 | 100 | 50 | SM/ML | Lakewood Formation (Qlw) Silty Sand, brown (10YR 4/3) and dark yellowish brown (10YR 4/6), fine-grained, trace gravel (to (to 1/2"), predominantly slate, some diatomaceous siltstone clasts. 54.2' - distinct iron oxide banding approximately 1 to 2" spacing, inclined 10° to 20° from 55.0' - 55.4' - Shear: 1/2" thick clay gouge, inclined approximately 47° from horizontal |
| 6 | 14 | 100 | 56 57 58 59 60 | | 56' - Silty Sand to Silt with Sand, yellowish brown (10YR 5/4), trace to some clay, faint iron oxide banding below 56'; disseminated manganese nodules, distinct manganese-rich layers, subhorizontal. 59.0' - increase in sand, distinct subhorizontal bedding |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|-------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 6 | 15 | 100 | 60 61 62 63 64 65 | | 60.1' - 62.1' - Sandy Silt 62.1' - grades to Silt with Sand, fine-grained 64.2' - moderate to strong anaerobic mottling, decrease in mangenese content |
| 7 | 16 | 100 | | CL | Clay, very dark grayish brown (10YR 3/2), massive, disseminated calciumm carbonate nodules (20%). 68.2' - 75.8' - disseminated calcium carbonate nodules (50% - 80%) |
| 7 | 17 | 100 | 71 72 73 74 | | |
| 8 | 18 | 100 | 75 76 77 78 79 80 | ML/SP ML | Alternating beds of Silt and Sand, brownish yellow (10YR 6/8) to gray (5Y 6/1), fine-grained, beds approximately 1/8-inch thick, subhorizontal, moist. 76.1' - Shear: clay gouge 1/4- to 1/2-inch thick, inclined approximstely 27° from horizontal Silt with Sand lenses, brownish yellow (10YR 6/8), fine-grained, moist. Strong iron oxide and mangenese staining. 79.2' - Shear: clay gouge 1/4-inch thick, inclined approximately 57° from horizontal |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | | ISCS | |
|-----|-------|-------|---|---------------|--|
| Box | Run # | % Rec | | lass. | Description |
| 8 | 19 | 100 | 80 - 81 - 82 - 83 - 84 - 85 | SP S | Same as previous Sand, light gray (7/N) to olive gray (5Y 5/2), some clay, trace silt, moist. Upper 7 to 8 inches permeated with secondary clay. (Marine Sand) |
| 9 | 20 | 100 | 83 86 87 88 88 89 90 | 5 | 85' - grades to Sand, gray (6/N), fine-grained, clean, massive, friable, moist. |
| 9 | 21 | 20 | - | P/ML 1 | 90.5' - grades to Gravel and Sand, gravel rounded to subrounded (to 2") . Interbedded Sand and Silt, light reddish brown (5YR 6/4) and yellowish brown (10YR 5/6), fine-grained, 1/4" thick beds to finely laminated. Gravel zone at base, exotic clasts of volcanics and Monterey Formation (to 2"). 91.1' - 95.0'- No Recovery |
| 10 | 22 | 54 | | | Sand, gray (5/N), trace to no silt, fine-grained, moist. 97.7' - 100.0'- No Recovery |



Project No.: A8929-06-02 Client: Westfield

Location: Avenue of the Stars Century City, California

| | D " | 0/ D | Dept | | |
|-----|------------|-------------|---------------------------------|---|---|
| Box | Run # | % Rec | (feet 100 | | Description Silty Sand, gray (5/N), trace clay, fine-grained, laminated, moist. |
| 10 | 23 | 42 | 100 101 102 103 104 | SM/SP - - - - - - - - - - | 100.3' - 102.1'- Sand, massive, moist 102.1' - 105'- No Recovery |
| 11 | 24 | 86 | 105 106 107 | - | 105.0' - 107.2'- Sand, dark bluish gray (5PB 3/1), fine-grained, laminated, wet 107.2' - 107.5 - No Recovery |
| 11 | 25 | 66 | 108 109 | - SM - SM | Silty Sand, dark bluish gray (5PB 3/1), fine-grained, laminated, wet. 109.2' - 110.0' - No Recovery |
| | | | 110 111 | - | Sand with Gravel, dark bluish gray (5PB 4/1), fine- to coarse-grained, wet. |
| 12 | 26 | 62 | 112 113 | | 112.9' - grades to Sand, gray (5Y 5/1), fine-grained, wet. |
| | | | 114 115 | - - | 113.1' - 115.0'- No Recovery |
| | | | 116 117 118 119 120 | | Total Depth Drilled 115 feet Artificial Fill to 9.5 feet Groundwater encountered during drilling at 36.8 feet Backfilled with bentonite grout Completed with concrete patch |

BORING TA-B6



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 - 1 | | Hand Augered to 5 feet |
| | | | 2 | | |
| | | | 3 | | |
| | | | 4 - 5 | | |
| | | | - 6 - | | 5' - 10' - No Recovery |
| | | | 7 - 8 | | |
| | | | - 9 - | | Artificial Fill (af) |
| | | | 10 - 11 | | Sandy Clay and Silty Sand. Asphalt fragments (to 2") |
| 1 | 1 | 100 | | CL/ML | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Clay with Sand to Silt with Sand, very dark brown (10YR 2/2), fine-grained, trace to minor gravel (to 1/2"), trace clay, moist. |
| Ĩ | 1 | 100 | 13 - 14 | | |
| | | | 14 - 15 | | |
| | | | 16 - | SM | Silty Sand, brown (10YR 5/3), fine-grained, trace fine gravel (to 1/2"), moist. |
| 1 | 2 | 100 | 17 - 18 | | |
| | | | - 19 - | | 18.8' - increase in gravel (to 1")Gravel predominantly slate, subrounded.19.3' - no gravel |
| | | | 20 | CL | Sandy Clay, brown (10YR 5/3), fine-grained, moist. |



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Project No.: A8929-06-02

Т

Client: Westfield

Location: Avenue of the Stars

Century City, California

| T | Box | Dup # | % Rec | Depth (feet) | USCS | Description |
|----|-----|-------|-------|-----------------|--------|--|
| | 50X | Run # | % Rec | (feet) | Class. | Sandy Silt, trace gravel, fine- to medium-grained, moist. |
| | | | | 20 - | | 20.1' - Sand with Silt, fine- to medium-grained, moist |
| | | | | 21 | | 20.5' - Silty Sand, trace clay, fine-grained, moist |
| | | | | - | | 21.4' - Silt, plastic |
| | | | | 22 | | 21.6' - Sandy Silt, trace fine slate gravel (to 1/2") |
| | 2 | 3 | 92 | - | | 21.9' - decrease in sand content |
| | | | | 23 | SM/GP | Silty Sand, grayish brown (10YR 5/2), trace clay, fine-grained, moist. |
| | | | | - | | 23.5' - 24.4' - Gravel with Sand, grayish brown (10YR 5/2), fine- to medium-grained, trace coarse- |
| | | | | 24 | | grained, moist. Gravel to 1 -1/2" - Scour zone |
| _ | | | | 25 | | 24.4' - 25.0'- No Recovery |
| | | | | - | SW | Sand with Gravel, gravish brown (10YR 5/2), fine- to coarse-grained, gravel to 1-1/2', moist, |
| | | | | 26 | | gravel predominantly slate, some exotics, |
| | | | | - | | 26.0' - 30.0' - No Recovery |
| | 2 | 4 | 20 | 27 | | |
| | 2 | 4 | 20 | - 28 | | |
| | | | | - 20 | | |
| | | | | 29 | | |
| | | | | - | | |
| | | | | 30 | | Manhan Bania J Cail (20.5) - 25.51 |
| | | | | 31 | SM | Marker Buried Soil (30.5' - 35.5') Silty Sand, brown (10YR 4/3), fine-grained, trace medium- and coarse-grained, moist. |
| | | | | 51 | 5111 | Sinty Sand, brown (101 K 4/5), nine-grained, trace medium- and coarse-grained, moist. |
| | | | | - | | |
| | 3 | 5 | 100 | 32 | MI /SM | Sandy Silt to Silty Sand, brown (7.5YR 4/4) to dark yellowish brown (10YR 4/3), fine-grained, |
| | 3 | 5 | 100 | 33 | | trace gravel (most to 1", few to 2"). |
| | | | | | | |
| | | | | 34 | | |
| | | | | - | | |
| ┣— | | | | 35 | | |
| | | | | - | | |
| | | | | 36 | | Older Alluvial Deposits (Qoal) |
| | | | | - | SP/SM | Alternating beds of Silty Sand and Sand with Gravel, dark yellowish brown (10YR 4/4), |
| | | | | 37 | | trace clay, fine- to medium-grained, massive to crudely laminated, moist, gravel 1" to 2". |
| | 3 | 6 | 96 | - 20 | | Increases in send content helpsy 26.2 |
| | 3 | 0 | 90 | 38 | | Increase in sand content below 36.3' |
| | | | | 39 | | |
| | | | | - | | |
| | | | | 40 | | |
| | | | | - | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Box | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|-----|--------|-------|-----------------|----------------|--|
| DUX | Kull # | % Rec | 40 | Class. | Description |
| | | | - 41 | | 40.0' - 41' - No Recovery |
| | _ | | - 42 | SW | Sand with Gravel, very dark grayish brown (10YR 3/2), fine- to coarse-grained, gravel to 2-1/2", wet. |
| 4 | 7 | 58 | 43 | | 43.9' - 45.0' - No Recovery |
| | | | 44 - | | |
| | | | 45 - | SP | Sand, dark grayish brown (10YR 4/2), fine-grained; grain size becomes coarser with depth. |
| 4 | 8 | 76 | 46 | | 46.7' - Gravel layer 46.9' - 47.5' - No Recovery |
| | | | 47 - 48 | | 40.7 - 47.5 - 110 Recovery |
| 4 | 9 | 60 | - 49 - | SW | Sand with Gravel, fine- to coarse-grained, gravel composed of slate and granitics (to 1/2"). 49.0' - 50.0' - No Recovery |
| | | | 50 | | |
| | | | - 51 | SM | Lakewood Formation (Qlw) Silty Sand, dark yellowish brown (10YR 4/6) and light yellowish brown (2.5Y 6/4), fine-grained, |
| | | | 52 | | trace gravel (to 1/2"), iron oxide staining in weak banded pattern, inclined 10° to 15° from horizontal. 51.0' - 52.3'- subhorizontal mangenese layers; anaerobic staining on layers inclined 10° to 15° |
| 5 | 10 | 100 | 53 | | from horizontal. |
| | | | 54 | | 52.3' - 53.4' - mangenese-stained beds, inclined approximately 10° from horizontal. 53.4' - 55.3' - anaerobic-stained beds, average inclination 10° (variable from 5 to 15 degrees |
| | | | 55 | | from horizontal), layers approximately 1/4" thick. |
| | | | - 56 | SM | Silty Sand, dark yellowish brown (10YR 4/6) and light yellowish brown (2.5Y 6/4), disseminated manganese nodules, massive. |
| | | | - 57 | | |
| 5 | 11 | 100 | - 58 - | | |
| | | | 59 | | |
| | | | - 60 | SM | Silty Sand with Clay, light yellowish brown (2.5Y 6/4), yellow (10YR 7/6) and very dark grayish brown (10YR 3/2), fine-grained, disseminated mangenese nodules, massive. |
| ļ | | | - | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars

Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 6 | 12 | 100 | 60 61 62 63 64 65 | CL | 60.0' - grades to light olive brown (2.5Y 5/3), yellow (10YR 7/6), very dark grayish brown (10YR 3/2). Clay, white (8/N), and very dark grayish brown (2.5Y 3/2), disseminated calcium carbonate nodules (10%). 64.0' - 68.3'- disseminated calcium carbonate (50-90%) |
| 6 | 13 | 100 | | | 68.3' - 70.0' - disseminated calcium carbonate (10-20%) |
| | | | 70 71 72 73 73 74 75 76 77 78 79 80 | | Total Depth Drilled 70 feet Artificial Fill to 11.2 feet Groundwater measured at 36.6 feet 16 hours after completion of drilling Backfilled with bentonite grout Completed with concrete patch |

BORING TA-B7



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 - 1 | | Hand Augered to 5 feet |
| | | | 2 | | |
| | | | - 4 - | | |
| | | | 5 - 6 - | | 5' - 10' - No Recovery |
| | | | 7 - 8 - | | |
| | | | 9 - 10 | | Artificial Fill (af) |
| 1 | 1 | 92 | 11 - 12 | | Sandy Clay and Sandy Silt, dark grayish brown (10YR 4/2), some concrete fragments, few asphalt fragments. |
| 1 | 2 | 40 | - 13 - 14 | | 12.3' - 14.0'- No Recovery |
| | | | - 15 - | | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Sandy Clay, brown (10YR 4/3), trace to some slate gravel (to 1/2'), disseminated organics, |
| 1 | 3 | 100 | 16 - 17 | | moist. 17' - grades to Sand with Silt and Gravel |
| | 5 | 100 | 18 - 19 | | Sand with Silt to Silty Sand, yellowish brown (10YR 5/4 and 10YR 3/3), fine-grained, some clay, trace to with gravel (to 1/2"), friable, moist. |
| | | | 20 | | Grades coarser and gravel content increases with depth |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 2 | 4 | 80 | 20 21 22 23 24 25 | ML | Same as previous Sand, yellowish brown (10YR 5/4), fine- to medium grained, with gravel (to 1"), moist. Sand with Silt, yellowish brown (10YR 5/4), fine- to medium-grained, trace to with gravel (to 1/2"). Abundant gravel at base. Silt with Sand, yellowish brown (10YR 5/4), fine-grained, friable, weak oxidation. 23.6' - grades to Sand with Silt, fine-grained, trace medium- to coarse-grained, trace fine gravel. 24' - 25' - No Recovery |
| 2 | 5 | 81 | 23 26 27 28 29 30 | | 26.0' - 28.2' - Sand, yellowish brown (10YR 5/4), fine- to medium grained, with gravel (to 1"). 28.2' - 29.1' - Sand with Silt, yellowish brown (10YR 5/4), fine-grained, trace to with gravel (to 1/2"), moist. Grades coarser and gravel content increases with depth. 29.1' - 30' - No Recovery |
| 3 | 6 | 100 | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | ML | Marker Buried Soil (30.0' - 35.5') Silt with Sand, yellowish brown (10YR 5/4), fine-grained, some clay, trace organics, some oxidation, friable, moist. Clayey Sand to Clay with Sand, brown (7.5YR 4/3), fine-grained, locally friable, oxidized. |
| 3 | 7 | 92 | 33 | | Older Alluvial Deposits (Qoal) Sand with Silt, yellowish brown (10YR 5/4), fine-grained, trace clay, moist, thinly bedded (1/4-inch thick) to laminated, beds inclined 5° to 10° from horizontal, iron oxide staining. 39.6' - 40.0' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| _ | | | Depth | USCS | |
|-----|-------|-------|---------------------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 4 | 8 | 97 | 40 41 42 43 44 | | Same as previous Sandy Silt to Silty Sand, brown (10YR 5/3), trace to with gravel, fine-grained, moist. 43.7' - increase in sand content |
| 4 | 9 | 97 | 45 46 47 48 48 50 | SW | 44.8' - 45.0' - No Recovery 45.0' - grades to very dark gray (10YR 3/1) Sand with Gravel, brown (10YR 4/3), fine to coarse, gravel (1/16 to 1½"), friable, loose. Lakewood Formation (Qlw) Silt, dark yellowish brown (10YR 4/6) and light yellowish brown (2.5Y 6/4), trace sand, fine-grained, trace gravel (to 1/2"), anaerobic and iron oxide staining in weak banded pattern, inclined approximately 10° from horizontal. 48.3' - 50.4' - Silty Sand, massive to weakly bedded, faint anaerobic staining along beds. 49.9' - 50.0' - No Recovery |
| 5 | 10 | 100 | 51 52 53 54 55 | | 50.4' - 51.7' - Sand, fine-grained 51.7' - 56.1' - Silty Sand to Silt, weakly bedded |
| 5 | 11 | 100 | - 56 57 58 58 59 60 | ML/CL | 56.1' - 58.3' - increase in clay content Silt and Clay, white (8/N) and very dark grayish brown (2.5Y 3/2), disseminated calcium carbonate (10%). |



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Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

Excavation Date: August 28, 2012 Drilling Company: Martini Drilling Excavation Method: H.S.A. - Continuous Core Boring Diameter: 8 inches Surface Elevation: Geologist: GAK/CHL

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| Dor | Dun # | % Rec | Depth (feat) | USCS Class | Description |
|-----|-------|--------|--|---------------|--|
| Box | Run # | 70 Kec | (feet) | Class. | Same as previous |
| 6 | 12 | 100 | 60 61 62 63 64 65 | | 61' - 67.2' - disseminated calcium carbonate (60-90%) |
| 6 | 13 | 100 | 60 66 67 68 68 69 70 | | Clay, dark grayish brown (10 YR 4/2) and light greenish-gray (10Y 8/1), trace to some disseminated organics, strong iron oxide staining. |
| | | | - 71 | | Total Depth Drilled 70 feet Artificial Fill to 14.8 feet |
| | | | 72 - 73 | | Groundwater encountered during drilling at 38.2 feet Backfilled with bentonite grout Completed with concrete patch |
| | | | 73 - 74 | | |
| | | | - 75 | | |
| | | | 76 | | |
| | | | 77 - 78 | | |
| | | | - 79 | | |
| | | | - 80 - | | |

BORING TA-B8



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|----------------------------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet |
| 1 | 1 | 100 | 6 6 7 8 9 10 | - 6 7 8 9 - | Artificial Fill (af) andy Clay and Clay with Sand, fine-grained some silt, some fine gravel, moist. |
| 1 | 2 | 20 | 10 11 12 13 14 15 | | 11.0' - 15.0' - No Recovery 15.0' - Clay with Sand, medium-grained, some concrete fragments |
| 2 | 3 | 78 | | ML | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Silt with Sand, brown (10YR 4/3), trace gravel (to 1/2'), fine- to coarse-grained, moist. 18.9' - 22.5' - No Recovery |
| | | | 20 | | |
| | | | - | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| D | D " | 04 D | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description Same as previous |
| 2 | 4 | 36 | 20 | SM | Silty Sand with Gravel, brown (10 YR 5/3) and dark gray (10YR 4/1), fine- to medium- grained, gravel (to 1/2"), moist. 23.9' - 25.0' - trace gravel |
| 3 | 5 | 40 | 25 26 27 28 29 30 | | 25.6' - 26.2' - Silty Sand, trace gravel 26.2' - 26.7' - Gravel and Sand, fine-grained 27.0' - 30.0' - No Recovery |
| 3 | 6 | 80 | 31 32 | ML/SM | Marker Buried Soil (29.8' - 35.8') Silty Sand to Sandy Silt, brown (10YR 4/4), trace to some slate gravel (to 1/2"), trace clay, slightly oxidized, friable, moist. 32.0' - 32.5' - No Recovery |
| 3 | 7 | 100 | 33 - 34 35 | CL/SC | Clay with Sand to Sandy Clay, very dark brown (10YR 2/2), fine- to medium-grained, moist. |
| 4 | 8 | 100 | 36 37 38 39 40 | | Older Alluvial Deposits (Qoal) Interbedded Silt with Sand and Sand, dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/8), fine-grained, trace fine gravel, thinly bedded (1/4-inch) to laminated, beds inclined 5° to 10° from horizontal, iron oxide staining, moist. |
| | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| _ | | | Depth | USCS | |
|-----|-------|-------|--|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 4 | 9 | 100 | - 41 | SM/SP | Same as previous Sand and Silty Sand with Gravel, very dark brown (10YR 3/2) to dark yellowish brown (10YR 3/4), minor gravel, fine-grained. 43.6' - 45.4' - yellowish brown (10YR 5/4) and strong brown (7.5YR 4/6), minor to abundant gravel (to 1½"), iron oxide staining. |
| 5 | 10 | 100 | 43 46 47 48 48 49 50 | SM | Lakewood Formation (Qlw) Silty Sand, light greenish gray (N 7/1) and strong brown (7.5YR 4/6), fine-grained, trace gravel (to 1/4"), anaerobic and iron oxide staining in mottled to weak banded pattern. 50.0' - 51.8' - weak mangenese laminations, subhorizontal |
| 5 | 11 | 100 | 50 51 52 53 54 55 | | 51.8' - 55.6' - faint anaerobic and iron oxide staining conmcentrated in beds, inclined 10° to 15° from horizontal, disseminated mangenese nodules. |
| 6 | 12 | 100 | - 56 57 58 59 60 | | 55.6' - 57.4' - faint anaerobic and iron oxide staining along bedding 57.4' - 61.2' - increase in clay content, no mangenese nodules, brownish yellow (10YR 6/6), some dark bluish gray mottling (5PB 4/1). |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| - | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 6 | 13 | 100 | 60 61 62 63 64 65 | | Same as previous Clay, white (8/N) and dark grayish brown (10YR 4/2), disseminated calcium carbonate nodules (10%), some disseminated mangenese. 62.0' - 68.0' - disseminated calcium carbonate (60-90%) |
| 7 | 14 | 100 | | | 68.0' - 72.3' - mottled dark gray (10YR 4/1), light greenish gray (10Y 8/1) and yellowish brown (10YR 5/8), iron oxide and mangenese staining, disseminated calcium carbonate (5-10%). |
| 7 | 15 | 64 | 70 71 72 73 74 75 | SP-SM | Below 70.3' - No carbonate Sand with Silt to Silty Sand, greenish gray (10Y 5/1) to gray (6/N), fine- to medium-grained, moist. 73.2' - 75.0' - No Recovery |
| 8 | 16 | 93 | 76 77 78 79 80 | SP | Sand, gray (6/N), clean, fine-grained, moist. (Marine Sand) 77.8' - Color change to light olive brown (2.5Y 5/3) 78.0' - 80.0' - No Recovery |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| Por | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|-----|--------|-------|----------------------|----------------|--|
| Box | Kull # | % Rec | (leet) | Class. | Description |
| 8 | 17 | 38 | 81 82 83 84 | | 81.4' - 82.0' - grades to Sand with Silt, light olive brown (2.5Y 5/4), very fine-grained, moist. 81.9' - 85.0' - No Recovery |
| | | | - | | |
| | | | 85 - 86 - | | 85.0' - Faint anaerobic staining in layers and mottling pattern. 86.3' - 86.7' - color change to light gray (7/N) |
| 9 | 18 | 34 | 87 - 88 - | | 86.7' - 85.0' - No Recovery |
| | | | 89 - 90 | | 90.0' - 95.5' - grades to Sand, gray (6/N), trace silt, fine-grained. |
| | | | 91 - 92 | | yoro yoro grades to band, gray (011), trace sin, nile granica. |
| 9 | 19 | 1 | 93 - 94 | | |
| | | | 95 - | | |
| | | | 96 - 97 - | | 95.5' - 100.0' - No Recovery |
| 10 | 20 | 1 | 98 - 99 - | | |
| | | | 100 | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 100 | | |
| | | | - 101 | | Total Depth Drilled 100 feet Boring terminated due to heaving sand and poor recovery |
| | | | 101 | | Artificial Fill to 17.6 feet |
| | | | 102 | | Groundwater encountered during drilling at 37.3 feet |
| | | | 102 - | | Backfilled with bentonite grout |
| | | | 103 | | Completed with concrete patch |
| | | | - | | |
| | | | 104 | | |
| | | | - | | |
| | | | 105 | | |
| | | | - | | |
| | | | 106 | | |
| | | | - 107 | | |
| | | | 10/ | | |
| | | | 108 | | |
| | | | - | | |
| | | | 109 | | |
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| | | | 110 | | |
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| | | | 111 | | |
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| | | | - | | |
| | | | 116 | | |
| | | | - | | |
| | | | 117 | | |
| | | | 118 | | |
| | | | | | |
| | | | 119 | | |
| | | | - | | |
| | | | 120 | | |
| | | | - | | |

BORING TA-B9



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Box | Run # | % Rec | (feet) | Class. | Description |
|-----|-------|-------|----------------------------------|--------|---|
| | | | Δ | | |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet |
| 1 | 1 | 89 | 5 6 7 8 9 10 | | Artificial Fill (af) Silty Sand and Sandy Clay, some concrete fragments, moist. 9.5' - 10' - No Recovery |
| 2 | 2 | 100 | 11 12 13 14 | | |
| 2 | 3 | 62 | 15 16 17 18 19 20 | | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Sandy Clay, very dark gray (10YR 3/1), fine-grained, some medium- to coarse-grained, trace fine gravel, trace disseminated organics, massive. 18.1' - 20' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | | | | | | | | | | |
|-----|-------|-------|----------------------|---------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|------------------|--|---|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | | | | | | | | | | |
| 3 | 4 | 74 | 20 21 22 23 | • SM • SP • ML/SM • CL | Silty Sand, brown (10YR 4/3), fine-grained, trace gravel, massive. Sand and Gravel, brown (10YR 4/3) fine-grained, some medium- to coarse-grained, gravel (to 1 ³ / ₄ "), massive. Sandy Silt to Silty Sand, brown (10YR 4/3), fine-grained. Sandy Clay, dark yellowish brown (10YR 4/4), fine-grained, moist. | | | | | | | | | | | | | | |
| | | | 24 - 25 | | 23.7' -25' - No Recovery | | | | | | | | | | | | | | |
| 2 | 3 5 | 100 | 26 27 | SM/ML | Silty Sand and Sandy Silt, dark yellowish brown (10YR 4/4), predominantly fine-grained with some medium and coarse, minor to abundant gravel (to 3/4"). | | | | | | | | | | | | | | |
| 2 | | 100 | 28 29 30 | | Marker Buried Soil (29.2' - 37.2') | | | | | | | | | | | | | | |
| | 6 | | 30 | ML CL | Sandy Silt, dark yellowish brown (10YR 3/4), fine-grained, some clay, trace gravel (to 1/4"). Sandy Clay, dark yellowish brown (10YR 3/4), fine-grained, trace gravel (to 1/8"), faint iron | | | | | | | | | | | | | | |
| 4 | | 85 | 33 34 35 | | oxide mottling. 34.2' - 35' - No Recovery | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | 35 - 36 37 | | 35.4' - 36.8' - laminated with trace manganese nodules36.8' - increase in gravel content |
| 4 | 7 | 94 | 38 | CL/SC | grained, massive to weakly laminated. | | | | | | | | | | | | | | |
| | | | 39 - 40 | SP | Sand, dark yellowish brown (10YR 4/4), some silt, fine-grained, trace fine gravel, iron oxide mottling. 39.7' - 40' - No Recovery | | | | | | | | | | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|-----------------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 5 | 8 | 75 | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | ML | Same as previous Silt, dark yellowish brown (10YR 3/4) and gray (10YR 5/1), widely spaced laminations. 43' - grades to silty sand 43.8' - 45' - No Recovery |
| 5 | 9 | 78 | 45 - 46 - 47 - 48 - 48 - 49 - 50 - | - ML | Sand, yellowish brown (10YR 5/6), fine- to medium-grained, friable, no cementation. Silt with Sand, yellowish brown (10YR 5/4), very fine-grained, weak laminations, oxidized. Sand, gray (10YR 5/1), fine- to medium-grained 48.0' - grades to Sand and Gravel, fine- to coarse-grained, fine to coarse gravel 48.9' - 50' - No Recovery |
| 6 | 10 | 98 | 51 - 52 - 53 - 54 - 55 - | - - - - - | Clay, brown (10YR 4/3), slightly laminated, trace manganese nodules, faint anaerobic and iron oxide banding. 54.9' - 55' - No Recovery |
| 6 | 11 | 99 | 56 - 57 - 58 - 59 - 60 - | - - | Sandy Clay to Clayey Sand, dark yellowish brown (10YR 4/4), fine-grained, trace fine gravel (to 1/2"), slightly laminated. 59.9' - 60' - No Recovery |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|-------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 7 | 12 | 98 | 60 61 62 63 64 - | | Same as previous Sand to Clayey Sand, dark yellowish brown (10YR 4/6), predominantly fine-grained, some medium- to coarse-grained, trace to abundant gravel. |
| 7 | 13 | 38 | 65 66 67 68 68 69 70 | SW | 64.9' - 65' - No Recovery 65.6' - increase in gravel content 66.9' - 67' - No Recovery Sand and Gravel, dark yellowish brown (10YR 4/6), trace to some silt, gravel predominantly slate (to 1½"). |
| 8 | 14 | 95 | 70 71 72 73 74 75 | SP SM/ML | Sand, dark yellowish brown (10YR 4/6), fine-grained, weakly laminated, loose, friable. 70.9' - trace to some clay, some manganese nodules. Sandy Silt to Silty Sand, dark yellowish brown (10YR 4/4), minor gravel (to 1/8"), weakly laminated. 74.7' - 75' - No Recovery |
| 8 | 15 | 100 | 76 77 78 79 80 | CL | Clay with Sand, dark brown (10YR 3/3), fine-grained, trace manganese nodules, massive to to slightly laminated, trace organics, oxidized. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California Excavation Date: May 10, 2013 Drilling Company: Martini Drilling Excavation Method: H.S.A. - Continuous Core Boring Diameter: 8 inches Surface Elevation: Geologist: GAK/CHL

CHL/SFK

| | | | Depth | USCS | | | | | |
|-----|-------|-------|---------|--------|--|-----|--|------------------------|--|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | |
| | | | 80 | | Same as previous | | | | |
| | | | - | | | | | | |
| | | | 81 | ML | Sandy Silt, dark yellowish brown (10YR 4/4), fine-grained. | | | | |
| | | | - | ~~~ | | | | | |
| 0 | 16 | 100 | 82 | CL | Sandy Clay, dark yellowish brown (10YR 4/4), minor gravel, massive. | | | | |
| 9 | 16 | 100 | 83 | | | | | | |
| | | | | | | | | | |
| | | | 84 | | | | | | |
| | | | - | | | | | | |
| | | | 85 | SW | Grades to well-graded sand with gravel (to 1"). | | | | |
| | | | - | | | | | | |
| | | | 86 | | | | | | |
| | | | - | CL | Clay, dark grayish brown (10YR 4/2), trace fine sand, trace to abundant gravel, distinct | | | | |
| | | | 87 | | manganese staining, anaerobic and oxidation banding, massive to crudely laminated. | | | | |
| 9 | 17 | 98 | - | | | | | | |
| | | | 88 | | | | | | |
| | | | - | | 88.7' - some calcium carbonate nodules | | | | |
| | | | | | | | | 89 | |
| | | | - 90 | CL | Clay with Sand, yellowish brown (10YR 5/4), fine-grained, abundant gravel, some manganese | | | | |
| | | | - | CL | nodules, slightly laminated. | | | | |
| | | | 91 | | notice, orginity minimized. | | | | |
| | | | - | | | | | | |
| | | | | | | 92 | | | |
| | | | - | SW | Sand and Gravel, dark yellowish brown (10YR 4/6), fine- to medium-grained, gravel (to 3/4"), | | | | |
| 10 | 18 | 100 | 93 | | laminated. | | | | |
| | | | - | | 93.5' - grades to sand, fine-grained | | | | |
| | | | | 94 | | | | | |
| | | | - | | | | | | |
| | | | 95 | | | | | | |
| | | | - | SP/CL | Alternating Sand and Clay beds, yellowish brown (10YR 5/4), some manganese nodules, | | | | |
| | | | 96 | | strong iron oxide mottling, thin laminations. | | | | |
| | | | - 97 | | | | | | |
| | 10 19 | | 9/ | | | | | | |
| 10 | | 98 | 98 | | | | | | |
| 10 | | 20 | - | | | | | | |
| | | | 99 | | | | | | |
| | | | - | SP | Sand, dark yellowish brown (10YR 4/4), some silt, fine-grained, massive to slightly laminated, | | | | |
| | | | | | | 100 | | well oxidized at base. | |
| | | | - | | 99.9' - 100' - No Recovery | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|-----------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 100 - 101 - 102 | | Same as previous Sandy Silt, dark yellowish brown (10YR 4/4), fine-grained, faint iron oxide banding. |
| 11 | 20 | 100 | - 103 - 104 - | CL | Clay to Sandy Clay, dark yellowish brown (10YR 3/4), fine-grained, trace medium- to coarse-grained, some manganese staining, trace calcium carbonate deposits. |
| | | | 105 - 106 - 107 | | Sand with Silt, dark yellowish brown (10YR 4/4), fine- to medium-grained, minor to abundant gravel (to 3/4"), friable, loose. |
| 11 | 21 | 50 | - 108 - 109 - | | 107.5' - 110' - No Recovery |
| | | | 110 - 111 - | | Total depth of boring: 110 feet. Artificial Fill to 15 feet. Groundwater encountered during drilling at 28 feet. |
| | | | 112 - 113 - | | Backfilled with bentonite grout. Concrete patched. |
| | | | 114 - 115 | | |
| | | | 116 - 117 | | |
| | | | 118 - 119 | | |
| | | | - 120 - | | |

BORING TB-B1



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---|----------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet Younger Alluvial and Fluvial Deposits (Qal/Qoal) Sandy Silt with clay, brown (10YR 4/3), fine- to coarse-grained, trace slate gravel, massive, |
| 1 | 1 | 100 | 5 6 7 8 9 10 | ML CL ML | Sandy Shit with Clay, brown (10 YR 4/5), fine- to coarse-grained, trace state gravel, massive, locally friable, weakly oxidized, moist. Older Alluvial Deposits (Qoal) Silt with Sand, dark yellowish brown (10YR 4/4), some clay, fine-grained, trace gravel, some disemminated organics, some oxidation and manganese staining, moist. Gradational lower contact. Clay with Sand, dark yellowish brown (10YR 4/6), fine-grained, trace gravel (to 1/4"), moist. Silt with Sand, dark yellowish brown (10YR 4/6), some clay, fine- to medium-grained, trace coarse, weakly laminated to massive, some organics, some oxidation, moist. |
| 2 | 2 | 100 | $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | SM | Silty Sand, dark yellowish brown (10YR 4/4), some clay, fine-grained, massive, well oxidized, few manganese nodules, trace fine gravel, moist. Gradational lower contact. |
| 2 | 3 | 96 | 13 - 16 - 17 - 18 - 19 - 20 | -CL | Sandy Silt with Clay, dark grayish brown (10YR 4/2),very fine-grained, weakly oxidized, massive to faint laminations, few manganese nodules, moist. Gradational lower contact. Clay with Sand, dark yellowish brown (10YR 4/4), fine-grained, laminated, well oxidized, few manganese nodules. 19.8' - 20' - No Recovery |
| | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|-----------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 3 | 4 | 96 | 20 21 22 23 24 24 | | Sandy Clay to Sandy Silt, gray (10YR 6/1), very fine- to fine-grained, moist, massive, some manganese. Trace gravel at top of unit increasing to abundant gravel at base, oxidation banding. 24.8' - 25' - No Recovery |
| 3 | 5 | 100 | 25 26 27 28 29 30 | SC SM | Clayey Sand, dark yellowish brown (10YR 4/6 - 3/6), fine-grained, moderate to well-oxidized, faintly laminated, moist. 27' - 28' - Trace calcium carbonate nodules Silty Sand, dark yellowish brown (10YR 4/6) and gray (10YR 6/1), fine-grained, trace medium and coarse grained, laminated (4 to 6-inches thick), well oxidized, moist. |
| 4 | 6 | 96 | 31 32 33 34 35 | SM/CL | grades to alternating silty sand and sandy clay below 30 feet. 34.8' - 35' - No Recovery |
| 4 | 7 | 89 | 36 36 37 38 39 40 | SP SP MIL | Sand, yellowish brown (10YR 5/6), fine- to medium-grained, trace to with silt, massive, friable, moist. Sand, yellowish brown (10YR 5/6), fine-grained, trace to some silt, faint to moderately developed laminations, moderate to well oxidized, friable, moist. Silt, yellowish brown (10YR 5/6), trace to some sand, very fine-grained, fine laminations to thinly bedded, distinct manganese-rich layers and oxidation staining, moist. 39.45' - 40' - No Recovery Alternating silty sand and clay beds to 40.2'. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Por | Dup # | % Rec | Depth (feet) | USCS | Description |
|-----|-------|-------|-----------------|--------|--|
| Box | Run # | % Rec | 40 | Class. | Description |
| | | | 41 42 | CL/ML | Predominantly Clay below 40.3', yellowish brown (10YR 5/6) |
| 5 | 8 | 84 | - 43 - | | 43.8' - 45.3' - grades to Sandy Silt |
| | | | 44 - 45 | | 44.2' - 45' - No Recovery |
| | | | - 46 | | 45.3' - 45.9' - Clay-rich with calcium carbonate nodules 46.6' - 47.6' - grades to Silty Sand with gravel (to 1/4-inch) |
| 5 | 9 | 68 | 47 48 | | TO.0 - TT.0 - grades to Sinty Sand with graver (to 1/4-men) |
| | | | 40 49 | | 48.4' - 50' - No Recovery |
| | | | 50 - 51 | SP | Sand, brown (10YR 4/3), medium-grained, trace silt, well oxidized, massive, moist. |
| 6 | 10 | 92 | 52 53 | CL | Clay with Sand, dark grayish brown (10YR 4/2), very fine-grained, trace to minor fine gravel |
| 6 | 10 | 83 | 53 - 54 | | (to 1/2"), laminated, well oxidized, trace to some disemminated manganese nodules, moist. |
| | | | - 55 - | | 54.1'-55' - No Recovery |
| | | | 56 - 57 | | |
| 6 | 6 11 | 92 | - 58 - | | |
| | | | 59 - 60 | SP/SW | Sand, dark brown (10YR 3/3), fine- to coarse-grained, variable silt content, trace fine gravel (to 1/2"), moist. |
| | | | - | | 59.6' - 60' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| _ | | | Depth | USCS | |
|-----|-------|-------|---|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 7 | 12 | 95 | 60 61 62 63 64 65 | CL | Clay, very dark gray (10YR 3/1), trace to some sand, fine-grained, organic-rich, massive, moist. lower gradational contact Clay with sand, dark grayish brown (10YR 4/2), trace to some silt, fine-grained, faint laminations to massive, moist. 64.8' - 65' - No Recovery |
| I | 15 | 100 | | CL | 65' - Abundant fine gravel Sandy Clay, dark yellowish brown (10YR 4/4) and dark grayish brown (10YR 4/2), fine- grained, weakly-developed laminations, some calcium carbonate nodules, moist. 70.5' - some manganese nodules |
| 8 | 14 | 100 | 70 71 72 73 74 75 | CL | Clay with sand, dark yellowish brown (10YR 4/4), minor silt, medium -to coarse-grained, some gravel, abundant calcium carbonate nodules, massive, moist. Gradational lower contact |
| 8 | 15 | 100 | 76 - 77 78 - 79 - 80 | CL | Clay, brown (10YR 4/3), trace to some sand, very fine-grained, weak oxidation, massive to faintly laminated, calcium carbonate nodules common, moist. Clay, dark yellowish brown (10YR 4/4), varying amounts of sand, very fine-grained, locally friable, massive, calcium carbonate nodules common, moist. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Box | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|-----|--------|-------|--|----------------|---|
| DUX | Kull # | % Kec | (leet) | Class. | Description |
| 9 | 16 | 100 | 81 81 82 83 84 84 85 | | Same as previous |
| 9 | 17 | 100 | 80 86 87 88 88 89 90 | | |
| 10 | 18 | 100 | | | Clayey Sand to Sandy Clay, brown (10YR 4/3), fine-grained, weakly oxidized, calcium carbonate nodules common, massive, moist. Clay, dark yellowish brown (10YR 4/4), some sand, fine-grained, well oxidized, abundant calcium carbonate nodules, massive, moist. |
| | | | 96 97 98 99 100 | | Total depth of boring: 95 feet Depth of Atificial Fill not determined Groundwater encountered during drilling at 30.5 feet. Backfilled with bentonite grout. Concrete patched. |

BORING TB-B2



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|-------------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet |
| 1 | 1 | 99 | 5 6 7 8 9 - | CL CL/SC | Younger Alluvial and Fluvial Deposits (Qal/Qoal) Sandy Clay, yellow brown, fine- to medium-grained, some fine gravel, moist. Older Alluvial Deposits (Qoal) Sandy Clay to Clayey Sand, dark yellowish brown (10YR 4/4), fine- to medium-grained, trace coarse, some fine gravel, massive, some organics, moist. Increasing sand with depth. |
| 2 | 2 | 100 | 10 11 12 13 14 15 | CL CL/SC | Sandy Clay, dark yellowish brown (10YR 4/4), very fine-grained, moist, manganese nodules concentrated in weak laminations, some organics, oxidized. 9.9' - 10' - No Recovery Clay with Sand, to Clayey Sand, dark yellowish brown (10YR 4/4), fine-grained, trace silt, fine gravel (to 1/2"), manganese and calcium carbonate nodules, well oxidized, moist. |
| 2 | 3 | 88 | 13 16 17 18 19 20 | CL | Sand, dark grayish brown (10YR 4/2), fine to coarse-grained, minor to abundant gravel, moist. Clay, dark yellowish brown (10YR 4/4), varying amounts of sand, fine-grained, faint laminations, well oxidized, moist. 19.4' - 20' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|------------|-------|-------|--------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 20 | | Sand with Silt, dark yellowish brown (10YR 4/4), fine- to medium-grained, with gravel (to 3/4"), |
| | | | - | | moist. |
| | | | 21 | CL | Sandy Clay, yellowish brown (10YR 5/6), very fine-grained, well oxidized, moist. |
| | | | 22 - | SC/CL | Clayey Sand to Sandy Clay, yellowish brown (10YR 5/6), fine- to coarse-grained, moist, |
| 3 | 4 | 58 | - | | weakly laminated. Increasing sand content with depth. |
| | | | 23 | | Abundant fine gravel below 22.2' |
| | | | - | | |
| | | | 24 | | 22.9' - 25' - No Recovery |
| | | | 25 - | | |
| | | | - | SP/SC | Sand to Clayey Sand, light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6), |
| | | | 26 | | medium grained, trace gravel, faint to moderately developed laminations, moist. |
| | | | - 27 | | Alternating sand and clay-rich layers. |
| 3 | 5 | 96 | - | | |
| | | | 28 | | |
| | | | - | | |
| | | | 29 | | 20.5' gradas to Sandy Clay/Silty Clay |
| | | | - 30 | | 29.5' - grades to Sandy Clay/Silty Clay 29.8' - 30' - No Recovery |
| | | | | | |
| | | | 31 | CL | Sandy Clay, yellowish brown (10YR 5/6), varying amounts of sand, fine-grained, trace fine gravel, |
| | | | - | | gravel, thin laminations, well oxidized, moist. |
| | | 100 | 32 | | |
| 4 | 6 | 100 | 33 | | |
| | | | | | |
| | | | 34 | | |
| | | | | | |
| | | | 35 - | 1 | |
| | | | 36 | | |
| | | | | ML | Sandy Silt, yellowish brown (10YR 5/6), varying amounts of sand, some clay, |
| | | | 37 | | fine- to medium-grained, laminated, moist. |
| 4 | 4 7 | 100 | - 38 | | 38' - grades to Silt Increase in sand content at 38.8' grading to Sandy Silt or Silt with Sand. |
| - r | | | - | | increase in saile content at 50.0 grading to bailey bit of bit with band. |
| | | | 39 | | |
| | | | 40 | | |
| | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| D | D " | 0/ F | Depth | USCS | Department |
|-----|-------|-------|--------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description Same as previous |
| 5 | | 100 | 40 | | some manganese nodules at 41.8' |
| 5 | 8 | 100 | 43 | SP | Sand, light olive brown (2.5Y 5/4), fine- to medium-grained, weak oxidation in layers, moist. |
| | | | 44 | SM | Silty Sand, light olive brown (2.5Y 5/4), trace to some very fine-grained sand, weak laminations, moist. |
| | | | 45 - | | Sand, light olive brown (2.5Y 5/4), fine-grained, friable, weak oxidation in layers, fine slate gravel, trace silt, moist. |
| | | | 46 | | |
| | | | - 47 - | ML/CL | Sandy Silt to Sandy Clay, dark yellowish brown (10YR 4/6), very fine-grained, moist, some organics, laminated, oxidation in wide-spaced layers, some manganese in beds and and disemminated nodules. |
| 5 | 9 | 86 | 48 | | |
| | | | - 49 - | | 48.3' - 50' - No Recovery |
| | | | 50 | - | |
| | | | - 51 | | |
| | | | 52 | | |
| 6 | 10 | 90 | 53 | | |
| | | | 54 - | | 54.5' - 55' - No Recovery |
| | | | 55 | | |
| | | | 56 - | | |
| | | | 57 | | |
| 6 | 11 | 100 | 58 | | |
| | | | 59 | SW | Sand with Gravel, yellowish brown or dark yellowish brown (10YR 5/4), fine- to coarse-grained, |
| | | | 60 - | 5W | Sand with Gravel, yellowish brown or dark yellowish brown (10YR 5/4), fine- to coarse-grained, grained, gravel to 1/2", moist. |
| | | | - | | l |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Dee | D # | 0/ D | Depth | USCS | Description |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) 60 | Class. | Description |
| 7 | 12 | 90 | 60 61 62 63 64 64 65 | | Sandy Clay, brown to strong brown (7.5YR 5/4 - 4/6), fine- to coarse-grained, locally faint laminations and manganese stringers, trace gravel (diatomaceous siltstone and slate), oxidized, moist. 64.5' - 65' - No Recovery |
| 7 | 13 | 100 | - 66 67 68 68 69 70 | | |
| 8 | 14 | 100 | 71 72 73 74 75 | | Clayey Sand with gravel to Sand with Gravel, yellowish brown (10YR 5/4), fine grained, some medium to coarse, trace gravel, moist. Gravel layers: 70.8' - 71.4' and 73.4' - 75.5' |
| 8 | 15 | 100 | | | Clay, yellowish brown (10YR 5/4), varyng amounts of silt and very fine sand, well-developed laminations (varve-like), manganese nodules common, oxidation in widely-spaced spaced layers, moist. 77.1' - 78.1' - manganese laminations 80' - 80.5' - increase in sand content; sand grades to coarse-grained |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|--------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 9 | 16 | 100 | 80 81 82 83 | CL | Same as previous Clay, yellowish brown (10YR 5/4), trace sand, medium- to coarse-grained, well-developed laminations (varve-like), well oxidized, oxidation in layers, moist. |
| | | | 84 - 85 - | | |
| | | | 86 - 87 - 88 | | Total depth of boring: 85 feet Depth of Artificial Fill not determined Groundwater encountered during drilling at 22.2 feet. Backfilled with bentonite grout. Concrete patched. |
| | | | 88 - 89 90 | | |
| | | | 91 92 | | |
| | | | 93 94 - | | |
| | | | 95 - 96 - | | |
| | | | 97 98 99 | | |
| | | | 99 - 100 - | | |

BORING TB-B3



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| 2 2 95 10 Becomes less oxidized with depth. 2 2 95 11 9.8' - 10.0' - No Recovery 11 11 12 12 SM Silty Sand with Clay, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4), very fir 13 I Sandy Clay, dark yellowish brown (10YR 4/4), very fine-grained, oxidized, moist. 14 14.8'-15' - No Recovery 15 grades to Sandy Silt, trace fine gravel at base. 16 SM Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine-grained, trace fine gravel (to calcium carbonate nodules, locally friable, slightly oxidized, moist. | | | | Depth | USCS | |
|--|-----|-------|-------|--------------------------------------|----------------------------|---|
| 1 1 | Box | Run # | % Rec | | Class. | Description |
| 1 1 96 - SM Silty Sand, dark grayish brown (10YR 4/2), some clay, fine-grained, trace gravel, trace manganese nodules, massive, weak oxidation, moist. 1 1 96 - SC Clayey Sand, yellowish brown (10YR 5/4), medium- to coarse-grained, trace slate gravel, trace calcium carbonate nodules, massive, moderately oxidized, moist. 1 1 96 - SC Clayey Sand, yellowish brown (10YR 4/4), fine- to medium-grained, massive, moist. 8 - SM Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine- to medium-grained, massive, moist. 9 - SM Silty Clay, brown (10YR 4/3), trace sand, very fine-grained, moist, massive, well oxidized Becomes less oxidized with depth. 9 - CL Silty Sand with Clay, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4), very fine-grained, oxidized, moist. 1 - SM Silty Sand with Clay, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4), very fine-grained, oxidized, moist. 2 2 95 - SM Silty Sand with Clay, dark yellowish brown (10YR 4/4), ine-grained, oxidized, moist. 14 - - - - - - 2 2 95 - SM Silty Sand with Clay, dark yellowish brown | | | | 1 2 - | | |
| 2 2 95 95 9.8' - 10.0' - No Recovery 11 11 11 12 SM Silty Sand with Clay, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4), very fir 13 CL Sandy Clay, dark yellowish brown (10YR 4/4), very fine-grained, oxidized, moist. 14 14.8'-15' - No Recovery 15 grades to Sandy Silt, trace fine gravel at base. 16 SM Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine-grained, trace fine gravel (to calcium carbonate nodules, locally friable, slightly oxidized, moist. | 1 | 1 | 96 | 6 - 7 8 9 - | SM SC SC SM CL | Silty Sand, dark grayish brown (10YR 4/2), some clay, fine-grained, trace gravel, trace manganese nodules, massive, weak oxidation, moist. Clayey Sand, yellowish brown (10YR 5/4), medium- to coarse-grained, trace slate gravel, trace calcium carbonate nodules, massive, moderately oxidized, moist. Clayey Sand, dark yellowish brown (10YR 4/4), fine- to medium-grained, massive, moist. Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine- to medium-grained, massive, friable, moist. Silty Clay, brown (10YR 4/3), trace sand, very fine-grained, moist, massive, well oxidized. |
| 16 SM Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine-grained, trace fine gravel (to calcium carbonate nodules, locally friable, slightly oxidized, moist. 17 | 2 | 2 | 95 | 11 12 13 14 | SM | 9.8' - 10.0' - No Recovery Silty Sand with Clay, yellowish brown to dark yellowish brown (10YR 5/4 to 4/4), very fine-grained, slightly oxidized, massive, moist. Sandy Clay, dark yellowish brown (10YR 4/4), very fine-grained, oxidized, moist. 14.8'-15' - No Recovery |
| 2 3 96 - 18 19 - 20 19.8' - 20' - No Recovery | 2 | 3 | 96 | - 16 - 17 - 17 - 18 - 19 | SM | Silty Sand with Clay, dark yellowish brown (10YR 4/4), fine-grained, trace fine gravel (to 1/2"), calcium carbonate nodules, locally friable, slightly oxidized, moist. |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | | | | | | | | | | | | | |
|-----|-------|-------|---------------|--------------------|---|----------------------------------|----|----|----------|-------|---|----|----|----|----|----|----|----|----|------|----|--|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | | | | | | | | | | | | | |
| | | | 20 21 221 222 | SM | Silty Sand, dark yellowish brown (10YR 4/4), some clay, fine- to coarse-grained, friable, weak oxidation, thick laminations, moist. | | | | | | | | | | | | | | | | | |
| 3 | 4 | 83 | 22 | | Below 22.6': Sand with fine gravel | | | | | | | | | | | | | | | | | |
| | | | - 24 - | ML | Silt, dark yellowish brown (10YR 4/4), minor sand and clay, very fine-grained, oxidation along beds, thin laminations, moist. | | | | | | | | | | | | | | | | | |
| | | | 25 | | 24.2' -25' - No Recovery | | | | | | | | | | | | | | | | | |
| | | | 26 27 | SM | Silty Sand, yellowish brown (10YR 5/6) to dark yellowish brown (10YR 4/4), fine-grained, some manganese and calcium carbonate nodules, crudely bedded to thick laminations, friable, moist. | | | | | | | | | | | | | | | | | |
| 3 | 5 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | - 28 | SM | Silty Sand, yellowish brown (10YR 5/6), fine-grained, moist, weakly developed beds, weak oxidation along beds, friable, moist. |
| | | | 29 - 30 | | Silty Sand with Clay, yellowish brown (10YR 5/6), fine-grained, thin laminations, some manganese nodules, slightly oxidized, moist. 29.7' - 30' - No Recovery | | | | | | | | | | | | | | | | | |
| | | 82 | - 31 | | Sand, brown (10YR 4/3), fine-grained, massive, few manganese nodules, friable, moist. | | | | | | | | | | | | | | | | | |
| 4 | 6 | | 82 | 82 | 82 | 82 | 82 | 82 | 32 33 | ML/SM | Sandy Silt to Silty Sand, dark yellowish brown (10YR 4/4), with clay, fine-grained, faint laminations, oxidized, moist. | | | | | | | | | | | |
| | | | - 34 - | SM | Silty Sand, light yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/6), fine-grained, moist. trace to some clay, faint laminations, well oxidized, friable, moist. | | | | | | | | | | | | | | | | | |
| | 4 7 | 95 | 35 36 - | | 34.1' - 35' - No Recovery | | | | | | | | | | | | | | | | | |
| 4 | | | 95 | 37 - 38 - | | Some manganese nodules below 39' | | | | | | | | | | | | | | | | |
| | | | 39 40 | | 39.8' - 40' - No Recovery | | | | | | | | | | | | | | | | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 5 | 8 | 98 | 40 41 42 43 44 44 | ML | Same as previous Clayey Silt to Sandy Silt, light yellowish brown (10YR 6/4) to dark yellowish brown (10YR 4/4), very fine-grained, fine laminations, well oxidized, manganese nodules and stringers common, moist. |
| 5 | 9 | 96 | 45 46 47 48 49 50 | | 44.9' - 45' - No Recovery 49.8' - 50' - No Recovery |
| 6 | 10 | 100 | 50 | SM | Lakewood Formation (Qlw) Silty Sand, white (2.5Y 8/1) and yellow brown (10YR 5/8), very fine-grained, friable. Sand, light gray (2.5Y 7/2) to pale yellow (2.5Y 7/3), fine-grained, trace to minor silt, friable. |
| 6 | 11 | 91 | 56 57 58 59 60 | SP | 56.1' - oxidation staining in mottled pattern; some clay pods. Sand, white (2.5Y 8/1), fine-grained, well sorted, manganese nodules concentrated in fine laminations, some oxidation staining concentrated along bedding. 59.6' - 60' - No Recovery |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--------------------------------------|-------------------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 7 | 12 | 52 | 60 61 62 63 64 65 | | 61' - becomes oxidized, oxidation staining concentrated along beds. 62.6' - 65' - No Recovery |
| 7 | 13 | 90 | | SW SP SW/GW | Sand, pale yellow (2.5Y 7/4), fine- to medium-grained, some coarse, trace gravel. Gravel is is subangular to subrounded. Sand, light gray (2.5Y 7/1), fine-grained, well sorted, friable. Sand with Gravel, pale yellow (2.5Y 7/4) and light gray (2.5Y 7/1), fine- to medium-grained, some coarse. Gravel concetrated in beds and dissseminated throughout. Slate and granitic gravel, fine to coarse (to 2"). 69.5' - 70' - No Recovery |
| 8 | 14 | 26 | 70 | | 71.3' - 75' - No Recovery |
| 8 | 15 | 80 | 76 77 78 78 79 80 | SP-SM | Sand with Silt, yellowish brown (10YR 5/6), fine-grained, trace to minor fine gravel. 76.4' - grades to light yellowish brown (2.5Y 6/3) 79' - 80' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 9 | 16 | 78 | 80 81 82 83 84 85 | | Grades to silty sand, yellowish brown (10YR 5/6). 83.9' - 85' - No Recovery |
| | | | - 86 - 87 - | | 87.1' - 87.5' - Some shell fragments (10-20%) |
| 9 | 17 | 77 | 88 - 89 - 90 | | Silt with Sand and Silty Sand, very dark gray (2.5Y 3/1), fine- to coarse-grained, unoxidized. Few gravel and rounded cobbles, subrounded, below 88' 88.9' - 90' - No Recovery |
| | | | 91 92 | | Total depth of boring: 90 feet Depth of Artificial Fill not determined Groundwater encountered during drilling at 70 feet. |
| | | | 93 - | | Backfilled with bentonite grout. Concrete patched. |
| | | | 94 - 95 | | |
| | | | - 96 - | | |
| | | | 97 - 98 | | |
| | | | - 99 - | | |
| | | | 100 | | |

BORING TB-B4



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------------|----------------------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 - | | Hand Augered to 5 feet |
| 1 | 1 | 86 | 5 6 7 8 9 - 10 | ML ML CL ML | Older Alluvial Deposits (Qoal) Silt with Sand, yellowish brown (10YR 5/6), some clay, fine-grained, oxidized, moist. Silt, yellowish brown (10YR 5/6), some clay and sand, fine-grained, oxidized, moist. Clay with sand, dark yellowish brown (10YR 4/4), fine-grained, trace gravel, trace calcium carbonate stringers, porous. Sandy Silt and Silt with Sand, yellowish brown (10YR 5/4), fine- to medium-grained, trace fine gravel, oxidized, moist. 9.3' - 10' - No Recovery |
| 2 | 2 | 28 | 10 11 12 13 14 15 | CL | 9.5 - 10 - No Recovery Increase in gravel content below 10'. Silty Clay, yellowish brown (10YR 5/4), trace to minor sand, fine-grained, some organics, oxidation mottling, moist. 11.4' - 15' - No Recovery |
| 2 | 3 | 84 | 16 16 17 18 19 | | Silty Sand to Sandy Silt, yellowish brown (10YR 5/4), fine-grained, some medium-grained beds, Moderately oxidized. Clay with Sand to Sandy Clay, yellowish brown (10YR 5/6), fine-grained, trace to some manganese and calcium carbonate stringers (to 19.4'), oxidized, moist. 19.2 - 20' - No Recovery |
| | | | 20 | | ······································ |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | | | | | | | | | | | | |
|-----|---------|---------------------------|--------|--------|--|-----|-----|---|--|--|----|----|----|----|----|----|-----------------------------|---|---|----|----|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | | | | | | | | | | | | |
| | | | 20 | | | | | | | | | | | | | | | | | | |
| | | | - | ML/SM | Silty Sand to Sandy Silt, yellowish brown (10YR 5/4), with clay, fine-grained, | | | | | | | | | | | | | | | | |
| | | | 21 | | slightly laminated, oxidized, moist. | | | | | | | | | | | | | | | | |
| | | | 22 | | | | | | | | | | | | | | | | | | |
| 3 | 4 | 90 | 22 | | | | | | | | | | | | | | | | | | |
| 5 | - | 70 | 23 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | 24 | | | | | | | | | | | | | | | | | | |
| | | | - | | | | | | | | | | | | | | | | | | |
| | | | 25 | | 24.5' - 25' - No Recovery | | | | | | | | | | | | | | | | |
| | | | | SM/ML | Silty Sand, brownish yellow (10YR 6/6), slightly oxidized, massive, moist. | | | | | | | | | | | | | | | | |
| | | | 26 | | 25.8' - grades to sandy silt, yellowish brown (10YR 5/4) | | | | | | | | | | | | | | | | |
| | | 100 27 28 29 | 100 | 100 | 100 | 20 | | 23.8 - grades to sandy sht, yenowish blown (101K 5/4) | | | | | | | | | | | | | |
| | | | | | | 100 | 100 | 27 | ML | Silt with Sand, light yellowish brown (10YR 6/4), fine-grained, some clay, | | | | | | | | | | | |
| 3 | 5 | | | | | | | - | | trace manganese nodules, oxidition along bedding, slightly laminated, moist. | | | | | | | | | | | |
| | | | | | | | | | 28 | | | | | | | | | | | | |
| | | | - | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | 29 | | | | | | | |
| | | | | | | | | | | | | | | | | | | - | | | |
| | | 98 | 98 | 98 | 98 | 98 | 30 | SM | Silty Sand, yellowish brown (10YR 5/6), fine-grained, slightly laminated to massive, | | | | | | | | | | | | |
| | | | | | | | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | - | | moderately oxidized, moist. | | | | |
| | | | | | | | | | | | | | | | 98 | 98 | | | 31 | | |
| | | | | | | | | | | | | | | | | | | - | | | |
| | | | | | | | | | | | | | | | | | | | 0.0 | 32 | ML |
| 4 | 6 | | | | | | | | | | | | | | | | - | | oxidation along bedding, thinly laminated, moist. | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | - 34 | | | | | | | | | | | |
| | | | | | | - | | 34.9' - 40' - No Recovery | | | | | | | | | | | | | |
| | | | 35 | SC | Clayey Sand, light yellowish brown (10YR 6/4), fine-grained, moderately oxidized, | | | | | | | | | | | | | | | | |
| | 4 7 100 | | - | ~~ | locally concentrated along bedding, thinly laminated, most. | | | | | | | | | | | | | | | | |
| | | | 36 | | , | | | | | | | | | | | | | | | | |
| | | | - | | | | | | | | | | | | | | | | | | |
| | | 100 | 37 | | | | | | | | | | | | | | | | | | |
| А | | | - 38 | | | | | | | | | | | | | | | | | | |
| + | | | - 30 | | | | | | | | | | | | | | | | | | |
| | | | 39 | | Lakewood Formation (Qlw) | | | | | | | | | | | | | | | | |
| | | | - | SP-SM | Sand to Sand with Silt, light gray (2.5YR 7/2), predominantly fine-grained, some medium- | | | | | | | | | | | | | | | | |
| | | | 40 | | and coarse-grained, friable, trace manganese nodules, iron oxide mottling. | | | | | | | | | | | | | | | | |
| | | | - | | | | | | | | | | | | | | | | | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 5 | 8 | 100 | 40 41 42 43 44 44 45 | | Same as previous |
| 5 | 9 | 98 | 45 46 47 48 48 49 50 | | 47.2' - 47.9' - Trace to some gravel (up to 1/4"), moderately cemented. Below 48' - loose, friable 49.9' - 50' - No Recovery |
| 6 | 10 | 96 | 50 51 52 53 53 54 55 55 | | 50.9' - 52.9' - manganese staining, slightly oxidized, weak laminations Below 54' - weak to strong iron oxide mottling 54.8' - 55' - No Recovery |
| 6 | 11 | 84 | | SP-SM | 55.4'-55.6' - with gravel (to 3") Sand with Silt, white (10YR 8/1), fine-grained, weak to strong iron oxide mottling, moist. 59.2' - 60' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|--|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 7 | 12 | 97 | 60 61 62 63 64 - | | Same as previous 61.5' - 61.6' - manganese staining 62.0' - 62.1' - manganese staining, slightly laminated 62.3' - 62.4' - manganese staining, slightly laminated 64.7' - slightly laminated |
| 7 | 13 | 100 | 65 66 67 68 69 70 | SP | 64.8' - 65' - No Recovery Sand, yellowish brown (10YR 5/6), very fine-grained, trace gravel, highly oxidized, moist, some silt blebs throughout unit. 68.9' - trace manganese nodules |
| | | | 71 72 73 74 75 | | Total depth of boring: 70 feet. Depth of Artificial Fill not determined Groundwater not encountered. Backfilled with bentonite grout. Concrete patched. |
| | | | - 76 77 78 78 79 80 - | | |

BORING TB-B5



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---------------------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 0 1 2 3 4 5 | | Hand Augered to 5 feet. |
| 1 | 1 | 100 | 5 6 7 8 9 9 | | Older Alluvial Deposits (Qoal) Clayey Sand, yellowish brown (10YR 5/4), fine- to medium-grained, trace coarse, moist. Gravel clasts are slate and diatomaceous siltstone (to 3/4"), weak oxidation. Silt, yellowish brown (10YR 5/4), minor to some sand, fine- to coarse-grained, trace to minor clay and gravel (1/2 to 3/4"), massive, moist, moderate oxidation. |
| 2 | 2 | 94 | 10 11 12 13 14 15 | | Sand with Gravel, yellowish brown (10YR 5/6), fine- to coarse-grained, gravel (to 1/2"), moist. Silt, yellowish brown (10YR 5/6), some clay, massive, organic-rich, moist. Sandy Clay, yellowish brown (10YR 5/6), fine-grained, massive to locally laminated, some manganese nodules, moderate oxidation, moist. 14.7' - 15' - No Recovery |
| 2 | 3 | 96 | 16 17 18 19 - | ML | Silt, yellowish brown (10YR 5/6), some sand, very fine-grained, massive, moderate oxidation, moist. Silt with Sand, yellowish brown (10YR 5/6), fine- to medium-grained, some clay, trace gravel (to 1/4'), some manganese stringers, moderate oxidation, moist. |
| | | | 20 | | 19.8' - 20' - No Recovery |



Project No.: A8929-06-02 Client: Westfield

Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|-------|-------|----------------------|----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----------------|--|--|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 4 | 98 | 20 21 22 23 | ML ML | Sandy Silt, yellowish brown (10YR 5/6) to brownish yellow (10YR 6/6), fine-grained, volume of sand variable, moderate oxidation, moist. 21.8' - grades to silty sand Sandy Silt, yellowish brown (10YR 5/6), with clay, fine-grained, slightly laminated, moderate oxidation, moist. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 23 24 25 | ML | Sandy Silt, yellowish brown (10YR 5/4), trace to some clay, fine-grained, slightly laminated moderate oxidation, moist. 24.9' - 25' - No Recovery | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | - 26 - 27 | CL ML | Clay, yellowish brown (10YR 5/4), organic-rich, slightly laminated, moist. Sandy Silt, yellowish brown (10YR 5/4), fine-grained, oxidized, slightly laminated, moist. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 5 | 98 | - 28 - 29 | CL | Clay, brown (10YR 5/3), trace sand, fine-grained, organic-rich, slightly laminated, trace manganese stringers, moist. Lakewood Formation (Qlw) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 30 31 | SP-SM | Sand with Silt, light brownish gray (10YR 6/2) to light gray (10YR 7/2), fine-grained, moist, weakly laminated, iron oxide mottling, friable. 29.9' - 30' - No Recovery | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 6 | 94 | 32 | SP | Sand, poorly graded, light brownish gray (10YR 6/2) to light gray (10YR 7/2), | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 33 - 34 - | | fine-grained, iron oxide mottling along bedding, friable, moist. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35 36 37 | | 34.7'-35' - No Recovery 35' - grades to fine- to medium-grained |
| 4 | 7 | 96 | 38 - 39 40 | | 37.6' - Slightly laminated39.0' - Some disseminated manganese39.8' - 40' - No Recovery | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| _ | | | Depth | USCS | |
|-----|-------|-------|---------------------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 5 | 8 | 88 | 41 42 43 44 | SP/SW | Same as previous 41.5' - with gravel (to 1" in size) Alternating layers of poorly graded and well graded Sand with Gravel, light gray (10YR 7/1), fine- to coarse-grained, gravel to 1" in size, variable iron oxide staining, friable, moist. 42.7' - Manganese in weakly developed laminations 44.4' - 45' - No Recovery |
| 5 | 9 | 100 | 45 46 47 48 48 50 | | 48.4' - Laminated |
| 6 | 10 | 88 | - 51 | | Sand with Silt, light gray (10YR 7/1), fine-grained, trace gravel (to 1/4" in size), friable. Manganese stained layers 51.6' - 51.8'; 52.2' - 52.7'; 53.9' - 54.4' 54.4' - 55' - No Recovery |
| 6 | 11 | 100 | - 56 57 58 58 59 60 | | Below 55' - iron oxide mottling |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| Box | Run # | % Rec | Depth (feet) | USCS Class. | Description |
|---------|-------|--------|-----------------|----------------|---|
| BOX | | 70 Kee | 60 | Class. | Description |
| 7 | 12 | 96 | 61 62 63 | SM | Silty Sand, light gray (2.5Y 7/2), fine-grained, iron oxide mottling, moist. 61.7' - faint manganese staining |
| | | | 64 - 65 | ML | Silt, light yellowish brown (2.5Y 6/4), minor sand, very fine-grained, highly oxidized, moist. 64.8' - 65' - No Recovery |
| | | | - 66 - | | |
| 7 | 13 | 94 | 67 - 68 | | |
| | | | - 69 - | SP | Sand, poorly graded, yellowish brown (10YR 5/6), trace to some silt, fine-grained, moist. 69.7' - 70' - No Recovery |
| | | | 70 - 71 | | 70.0' - 77.7' - Iron oxide mottling, weakly laminated |
| | | 0.6 | 72 | | |
| 8 | 14 | 96 | 73 - 74 | | 74.2' - 74.8' - Disseminated shell fragments |
| | | | - 75 - 76 | | 74.8' - 75' - No Recovery |
| 8 | 15 | 88 | 70 77 78 | | 77.6' - 78.3' - Gravel layer 78.4' - 78.6' - Disseminated calcium carbonate and shell fragments |
| 0 | 13 | 00 | - 79 - | | 78.4 - 78.6 - Disseminated calcium carbonate and shell fragments 79.3' - 79.4' - Gravel layer 79.4' - 80' - No Recovery |
| | | | 80 | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | | | |
|-----|-------|-------|-----------|--------|---|----|---------|---|---|---------|--|---------|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | | | |
| | | | 80 | SW | Sand, light brownish gray (10YR 6/2), fine- to medium-grained, trace fine gravel. | | | | | | | |
| | | | 81 | ML | Silt with Sand, yellowish brown (10YR 5/6), fine-grained, highly oxidized, slightly laminated. | | | | | | | |
| 9 | 16 | 40 | 40 | 40 | 40 | 82 | | 82' - Gravel zone 82.0' - 95.0' - No recovery (cobble in shoe) | | | | |
| | 10 | | | | | | 10 | 83 | | | | |
| | | | - 84 | | | | | | | | | |
| | | | - 85 | | | | | | | | | |
| | | | - 86 | | | | | | | | | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | - 87 | | | | |
| | 17 | | | | | | | 0 | 0 | - 88 | | |
| | | | | | | | | | | | | - 89 |
| | | | - 90 | | | | | | | | | |
| | | | - 91 | | | | | | | | | |
| | | | 92 93 | | | | | | | | | |
| | 18 | 0 | | | | | | | | | | |
| | | | | | | | - 94 | | | | | |
| | | | - 95 - | | | | | | | | | |
| | | | - | | Total depth of boring: 95.0 feet | | | | | | | |
| | | | 96 | | Depth of Artificial Fill not determined. Groundwater encountered during drilling at 77.6 feet. | | | | | | | |
| | | | 97 | | Backfilled with bentonite grout. Concrete patched. | | | | | | | |
| | | | 98 | | | | | | | | | |
| | | | 99 | | | | | | | | | |
| | | | 100 | | | | | | | | | |

BORING TB-B6



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | | | | | | |
|-----|-------|-------|-----------------------|--------|---|-------------|----|--|----|----|
| Box | Run # | % Rec | (feet) | Class. | Description | | | | | |
| | | | 0 1 2 3 4 | | Hand Augered to 5 feet Older Alluvial Deposits (Qoal) | | | | | |
| | | | 5 | | | | | | | |
| | | 98 | 98 | 98 | 98 | 6 - 7 | ML | Sandy Silt, strong brown (7.5YR 4/6), fine-grained, highly oxidized, moist. Sandy Silt, yellowish brown (10YR 5/4) to strong brown (7.5YR 4/6), some clay, fine-grained, slightly laminated, oxidized, moist. | | |
| 1 | 1 | | | | | 98 | 98 | 98 | 98 | 98 |
| | | | 10 - 11 | | Sandy Silt with Clay, light yellowish brown (10YR 6/4), fine-grained, moist. 9.9' - 10' - No Recovery | | | | | |
| 2 | 2 | 100 | - 12 - 13 | | Silty Sand, dark yellowish brown (10YR 4/6), fine-grained, moist. 11.7' - 11.8' - gravel layer 12.0' - grades to Sandy Silt 13.2' - 13.6' - sand layer, trace gravel (to 1.5" in size) | | | | | |
| | | | - 14 - 15 | | 13.9' - 14.3' - grades to fine-grained sand, trace manganese and calcium carbonate stringers | | | | | |
| | | | - 16 - 17 | ML/SM | Clay with Sand, dark yellowish brown (10YR 4/6), fine-grained, manganese stringers, porous, moist. Sandy Silt to Silty Sand, dark yellowish brown (10YR 4/6), fine-grained, moist. Trace calcium carbonate and manganese to 19.4' | | | | | |
| 2 | 3 | 96 | - 18 - 19 | | | | | | | |
| | | | 20 | | 19.8' - 20' - No Recovery | | | | | |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | | | Depth | USCS | |
|-----|-------|-------|----------------------------|--------|--|
| Box | Run # | % Rec | (feet) | Class. | Description |
| 3 | 4 | 100 | 20 21 22 23 24 | CL | Same as previous Sandy Clay, yellowish brown (10YR 5/6), fine-grained, slightly laminated, moist. grades to dark yellowish brown (10YR 4/6) and strong brown (7.5YR 4/6) |
| 3 | 5 | 98 | 25 26 27 28 | | 25.8' - grades to Sandy Silt, yellowish brown (10YR 5/4), fine-grained. Sandy Clay, light brownish gray (2.5Y 6/2), fine-grained, moist, trace manganese stringers. |
| | | | 29 30 | | Lakewood Formation (Qlw) 29.9' - 30' - No Recovery Sand with Silt, mottled light gray (10YR 7/2) and light brownish gray (10YR 6/2), fine-grained, |
| 4 | 6 | 98 | 31 32 33 | 51-514 | slightly laminated, weakly cemented, moderate to strong oxidation mottling, moist. |
| | | | 33 34 35 | | 34.9' - 35' - No Recovery |
| 4 | 7 | 42 | 36 37 38 | | 37.1' - 40' - No Recovery |
| | | | 39 40 | | |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| [| | | Depth | USCS | |
|-----|-------|-------|----------------------------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 40 | | Same as previous |
| 5 | 8 | 74 | 41 42 43 44 44 | | Alternating beds of Sand with Gravel and Sand, light gray (2.5Y 7/2) to pale yellow (2.5Y 7/3), trace to some silt, fine- to medium-grained, gravel slate and siltstone (to 2"), weak to strong oxidtion, friable, weak to moderate cementation. 43.7' - 45' - No Recovery |
| 5 | 9 | 86 | 45 46 47 48 48 50 | | 49.3' - 50' - No Recovery |
| 6 | 10 | 84 | 50 51 52 53 54 55 | SP | 51.8' - 51.9' - strong manganese staining 52.2' - 52.4' - strong manganese staining Sand, light gray (2.5Y 7/2) to pale yellow (2.5Y 7/3) and light yellowish brown (2.5Y 6/4), fine-grained, trace silt, friable. 54.2' - 55' - No Recovery |
| 6 | 11 | 98 | 56 56 57 58 59 60 | | Sand with Silt, olive yellow (2.5Y 6/6), fine-grained, moderately cemented. 59.9' - 60' - No Recovery |



Project No.:A8929-06-02Client:WestfieldLocation:Avenue of the StarsCentury City, California

| | D " | 0/ F | Depth | USCS | |
|-----|-------|-------|--|--------|---|
| Box | Run # | % Rec | (feet) 60 | Class. | Description Same as previous |
| 7 | 12 | 100 | 60 | | grades to yellowish brown (10YR 5/6) |
| 7 | 13 | 100 | | | color change to light gray (2.5Y 7/2) |
| 8 | 14 | 100 | | | 71.9' - 73.1' - Shell fragments and calcium carbonate stringers, color grades to yellowish brown (10YR 5/4) |
| 8 | 15 | 42 | 76 76 77 78 78 79 80 | SW | Sand with Gravel, yellowish brown (10YR 5/4), fine- to coarse-grained, gravel predominantly slate (to 1"). 77.1' - 80' - No Recovery |



Project No.: A8929-06-02 Client: Westfield Location: Avenue of the Stars Century City, California

| | | | Depth | USCS | |
|-----|-------|-------|---------------|--------|---|
| Box | Run # | % Rec | (feet) | Class. | Description |
| | | | 80 - 81 | SP | Sand, light olive brown (2.5Y 5/4), fine- to medium-grained, trace fine gravel (to 1-1/4") gravel, friable, uncemented. |
| 9 | 16 | 56 | 82 - 83 | | |
| | | | 83 84 | | 82.8' - 85' - No Recovery |
| | | | 85 | | |
| | | | 86 - 87 | | Total depth of boring: 85 feet Depth of Artificial Fill not determined. Groundwater not encountered |
| | | | 87 88 | | Backfilled with bentonite grout. Concrete patched. |
| | | | - 89 - | | |
| | | | 90 - 91 | | |
| | | | 92 | | |
| | | | 93 | | |
| | | | 94 - 95 | | |
| | | | - 96 | | |
| | | | - 97 - | | |
| | | | 98 - 99 | | |
| | | | - 100 | | |
| | | | - | | |

APPENDIX B

LOGS OF PREVIOUS BORINGS

| IATE. DUAL. (ft) | | | | ٤Y | | Martini Dril DRILLIN | G COMPANY/DRILLING H lling / CME 75 G METHOD | BOREHOLE LOCATION | BORING NO |
|---|----------------|--------------------|-------|-----------------|----------|--------------------------------|---|--|--------------------------------------|
| BETWEEN STRATA MAY BE GRADUAL BETWEEN STRATA MAY BE GRADUAL ELEVATION (ft) | DEPTH (ft) | BOX# | RUN # | % RECOVERY | SAMPLE I | | - | See Plate 3 HOLE DIAMETER 8 inches | GROUND EL 282 feet |
| DE OF BORING LOCATION SHOWN ON LC OXIMATE. TRANSITIONS BETWEEN STR 0867 | | | | | | CL- ML | 1 inch; color variable, ma (10YR 4/2); appears very (10YR 2/2), organic-rich Hand augered to 5-feet NOTE: Jsm = Santa Monica Slat Tm = Modelo Formation | ie |) to dark gravish brown |
| AT THE EXPLORATION LOCATION LATITUDE AND LONGITUDE OF BORING LOCATION AES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS 522 542 542 542 542 542 542 542 542 542 | _ 5 _ | 1 | 1 | 100 | | | | | |
| UC SUBSUKFACE CONDITIONS AT THE EXPLORA LOCATIONS AND AT OTHER TIMES MAY DIFFER. | _ 10 | 1 | 2 | 100 | | | | | |
| THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS AT OTHER LOCATI | - 15 - | 1 | 3 | 100 | | | At 15.0 to 15.5' and 18.0 At 16.6': Small piece of g | 9 to 19.7': Organic-rich layer, 20-30% g | gravel |
| | - 20 - | | | | | | INUED ON FOLLOWING F | | /WL/MW 10/13/2011 //MF 10/13/2011 |
| | | side Su ngeles, | | Extens ornia | ion | | amec [©] | LOG OF Project No.: 4953-10-15 | BORING Figure: T1-B1 |

| | | | | | | LING COMPANY/DRILL hi Drilling / CME 75 | ING EQUIENIEN I | BORING NO T1-B1 |
|----------------|--------|---------|--------|------------|---|--|--|--|
| (ft) | _ | | | X | | LING METHOD | BOREHOLE LOCATION | (Continued |
| NO | I (ft) | # | # | VER | O Hollo | w Stem Auger | See Plate 3 | |
| ELEVATION (ft) | DEPTH | BOX # | RUN # | % RECOVERY | Hollor Hollor Hollor 5/21/1 GRO | ES DRILLED | HOLE DIAMETER 8 inches | GROUND EL 282 feet |
| LEV | DE | | | | | UNDWATER READINGS | 0 menes | 202 1001 |
| E | | | | 0 | | ntered at 47 feet during drill | ng. | |
| | | | | | | ML/ Af Continued | | |
| - | - + | - | | | | | | |
| | | | | | | | | |
| 260- | + - | - | | | | | | |
| | | 2 | 4 | 100 | | At 22.3': Asphalt f | ragment [AL FAN DEPOSITS [Qfo] | |
| - | + - | - | | | | Sandy Silt, trace to | some clay, trace coarse sand (Jsm and Tm t and stiff; lower contact is narrowly gradati |); brown (7.5YR 4/4); onal |
| | ļ . | | | | | | detrital charcoal, sample obtained | |
| | | | | | | | | |
| | - 25 - | | | | | subrounded slate (| avel, fine grained, clasts 15-20% up to 1 in Jsm), shale (Tm) and sandstone (Tm); brow | cn, mainly subangular to vn (7.5YR 4/4); appears |
| | | | | | | moist and dense | | |
| | + - | | | | | ML Clayey to Sandy S | ilt, variable coarse sand and fine gravel (Jsr | n and Tm), clasts |
| 255- | ļ . | | | | | 2-10%, up to ³ / ₄ in stiff; poorly sorted | ch; dark brown (7.5YR 3/3); appears very r , lower contact is gradational | noist and stiff to very |
| | | 2 | 5 | 90 | | | | |
| | + - | | | 50 | | At 28 0 to 28 1' S | ilty Sand bed, fine grained | |
| | | | | | | At 28.1 to 29.3': G | ravel increases to 15-30%, up to ³ / ₄ inch (Js | m and Tm) |
| | + - | | | | | | | |
| | 20 | | | | | | | |
| | - 30 - | | | | | | | |
| | + - | | | | | | | |
| | | | | | | (Jsm), shale (Tm) | sts 50-70% up to 2 inches, mainly subangu and sandstone (Tm); matrix is fine to coarse | e clayey sand; color |
| 250- | + - | | | | | variable, mainly d is sharp, erosional | ark brown (7.5YR 3/4); appears very moist | and dense; lower contact |
| | | 2 | 6 | 100 | | SC At 32.5 to 33.1': G | rades to Clayey Sand with Gravel, fine to c | oarse grained |
| - | † - | | | | | GC | | |
| | - | - | | | | | yey Silt, variable fine sand, trace coarse sar | |
| | | | | | | ML brown (7.5YR 3/4 between runs | ; appears moist and very stiff to hard; lowe | er contact occurs |
| | - 35 - | | | | | ML Sandy Silt, trace to | some clay; brown (7.5YR 4/4) to dark yel | lowish brown (10YR |
| | | | | | | 4/6); appears mois | t to very moist and medium stiff to stiff; low | ver contact 18 sharp |
| - | Ī | | | | | | | |
| 245- | + - | | | | | GM Silty Gravel, clast | 60-70%, up to 3/4 inch, mainly subrounded); matrix is fine to coarse silty sand; color y | slate (Jsm), shale (Tm) |
| | | 3 | 7 | 94 | Para | and dense; lower d | | anaon, appears moist |
| | + - | | | | | | | |
| | | | | | | At 38.3 to 38.7': C stiff | layey to Sandy Silt; brown (7.5YR 4/4); ap | pears very moist and |
| | † - | 1 | | | | | | |
| | L 40 - | | | | | | a | |
| | | | | | • | CONTINUED ON FOLLOW | | N/WL/MW 10/13/2011 |
| MTA | A West | side Su | bwav | Extens | | | , | F BORING |
| | | | Califo | | | amed | | 1561 Figure: T1-B1 |

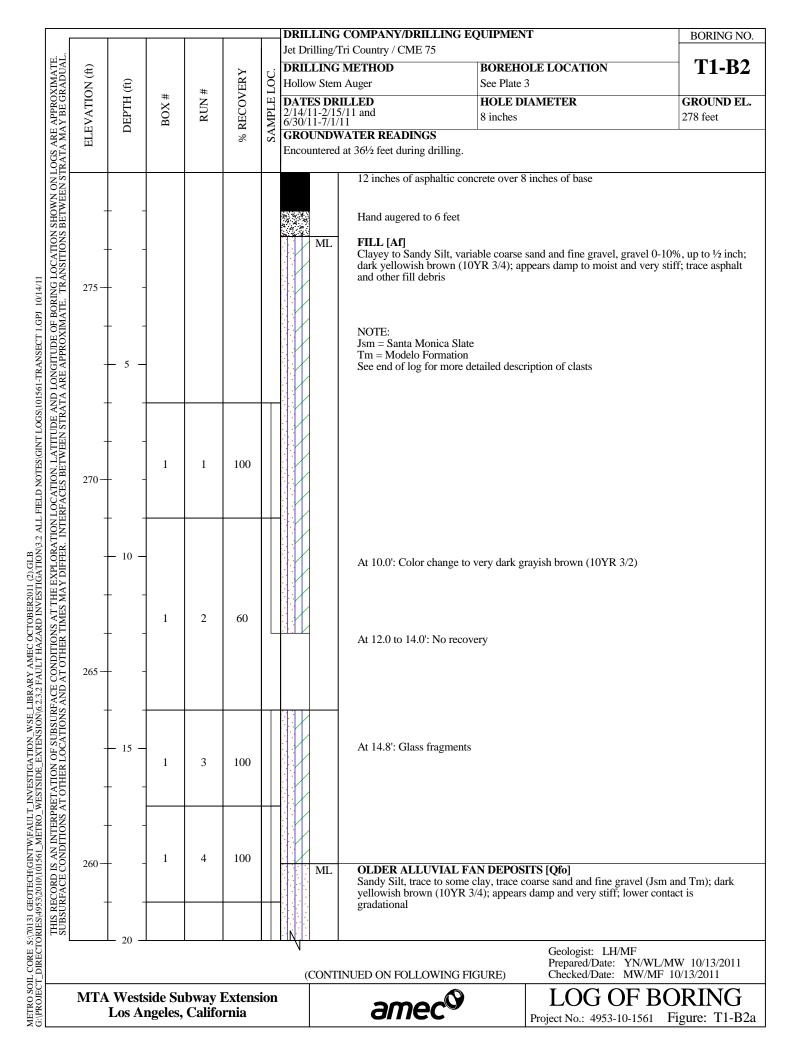
| | | | | | | | NG COMPANY/DRILL Drilling / CME 75 | | BORING NO | |
|---|--------|---------|--------|------------|-------------------------|---|--|--|--|--|
| t) | | | | ~ | _, | | NG METHOD | BOREHOLE LOCATION | T1-B1 | |
| N (f | (ft) | | -11 | ER | о, | | Stem Auger | See Plate 3 | (Continued | |
| DIT OF | LH (| # X | # Z | NO. | LEI | | DRILLED | HOLE DIAMETER | GROUND EL | |
| VA' | DEPTH | BOX # | RUN | % RECOVERY | SAMPLE LOC | 5/21/11 | | 8 inches | 282 feet | |
| ELEVATION (ft) | | | | 4 % | [A] | | DWATER READINGS | 1 | I | |
| | | | | | | Encount | ered at 47 feet during drilling | ng. | | |
| | | | | | $\left\{ \top \right\}$ | | M Qfo Continued | | | |
| าออา | | | | | | | At 40.0 to 40.8': M | atrix becomes fine to coarse grained, well g | graded sand | |
| . 19 | + - | | | | | | M/ ESTUARINE DE IL Alternating beds of | POSITS [Qe] very fine Silty Sand/Sandy Silt and Silty C | lay; rare (<1%) coarse | |
| | | | | | | | sand; brown (7.5Y) | R 4/4); appears very moist and stiff; lower | contact is sharp | |
| 240- | † - | | | | | | ،L | | | |
| NEX | | 3 | 8 | 100 | | | | | | |
| - | † - | 1 | | | | | | | | |
| MAL | | | | | | | | ty Sand, fine to coarse grained; appears me | bist and dense; upper | |
| TY I I | T - | | | | | | and lower contacts are sharp | are sharp | | |
| APPR | 45 - | | | | | Silty Sand and Sandy Silt, very fine grained, trace to some cla | v: brown (7.5YR 4/3) | | | |
| AKE | | | | | $\left \right $ | | IL appears very moist | and medium stiff/dense; lower contact is g | radational | |
| | ļ . | - | | | | | | | | |
| 01K | | | | | | | | | | |
| 235- | + - | - | | 98 | | | $\sum_{\mathbf{A} t \ 47'} \mathbf{Groundwat}$ | er encountered during drilling | | |
| | | 3 | 9 | | 0 | | M At 47.2 to 47.6': Si | ty Sand, fine grained, micaceous | | |
| G . | + - | - | | | | | L soft and wet | ternating beds of very fine Silty Sand as ab | ove, and Clay, appears | |
| LAC | | | | | | | L/ At 48.2 to 49.1': Al | ternating beds of Clayey Silt and Silty Grav | vel; appears wet and | |
| | + - | - | | | | 00 | son, gradadollar da | nsition to unit below AL FAN DEPOSITS [Qfo] | | |
| Ч | | | | | | \$P1 | Silty Gravel, clasts | 50-60%, up to ³ / ₄ inch, mainly subangular (Tm), matrix is fine to coarse silty sand; ver | | |
| , JIFFE | - 50 - | | | | tΠ | jų | 3/1); appears very | noist to wet and dense; lower contact is sha | arp, erosional | |
| ES MAT DIFFER. IN ERFACES BEI WEEN STRATA AKE AFFRUSTIMATE. IKANSHIONS BEI WEEN SIKATA MAT BE UKADUAL ELEVATION (ft) ELEVATION (ft) | | | | | | | L Silty Clay and Clay | ey Silt, variable fine sand, trace coarse san | d (Ism and Tm): brown | |
| | | | | | | | | rs wet and soft; lower contact is gradationa | | |
| 230- | ļ . | | | | | | ML up to $\frac{1}{2}$ inch, mainly subangular to subrounded slate | y Clay, variable fine to coarse sand and fin | Clay, variable fine to coarse sand and fine gravel, clasts 5-20%, | |
| | | 4 | 10 | 0 100 | | | | y subangular to subrounded slate (Jsm), sh 7.5YR 3/3); appears very moist and stiff to | ngular to subrounded slate (Jsm), shale (Tm) and sandstone 3/3); appears very moist and stiff to very stiff; lower contact | |
| | + - | | 10 | | | | | - | | |
| | | | | | | | | | | |
| A CK | + - | | | | | | | | | |
| | | | | | | | | | | |
| | - 55 - | | | | $\left \right $ | | | | | |
| EKL | | | | | | | | | | |
| | + - | - | | | | | | creasing sand, gradational transition to unit | below | |
| INC | | | | | | 0/0/ | Clavev Gravel, class | L DEPOSITS [Qfof1] ts 50 to 60%, up to 34 inch, mainly subang | ular to subrounded slate | |
| 230 - | + - | | | | | S | M (Jsm), shale (Tm) a | nd sandstone (Tm), matrix is fine clayey sinoist and dense; lower contact is sharp, erc | and; dark brown (7.5YR | |
| | | 4 | 11 | 100 | | | Silty Sand, fine to 1 | nedium grained, trace to some clay, trace f | ine gravel, color | |
| קרר | † - | 1 | | | | | variable; appears v | ery moist and dense | | |
| TAL | | | | | | | | avel increases to 30-40% | | |
| | T - |] | | | | / ^s | C At 58.8 to 60.0': Gi | ades to Clayey Sand, trace fine gravel | | |
| | L 60 - | | | | | N | | | | |
| _ | 00 - | | | | _ | N | | Geologist: ME/ME Prenared/Date: YN | 7 J/WL/MW 10/13/2011 | |
| | | | | | | (CO | NTINUED ON FOLLOWI | | | |
| MTA | A West | | | | ion | | ~~ ~~ | LOG OF | BORING | |
| | Los A | ngeles. | Califo | ornia | | | amec | Project No.: 4953-10-1 | | |

METRO SOIL CORE S:/70131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2).GLB

| (ff) | (j) | | X | | lartini Dri RILLIN | G COMPANY/DRILL lling / CME 75 G METHOD | BOREHO | DLE LOCATION | BORING NO T1-B1 (Continued) | | |
|---------------------------|-------------------|----------------------|-------|------------|------------------------------|---|--|---|--|---|--|
| ELEVATION (ft) | DEPTH (ft) | BOX # | RUN # | % RECOVERY | MPLE I | DATES DRILLED HO | | See Plate 3 HOLE D 8 inches | 3 IAMETER | GROUND EL. 282 feet | |
| ELJ | | | | % | | | WATER READINGS d at 47 feet during drilli | ng. | | | |
| (II) NOLLEATION (II) 2220 | - | 4 | 12 | 90 | 000 | 2.5 | (Jsm) with some su contact is sharp, er LAKEWOOD FC Silty Sand, fine to | ubangular to subro osional DRMATION [Qlw medium grained, co prown (10YR 5/8); | apported, up to 2 inches, ma unded shale (Tm) and sand] olor variable, mainly light y appears moist and dense, a | stone (Tm), lower | |
| | - 65 - | - | | | | SP- SM | Poorly Graded San 6/4) to yellowish b | d with Silt, fine to rown (10YR 5/8); | medium grained; light yelle appears wet and dense | owish brown (2.5Y | |
| 215 | + | 5 | 13 | 86 | | | At 67.5 to 68.3': Be | ecomes fine graine | d, color is grayish brown (2 | 2.5Y 5/2) | |
| | - 70 - | - | | | | | At 69.2 to 69.4': Cl | staining layey Silty Gravel, e rock, matrix is fin | yellowish brown (2.5Y 6/3 clasts 50 to 60%, up to ¹ /2-i te to coarse grained, clayey, 7/8) | nch, mainly | |
| 210 | + | - 5 14 | 80 | | SM | slate and quartzite Silty Sand, fine to brown (7.5YR 5/8) | medium grained; h) to yellowish red (| lasts 15-20%, up to ³ / ₄ inch, ighly oxidized, color variab 5YR 4/6); appears wet and | le, mainly strong dense; abundant | | |
| | - 75 - | - | | | | SM/ SC | At 73.2 to 73.3': M (7.5YR 4/1) At 73.3 to 73.4': C yellow (10YR 6/8) At 73.4 to 74.0': Cl inch, mainly subar | langanese oxide-ric Clayey, Silty Sand, layey, Silty Sand w ngular to subrounde | tion; lower contact occur b ch bed; subangular slate (Js fine grained; yellow (2.5Y yith Gravel, fine grained, cl ed slate (Jsm), shale (Tm) a | m); color is dark gray $8/6$) to brownish asts 25-35%, up to $\frac{3}{4}$ | |
| 205 | - | - 5 | 15 | 100 | | SM | Silty Sand, fine gra to light olive brown At 76.6 to 78.0': O At 77.1 to 77.3': Tr At 78.0': Color bec | At 74.0 to 75.0': No recovery Silty Sand, fine grained; highly oxidized; strongly mottled, strong brown (7.5 YF to light olive brown (2.5Y 5/3); appears wet and dense; slightly micaceous, well At 76.6 to 78.0': Oxidation decreases with depth At 77.1 to 77.3': Trace fine gravel (Jsm) At 78.0': Color becomes light brownish gray (2.5Y 6/2) with faint strong brown (7.5YR 5/6) mottling; slightly micaceous | | | |
| 210 | ⊥ ₈₀ - | | | | | (CON | FINUED ON FOLLOW | ING FIGURE) | Geologist: ME/MF Prepared/Date: YN/V Checked/Date: MW/ | WL/MW 10/13/2011 MF 10/13/2011 | |
| MT | A West Los A | tside Su Ingeles, | | | sion | | amed | NO NO | | BORING | |

| fit) | Ν | | | Martini Dri | G COMPANY/DRILL lling / CME 75 G METHOD | LE LOCATION | BORING NO | | | |
|----------------|---------|---------|-------|-------------|---|---------------------------|---|--|--|---|
| ELEVATION (ft) | (ff) | # | # | VER | TOC | Hollow Ste | - | See Plate 3 | e 3 DIAMETER | (Continued |
| VATI | DEPTH | BOX # | RUN # | % RECOVERY | | DATES D 5/21/11 | RILLED | 8 inches | AMETER | GROUND EL 282 feet |
| ELE | | | | % R | SAN | | WATER READINGS d at 47 feet during drill | ing. | | I |
| | | | | | | SM | Qlw Continued | | | |
| 200- | | | | | | SM/ CL | brown (10YR) 5/2 Silty Sand and Silt mainly gravish bro | ty Clay interbedded I by 0 (10 YR 5/2) to y | aminae, very fine grained ellowish brown (10YR 5/ | ; color variable, |
| | | 6 | 16 | 66 | | SM | thickness 1/4 inch | ears wet and dense/st to 2 inches; lower co oxidized Clay/Silt bec | tiff; micaceous, typical be ontact is sharp d | d and lamination |
| | | | | | | 사람물 | SAN PEDRO FO | RMATION [Qsp] ne grained, greenish | gray (10BG 5/1); appears | s wet and dense; |
| | - 85 - | | | | | | | | | |
| | | | | | | | | | | |
| 195 - | | - | | | | | | | | |
| | | 6 | 17 | 0 | | | | | | |
| - | | | | | | | | | | |
| | | | | | | | | | | |
| | - 90 - | | | | | SM | Silty Sand, very fi gray (10 BG 4/1); | ne grained, trace coa appears wet and den | rse sand and fine gravel (ase; occasional lamination | Jsm); dark greenish s |
| | + - | | | | | on of GM | (Jsm), some quartzite; matrix is fine to coarse silty sand; dat | | | to subrounded slate eenish gray (10Y |
| 190- | + - | 6 | 18 | 34 | | | 4/1); appears wet and dense; depth of lower contact uncerta At 91.7' to 95.0': No recovery | | ower contact uncertain du | e to poor recovery |
| | - | | | | | | | | | |
| | + - | | | | | | | | | |
| | - 95 - | | | | | SM | Silty Sand, very fi 5/1); appears wet | ne grained, trace coa | rse sand (Jsm and Tm); g | reenish gray (10BG |
| | + - | | | | | o GP | At 95.7 to 96.3' an | | vel, clasts 50 to 60%, up t some granitic rock | o ½ inch, mainly |
| 185 - | + - | | | | | SM | | | | |
| | - + | 6 | 19 | 80 | | | | | | |
| | - | | | | | GP SM | | | | |
| | L 100 - | | | | | | At 99.0 to 100.0': | ino recovery | | |
| | 100 - | | | | | | TINUED ON FOLLOW | ING FIGURE) | Geologist: ME/MF Prepared/Date: YN/ Checked/Date: MW | WL/MW 10/13/2011 /MF 10/13/2011 |
| MTA | West | | | | sion | | amed | | | BORING |
| | Los A | ngeles, | | rnia | | | anet | • | Project No.: 4953-10-150 | 51 Figure: T1-B1 |

| | | | | | | RILLING COMPANY/DRII artini Drilling / CME 75 | LING EQUIPMENT | BORING NO |
|----------------|------------|---------|---------|------------|-------|--|--|--------------------------|
| () | | | | | | RILLING METHOD | BOREHOLE LOCATION | T1-B1 |
| ELEVATION (ft) | (t) | | | % RECOVERY | | llow Stem Auger | See Plate 3 | (Continued |
| [O]] |) H | # | RUN # | IVC | ЦЦ | TES DRILLED | HOLE DIAMETER | GROUND EL |
| LAV | DEPTH (ft) | BOX # | RU | ECO | Idl 5 | 21/11 | 8 inches | 282 feet |
| LEV | Ī | щ | | % R | NAN O | ROUNDWATER READING | S | |
| Щ | | | | 0` | | countered at 47 feet during dr | | |
| | | | | | | N END OF BORI | | |
| | | | | | | END OF BORI | NG AT 100 FEET | |
| | 1 - | | | | | NOTES: Boring backfille | d with cement/bentonite grout from bottom up | and natched |
| | | | | | | _ | | - |
| 180- | 1 - | | | | | -Where observe | listed in order of predominance (most predomi d, contacts and bedding appear subhorizontal u | inless otherwise noted. |
| | | | | | | -Non-recovery i noted. | ntervals are assumed to occur at the bottom of | run unless otherwise |
| | L . | | | | | -Santa Monica S | Slate (Jsm) clasts are generally very dark gray, | subangular to |
| | | | | | | subrounded slat | e unless otherwise noted. Modelo Formation (7) llow to tan, subangular to subrounded shale an | Tm) clasts are generally |
| | | | | | | otherwise noted | _ | |
| | T 1 | | | | | -The term "clast -Beds are generation | s" herein describes gravel-size rock fragments ally massive unless otherwise noted. | (larger than ¼ inch). |
| | | | | | | | | |
| | + 105 - | | | | | | | |
| | | | | | | | | |
| | † † | | | | | | | |
| | | | | | | | | |
| 175- | + - | | | | | | | |
| | | | | | | | | |
| | + - | | | | | | | |
| | | | | | | | | |
| | + - | | | | | | | |
| | | | | | | | | |
| | - 110 - | | | | | | | |
| | | | | | | | | |
| | + | | | | | | | |
| | | | | | | | | |
| 170- | 4 4 | | | | | | | |
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| | | | | | | | | |
| | T 1 | | | | | | | |
| | | | | | | | | |
| | + 115 - | | | | | | | |
| | | | | | | | | |
| | † † | | | | | | | |
| | | | | | | | | |
| 165- | + | | | | | | | |
| | | | | | | | | |
| | + - | | | | | | | |
| | | | | | | | | |
| | + | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | ~ | | | | | | Geologist: ME/MF Prepared/Date: VN | /WL/MW 10/13/2011 |
| | | | | | | | Checked/Date: MV | V/MF 10/13/2011 |
| MT | A Wests | side Su | bway F | Extensi | ion | | LOG OF | BORING |
| | | | Califor | | | ame | C Project No.: 4953-10-1 | |



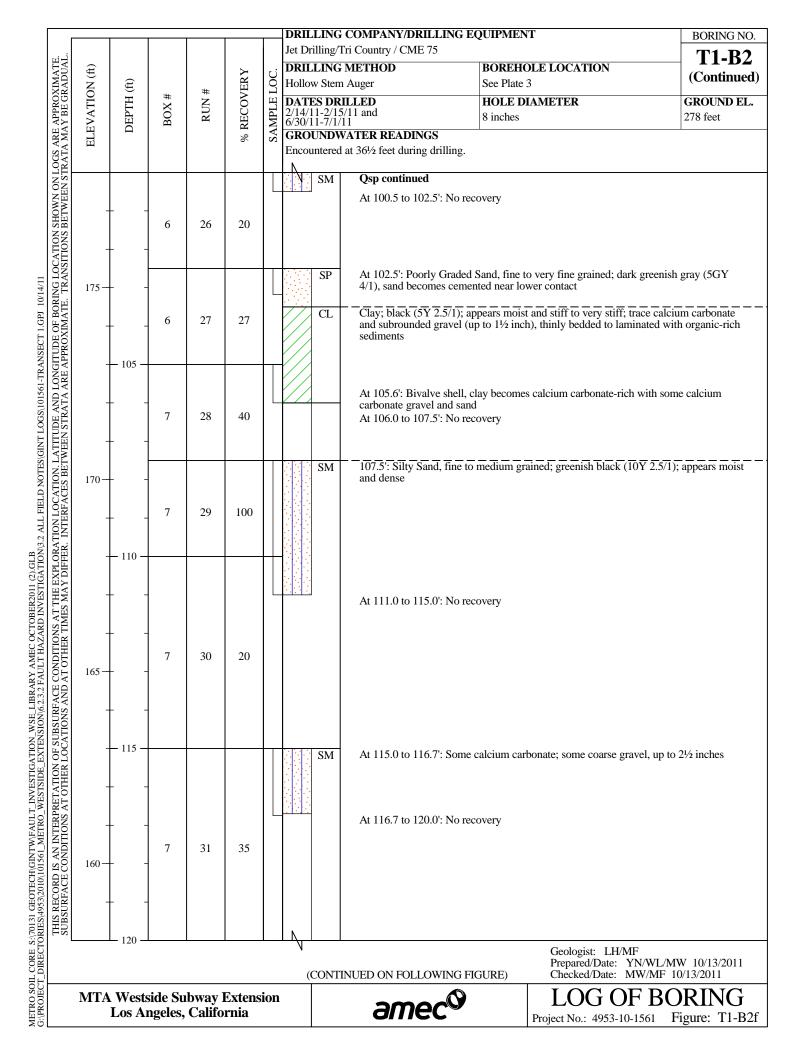
| | | | | | | | | COMPANY/DRILL | ING EQUIPMEN | 11 | BORING NO |
|----------------|--------------|--------|--------|----------|-------------------|---------|--|---|--|--|--|
| | | | | | | | • | - | BORFH | OLE LOCATION | T1-B2 |
| И (ft | (1) | | | 3RΥ | OC. | | DRILLING METHODBOREHHollow Stem AugerSee Plate | | | (Continued | |
| IOL | H (f | # | # Z | OVE | ΕL | | | ILLED | | DIAMETER | GROUND EL. |
| VAT | DEPTH (ft) | BOX # | RUN # | RECOVERY | SAMPLE LOC. | | 1 - 2/14 | 5/11 and | 8 inches | | 278 feet |
| ELEVATION (ft) | | щ | | % R | SAN | | | VATER READINGS | | | |
| Ш | | | | | | | | l at 36 ¹ /2 feet during dri | lling. | | |
| | | | | | $\left \right $ | | ML | Qfo Continued | | | |
| | | | | | $\left \right $ | | | At 20.5': Charcoal | fragment, sample | obtained | |
| - | + - | | | | $\left \right $ | | | At 21.0': Gravel co | ntent increases to | 5 to 10% | |
| | | 2 | 5 | 92 | $\left \right $ | | | | | | |
| - | † - | | | | $\left \right $ | | | | | | |
| 255 | | | | | $\left \right $ | | | | | | |
| 255 — | F - | | | | $\left \right $ | | SM | Silty Sand, fine gra | angular slate (Ism | e sand and gravel, clasts 10 t a) with lesser subrounded sh | $\overline{15\%}$, up to $1\frac{1}{2}$ |
| | | | | | | | | (Tm); dark yellow | ish brown (10YR | 3/6); appears damp and den | se; lower contact is |
| | | | | | | | | sharp | | | |
| _ | - 25 - | | | | | | | | | | 1 |
| | | | | | | | CL | | | lowish brown, appears mois | - |
| - | - 1 | | | | | | SM | At 25.6': Silty Sand | I, fine grained, var (Jsm and Tm): br | riable coarse sand and fine g own (10YR 5/3); appears dr | ravel, clasts 5 to |
| | | 2 | 6 | 40 | | | | At 26.0 to 29.0': No | o recovery | <u> </u> | <u></u> |
| - | - + | - | | +0 | | | | | | | |
| | | | | | | | | | | | |
| 250- | - | | | | | | | | | | |
| | | | | | | | | | | | |
| - | - + | | | | $\left \right $ | 311 | SM/ | Silty Sand and San | dy Silt, fine grain | ed, some coarse sand and fir | ne gravel, clasts 5 |
| | | | | | | | ML | $to15\%$, up to $\frac{1}{2}$ inc | h; mainly subang | ular, slate (Jsm) with lesser vn (10YR 3/4); appears moi | subrounded shale and |
| - | - 30 - | 2 | | 100 | $\left \right $ | | | stiff; lower contact | is gradational | , i (i v i i o/ +), appears mor | |
| | | 2 | 7 | 100 | $\left \right $ | | | | | | |
| - | + - | | | | $\left \right $ | | | | | | |
| | | | | | | | ML | Clayey to Sandy S | ilt, some coarse sa | and and gravel, clasts 5 to 150 | w, up to ³ / ₄ inch; |
| - | F - | | | | $\left \right $ | | | sandstone (Tm); da | urk yellowish brov | ate (Jsm) with lesser subrou vn (10YR 3/6); appears moi | st and very stiff; |
| 715- | | 2 | 8 | 72 | $\left \right $ | | | lower contact is sh | arp | | |
| 245 — | | | | | | | | | | | |
| _ | L _ | | | | | | | | | | |
| | | | | | | | | | | | |
| _ | - 35 - | 2 | | 100 | | | | | | 1 | |
| | | 2 | 9 | 100 | $\left \right $ | | | At 35.0': Coarse sa | nd and gravel con | tent decreases to trace | |
| - | - 1 | | | | \square | | | | | | |
| | | | | | $\left \right $ | ЦИ | SN/ | ✓ At 36.5' Groundw | | luring drilling | |
| - | - | | | | | | SM | ESTUARINE DE Silty Sand, fine gra | ined, trace coarse | sand (Jsm and Tm); faintly | mottled, dark grayish |
| | | | | | $\left \right $ | | | brown $(2.5Y 4/2)$ t sharp | o dark yellowish b | prown (10YR 3/6); appears | wet; lower contact is |
| 240 | - | 3 | 10 | 63 | $\left \right $ | | | ·· r | | | |
| | | | | | | ·· [:]· | | At 38.5 to 40.0': N | o recoverv | | |
| - | - | | | | | | | | | | |
| | | | | | | | | | | | |
| | L 40 - | l | 1 | I | 1 | | | | | Geologist: LH/MF | |
| | | | | | | ſſ | ONT | INUED ON FOLLOW | NG FIGURE) | Prepared/Date: YN/V Checked/Date: MW/ | VL/MW 10/13/2011 MF 10/13/2011 |
| МТА | West | vido S | huer | Fytona | ior | | | | | | |
| | Wests | | | | non | | | amed | U. | | |
| | | 0, | | | | [| | | - | Project No.: 4953-10-156 | n 11guie. 11-D2 |

11 METRO SOIL CORE 5://0131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB

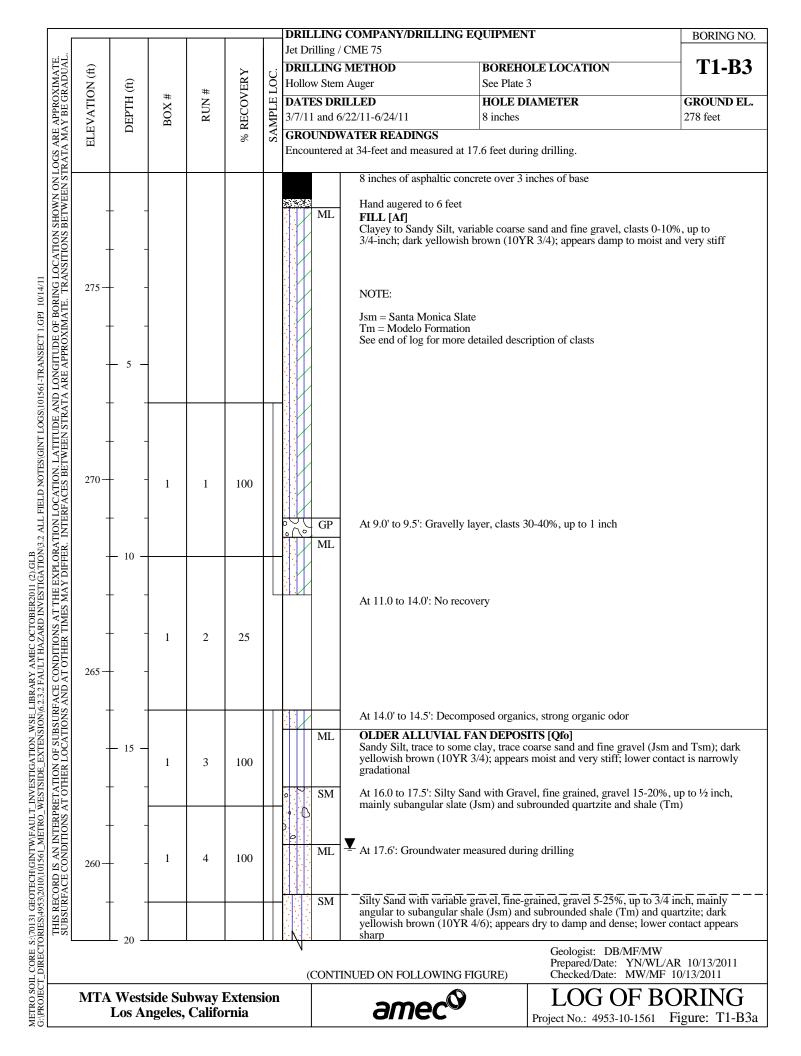
| | | | | | | | G COMPANY/DRILI /Tri Country / CME 75 | | BORING NC | | | | |
|----------------|--------|---------|--------|------------|------------------|----------------------------|--|--|---|--|--|--|--|
| (ĮĮ | | | | × | | - | G METHOD | BOREHOLE LOCATION | T1-B2 | | | | |
| E) N | (ft) | | + | ER | S | Hollow Ste | | See Plate 3 | (Continued | | | | |
| JIC | | BOX # | RUN # | % RECOVERY | SAMPLE LOC. | DATES D | RILLED | HOLE DIAMETER | GROUND EL | | | | |
| ELEVATION (ft) | DEPTH | BO | RI | | | 2/14/11-2/1 6/30/11-7/1 | 15/11 and 1/11 | 8 inches | 278 feet | | | | |
| ELI | | | | | | | WATER READINGS | | | | | | |
| | | | | | | N | d at 5072 leet during di | nning. | | | | | |
| | | | | | | N SM | Qe Continued At 40.0 to 40.8': I | Becomes coarser, fine to medium grained, tra | ace coarse sand and fine | | | | |
| - | ļ . | - | | | | | gravel (Jsm and T | | | | | | |
| | | 3 | 11 | 88 | | ه SP | At 41.2 to 41.6': | Sand with Gravel, fine to coarse grained, gra | rivel 20 to 30%, up to $\frac{1}{2}$ | | | | |
| - | | - | | | | SM/ ML | Silty Sand/Sandy | i); dark brown (10YR 3/3), appears wet; low Silt, fine grained, trace coarse sand and fine | gravel (Jsm and Tm); | | | | |
| | | | | | $\left \right $ | | | ark grayish brown (2.5Y 4/2) to dark brown y stiff; well sorted; lower contact is gradation | | | | | |
| 235 - | + - | | | | | | | | | | | | |
| | | 3 | 12 | 100 | | SM | Silty Sand Fine of | rained, trace coarse sand and fine gravel (Jsr | $n \text{ and } \overline{Tm}$ brown (7.5V | | | | |
| - | + - | | | 100 | | SM | | and dense; well sorted; lower contact is narr | | | | | |
| | | | | | | | | | | | | | |
| - | - 45 - | | | 1 | | | | | | | | | |
| _ | L . | | | | | | | | | | | | |
| - | | 3 | 13 | 100 | | | | | | | | | |
| - | ļ - | | | | | GW | | AL DEPOSITS [Qfof1] vel with Silt and Sand, soil matrix is fine to a | coarse sand, clasts 60 to | | | | |
| | | | | | \parallel | SP | 70%, up to $1\frac{1}{2}$ in | ch, mainly Jsm and Tm, some granitic rock; ars wet; lower contact occurs between runs | dark yellowish brown | | | | |
| 230- | + - | - | | | | or | | nd, fine grained; brown (10YR 4/3); appear | s wet and dense | | | | |
| | | | 1.4 | 00 | | | | | | | | | |
| - | + - | 3 | 14 | 80 | | ्र व sw | Well Graded San | d with Gravel, fine to coarse grained, clasts | 15 to 25%, up to ½ inch, | | | | |
| + | | | | | | | mainly Jsm and T brown (2.5Y 3/3) | m, some quartzite, gravel content increases ; ; appears wet and dense; lower contact occu | with depth; dark olive rs between runs | | | | |
| | - 50 - | | | | \square | SW | | Well Graded Sand, fine to medium grained, o); appears wet and dense | coarsens with depth; | | | | |
| _ | L . | | | | | | |), appears wer and dense | | | | | |
| | | | | | | | | | | | | | |
| - | + - | - | | | | D C | | | | | | | |
| | | 4 | 15 | 60 | | | | | | | | | |
| 225- | + - | - | | | | | At 53.0 to 55.0': N | Jo recovery | | | | | |
| | | | | | | | | | | | | | |
| - | + - | - | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| - | - 55 - | | | | | SP | Poorly Graded Sa | nd, fine to medium grained, coarsens with d lense; lower contact is erosional, appears to | epth; brown (10YR 4/3); dip about 15 degrees | | | | |
| - | ļ . | | | | | | | | useu 15 useroos | | | | |
| | | | | | | ML | LAKEWOOD F Clavey to Sandy | ORMATION [Qlw] Silt, trace to some fine sand, trace coarse sar | d (Jsm and Tm): dark | | | | |
| - | + - | | | | | | vellowish brown | (10YR 4/4), trace magnesium oxide specks (iff; lower contact is sharp | <1/8 inch); appears very | | | | |
| | | 4 | 16 | 50 | | ГЛЩ | $-\overline{\text{At}} \overline{57.5} \text{ to } \overline{60.0'}$ | - | | | | | |
| 220- | + - | - | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| - | † - | | | | | | | | | | | | |
| | L 60 - | | | | | | | | | | | | |
| | 50 | | | | | N | | Geologist: LH/MF Prepared/Date: YI | 7 N/WL/MW 10/13/2011 | | | | |
| | | | | | | | FINUED ON FOLLOW | VING FIGURE) Checked/Date: M | W/MF 10/13/2011 | | | | |
| | West | | | | sion | | ame | | FBORING | | | | |
| | LOS A | ngeles, | Califo | ornia | | | | Project No.: 4953-10-1 | 561 Figure: T1-B2 | | | | |

| 0 | | | | | Jet I | LLING COMPANY/DRILL brilling/Tri Country / CME 75 LLING METHOD | | BORING NO T1-B2 | | |
|----------------|--------|--------|--------|------------|------------------------------------|--|---|-------------------------------------|--|--|
| N (ft | (ft) | | | ŝRΥ | | Dw Stem Auger | BOREHOLE LOCATION See Plate 3 | (Continued | | |
| IOL | H (f | # | RUN # | OVE | | FS DRILLED | HOLE DIAMETER | GROUND EL | | |
| VAT | DEPTH | BOX # | RU | % RECOVERY | Holl 12/14 6/30 GR | /11-2/15/11 and /11-7/1/11 | 8 inches | 278 feet | | |
| ELEVATION (ft) | | | | % R | | OUNDWATER READINGS | | | | |
| Ι | | | | | Enc | ountered at 361/2 feet during dr | lling. | | | |
| | | | | | | Qlw Continued | | | | |
| | | | | | | CL/ Marker Bed M _H CH Silty Clay and Cla | y; trace to some fine sand; dark grayish bro | wn (2.5Y 4/2); appears | | |
| | | | | | | very moist and very 20%, up to 1/16 ir | y stiff; some vertically-oriented, prismatic n ch x ¼ inch); lower contact is gradational | anganese flecks (5 to | | |
| _ | | | | | | At 61.5 to 62.0': B brown (2.5Y 4/2) | ecomes mottled, dark yellowish brown (10) | (R 4/3) to dark grayish | | |
| | | 4 | 17 | 80 | | At 62.0': Becomes | very dark grayish brown (2.5Y 3/2), trace c | alcium carbonate | | |
| 215- | | 4 | 17 | 80 | | $\begin{array}{c c} & \text{nodules up to 1 in} \\ \hline \text{CL} & \textbf{Marker Bed } \textbf{M}_{G} \end{array}$ | Carbonate-rich Bed [Olw] | | | |
| - | | | | | | Silty Clay with ex 90%, occurs as po | ensive calcium carbonate development, calc wdery deposits and clusters of subangular, | 1/8 inch to 1/4 inch | | |
| - | | | | | 4/ | concretions: silty of | clay is very dark grayish brown (2.5Y $3/2$), are white (10YR 9.5/1), calcium carbonate | calcium carbonate | | |
| | | | | | | (10YR 8/1); appea | rs moist to very moist and very stiff to very | hard (concretions); | | |
| - | - 65 - | | | | $\left \right $ | lower contact is na At 64.0 to 65.0': N | nrowly gradational o recovery | | | |
| | | | | | | | very moist to wet and medium stiff to very h | ard | | |
| - | | | | | | | | | | |
| | | | | | | | | | | |
| - | | | | | | | | | | |
| | | 4 | 18 | 94 | | | | | | |
| 210- | | | | | | | | | | |
| - | | | | | | ML At 68.7 to 69.1': C | rades to Sandy Silt, trace calcium carbonate | : gravish brown (2.5Y | | |
| | | | | | | 5/2); appears mois | and hard | | | |
| | _ 70 _ | | | | | to 30% | alcium carbonate content decreases and bec | | | |
| | 70 | | | | | CH dark yellowish bro | y, trace to some fine sand; mottled, light oliv wn (2.5Y 4/6); very moist; very stiff; 5-15% | calcium carbonate, | | |
| - | | | | | | occurs as dispersed deposits and small (< ¹ / ₄ inch) nodules and vertically oriented prisms | | | | |
| | | | | | | At 71.3': ³ / ₄ inch th | ate deposits and small | | | |
| - | | | | | | (< ¹ /4 inch) concret | ons | | | |
| | | 5 | 19 | 100 | | | | | | |
| 205 — | | | | | | At 73.0 to 74.5': L | ittle or no calcium carbonate | | | |
| | | | | | | | | | | |
| - | | | | | | | | | | |
| | | | | | | SP/ Poorly Graded Sa | nd with Silt, fine to medium grained, trace c | oarse sand and fine | | |
| - | - 75 - | | | | | SM gravel (Jsm); light | olive brown (2.5Y 5/4); appears wet; lower | contact is sharp | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| - | | | | | | | | | | |
| | | 5 | 20 | 100 | | | | | | |
| 200- | | 5 | 20 | 100 | | | | | | |
| | | | | | | | | | | |
| - | | | | | | At 79.0 to 80.0': N | larker Bed M_{C} - Grades to fine to coarse, po | orly graded sand, 5 | | |
| | | | | | | to10% fine gravel | | | | |
| | L 80 - | I | I | 1 | | | Geologist: LH/MF | | | |
| | | | | | | (CONTINUED ON FOLLOW | | WL/MW 10/13/2011 W/MF 10/13/2011 | | |
| | West | | | | sion | 2000 | 🔊 🛛 LOG OF | BORING | | |
| | Los A | ngeles | Colifo | mio | | | - | 561 Figure: T1-B2 | | |

| Ţ. | | | | | | | Jet Drilling/ | G COMPANY/DRILL Tri Country / CME 75 | | BORING NO T1-B2 |
|---|----------------|---------|---------|--------|----------|---------------------|----------------------------|---|---|--------------------------|
| 70Q | [[[] | () | | | RY | LOC. | Hollow Ster | G METHOD | BOREHOLE LOCATION See Plate 3 | (Continued |
| GRA | NO | (tf) H | # | # 7 | VE | ELC | | - | HOLE DIAMETER | GROUND EL. |
| BE | /AT | DEPTH | BOX # | RUN # | RECOVERY | [] III | 2/14/11-2/1 6/30/11-7/1 | 5/11 and | 8 inches | 278 feet |
| MAY | ELEVATION (ft) | DF | В | | % RI | SAMPLE | 6/30/11-//1 | WATER READINGS | | |
| ES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL | н | | | | 0.1 | | | d at 361/2 feet during dr | lling. | |
| ELS NE | | | | | | | N SP/ | Qlw Continued | | |
| IWE | 4 | | | | | | | | | |
| SBE | | | | | | | | brown (10YR 5/8) | ecomes strongly mottled, light olive brown ; appears wet and dense; trace concretionary | y iron oxide laminations |
| LION | + | | | | | | | At 81.4': ¹ / ₂ inch th | ick, subhorizontal, concretionary iron oxide | lamination |
| ISN | | | 5 | 21 | 90 | | | Silty Sand, fine gr | ained, trace coarse sand and fine gravel (Jsn | n and quartzite); light |
| TR | 195 | | | | | | | olive brown (2.5Y distinct lamination | 5/4) to yellowish brown (10YR $5/8$) to stross defined by variable oxidation | ong brown (7.5YR 5/8); |
| ATE. | | | | | | | | | | |
| XIM | + | | | | | | | | | |
| PRO | | | | | | | | | | |
| RE AI | + | - 85 - | | | 1 | $\uparrow \uparrow$ | 調査 | | | |
| CA AF | | | | | | | SM | SAN PEDRO FO | RMATION [Qsp] e grained; very dark greenish gray (5GY 3/1 |) |
| FRAT | 1 | | | | | L | | At 86.3 to 90.0': N | |) |
| EN S' | | _ | | | | | | | · · · · · · · · · · · · · · · · · · · | |
| EVER | T | | | | 25 | | | | | |
| S BEI | 190 | | 6 | 22 | 25 | | | | | |
| ACE | | | | | | | | | | |
| TERF | 4 | | | | | | | | | |
| E. | | | | | | | | | | |
| FER | + | - 90 - | | | | + | SM | - | | |
| Y DII | | | | | | | | At 90.3 to 92.5': N | o recovery | |
| MA | + | | _ | | 10 | | | | | |
| IMES | | | 6 | 23 | 10 | | | | | |
| SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMI | + | | | | | | | | | |
| OTH | | | | | | | SM | At 92.5': Oxidizes | upon contact with open air | |
| DAT | 185 | | | | | | | | | |
| INA | | | 6 | 24 | 70 | | | | | |
| IONS | 1 | | | | | L | | | | |
| CAT | | - 95 - | | | | | | | | |
| RLO | | ,,, | | | | | SM | | ilty Sand, fine to coarse grained, some grave , mainly subrounded slate (Jsm) and granit | |
| OTHE | 4 | | | | | | | | | |
| ATC | | | | | | | 그렇게 | Δt 96 5 to 100 0'- N | lo recovery, cemented zone | |
| ONS | + | | | | | | | A: 30.3 10100.0 : 1 | | |
| ITIO | | | 6 | 25 | 25 | | | | | |
| CON | 180 | | | | | | | | | |
| FACE | | | | | | | | | | |
| SUR | + | | | | | | | | | |
| SUB | | 100 | | | | | | | | |
| | | - 100 - | | | - | • | Ň | | Geologist: LH/MF Prenared/Date: VI | 7 N/WL/MW 10/13/2011 |
| | | | | | | | (CONT | TINUED ON FOLLOW | ING FIGURE) Checked/Date: M | W/MF 10/13/2011 |
| I | | | | bway i | | sion | ı | amed | 🔊 LOG OF | F BORING |
| |] | Los Ai | ngeles, | Califo | rnia | | | <i>コ11</i> せい | Project No : 4953-10-1 | 561 Figure: T1-B2 |

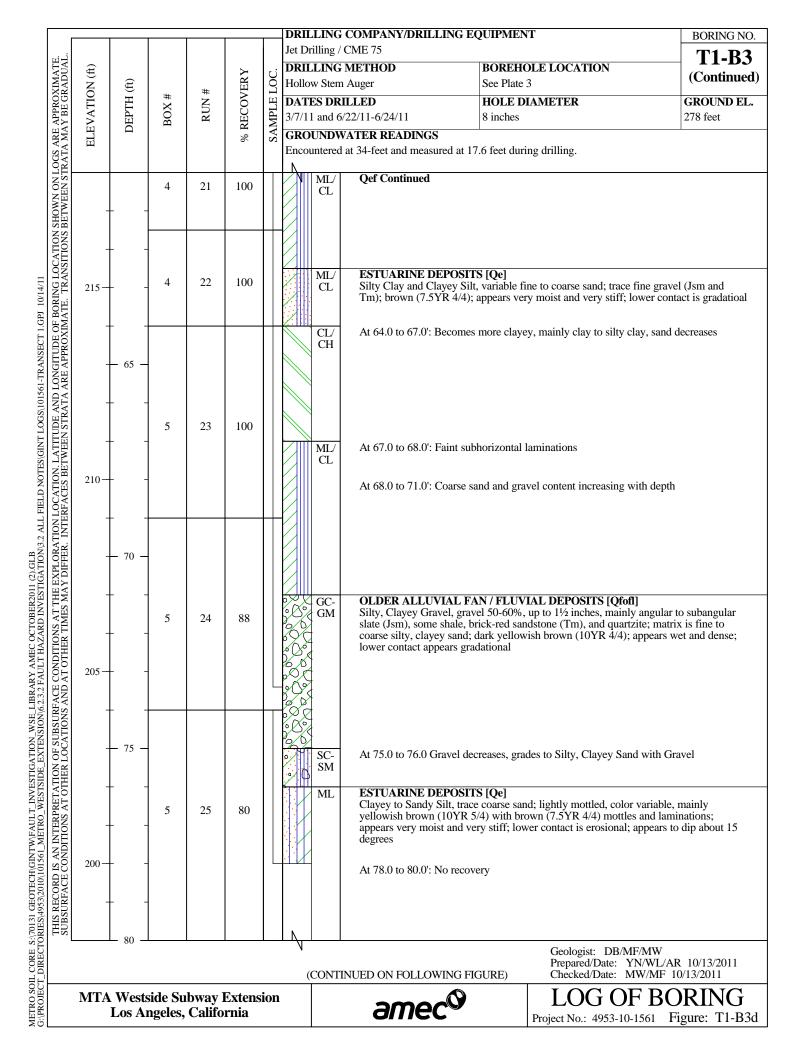


| Г | | | 1 | 1 | | | | | G COMPANY/DRILLING | EQUIPMENT | BORING NO. |
|---|----------------|---------|---------|---------|--------|--------|----------|---------|---|---|---|
| щĻ | | | | | | | | - | Tri Country / CME 75 | | T1-B2 |
| MAT | ELEVATION (ft) | () | | | RY | LOC. | | | METHOD n Auger | BOREHOLE LOCATION See Plate 3 | (Continued) |
| OXI GRA | ION | | | | | | | | RILLED | HOLE DIAMETER | GROUND EL. |
| APPR BE | /AT | EPTI | BOX # | RU | ECC | SAMPLE | 2/14/ | 11-2/1 | 5/11 and /11 | 8 inches | 278 feet |
| RE A MAY | TEV | DI | | | % R | SAN | 6/30/ | UND | WATER READINGS | | |
| GS A | Щ | | | | 0 | | Enco | untered | l at 361/2 feet during drilling | 5. | |
| STR | | | | | | | | SM | Qsp Continued | | |
| NON | | | | | | | | SIVI | Qsp Continueu | | |
| MOF | - | | | | | | · : ·. | ł | At 121' Some gravel a | nd cobbles, no recovery to 122.5' | |
| N SF US BF | | | 7 | 32 | 40 | | | | | | |
| ATIC | - | | | | | | | | | | |
| ANSI | | | | | | | 신모근 | SM | | | |
| D ^N L | 155 — | | | | | | | | | | |
| BOR ATE. | | | | 22 | 00 | | | | | | |
| AIM N | - | | 7 | 33 | 80 | | | | At 124.0 to 124.5': Sil | t content increasing, interbedded fine to o | coarse gravel layers |
| | | | | | | | | | At 124.5 to 126.0': Sa | ndy Silt interbeds | |
| E AF | - | - 125 - | | | | + - | | | | | |
| D LC A AR | | | | | | | | | | | |
| RAT. | - | | | | | | - 1- 1 - | J | At 126.0 to 130.0': No | recovery | |
| AT THE EXPLORATION LOCATION LATITUDE AND LONGITUDE OF BORING LOCATION SHOWN ON LOCS ARE APPROXIMATE. MES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL | | | | | | | | | | | |
| ATT WEE | - | | 1 | | | | | | | | |
| BET UNIT | 150 | | 7 | 34 | 20 | | | | | | |
| ATIC | 150- | | | | | | | | | | |
| LOC | | | | | | | | | | | |
| INTE NLI | | | | | | | | | | | |
| DRAT BRAT | _ | - 130 - | | | | | | | | | |
| G:/PROJECT_DIRECTORES/4953/2010/101561_METRO_WESTSIDE_EXTENSION(6.2.3.2 FAULT HAZARD INVESTIGATION)3.2 ALL FIELD NOTES/GINT LOGS/101561_TRANSECT 1.GPV 1014/11 THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LATITUDE AND LONGITUDE OF BORING 1 SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRA | | 150 | | | | | | | END OF BORING AT | 130 FEET | |
| HEE | - | | | | | | | | NOTES: Boring backfilled with | cement/bentonite grout from bottom up | and patched |
| AT TI | | | | | | | | | - | | - |
| SNC Z | - | | | | | | | | Where observed, cont | in order of predominance (most predomin acts and bedding appear subhorizontal up | less otherwise noted. |
| DITIO | | | | | | | | | -Non-recovery interval noted. | s are assumed to occur at the bottom of r | un unless otherwise |
| | 145 — | | | | | | | | -Santa Monica Slate (J | sm) clasts are generally very dark gray, s s otherwise noted. Modelo Formation (T | ubangular to m) clasts are generally |
| EN | | | | | | | | | white to pale yellow to | tan, subangular to subrounded shale and | |
| JRF4 NS A | - | | | | | | | | otherwise noted. -The term "clasts" here | ein describes gravel-size rock fragments (| larger than 1/4 inch). |
| UBSI | | | | | | | | | -Beds are generally ma | assive unless otherwise noted. | |
| IATION OF SUBSURFACE CONDITIONS OTHER LOCATIONS AND AT OTHER TI | - | - 135 - | | | | | | | | | |
| TON LER | | | | | | | | | | | |
| TAT | - | | | | | | | | | | |
| IS AN INTERPRE | | | | | | | | | | | |
| NTE | - | | | | | | | | | | |
| | | | | | | | | | | | |
| D IS E CC | 140 | | 1 | | | | | | | | |
| THIS RECORD SUBSURFACE | | | | | | | | | | | |
| SV492 | - | | | | | | | | | | |
| HE | | _ 140 _ | | | | | | | | | |
| | | - 140 - | | | | | | | | Geologist: LH/MF | |
| | | | | | | | | | | Prepared/Date: YN/ Checked/Date: MW | WL/MW 10/13/2011 /MF 10/13/2011 |
| | МТА | West | side Su | ıbway [| Extens | sion | | | A | LOG OF | BORING |
| 1:/HK | | | | Califo | | | | | amec | Project No.: 4953-10-15 | |
| | | | | | | | | I | | | <u> </u> |



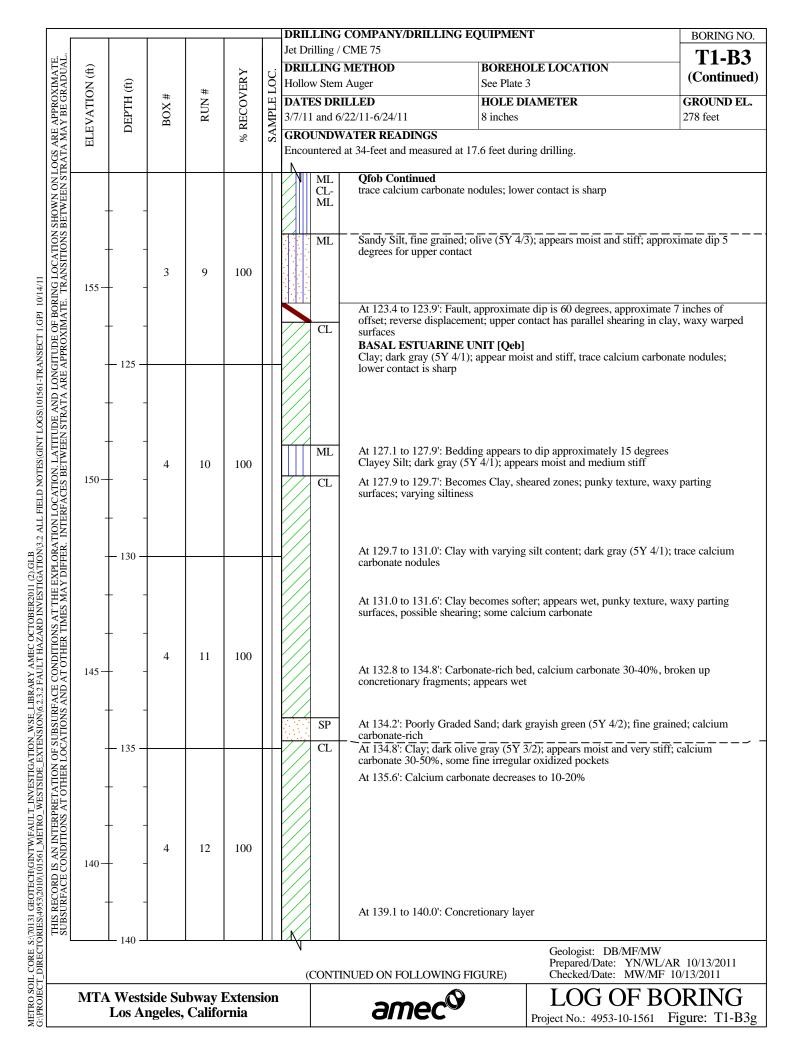
| | | | | | | Jet Drilling | G COMPANY/DRILI 5 / CME 75 | | BORING NO |
|----------------|--------|---------|-------|------------|------------|--------------|---|---|--|
| (ft) | | | | × | ເງ | | G METHOD | BOREHOLE LOCATION | T1-B3 |
| NC | (ft) | | # | /ER | ΓŎ | Hollow Ste | - | See Plate 3 | (Continued |
| JIL | HT | BOX # | RUN # | NO N | LE | DATES D | | HOLE DIAMETER | GROUND EL |
| ELEVATION (ft) | DEPTH | BO | RI | % RECOVERY | SAMPLE LOC | | 6/22/11-6/24/11 | 8 inches | 278 feet |
| ELE | | | | %] | SA | | WATER READINGS | | I |
| | | | | | | Encountere | ed at 34-feet and measu | red at 17.6 feet during drilling. | |
| | | 2 | 5 | 80 | | SM | Qfo Continued At 20.0 to 21.0' at | nd 23.8 to 24.4': Soil matrix grades to fine | to coarse sand with silt: |
| _ | L _ | | | | | | | 10YR 5/4); gravel as above | |
| | | | | | | | | | |
| - | | | | | | | | | |
| | | | | | | | | | |
| 255 — | | 2 | 6 | 100 | | ML | At 22.7 to 23.5': C 4/4); appears moi | layey to Sandy Silt, trace coarse sand; dar | k yellowish brown (10YR |
| | | | | | | SM | | | |
| - | | | | | | | | Occasional Sandy Silt lenses | |
| | | | | | | | | | |
| - | - 25 - | _ | | | | | + | | |
| | | 2 | 7 | 68 | ΙL | GW GW | (Jsm) and subang | vel with Sand, gravel 60-70%, up to 1 inch ular to subrounded shale (Tm) and quartzi | te, matrix is fine to coarse, |
| - | - + | | | | | | | brown (10YR 5/3); appears dry to damp; | |
| | | | | | + | | | | |
| - | + - | | | | | ML | Sandy Silt with C | lay, trace coarse sand; dark yellowish brow | \sqrt{n} (10YR $\frac{1}{6}$), appears |
| | | 2 | 8 | 68 | | | very moist and ve | ry stiff; lower contact occurs between runs | in (1011x 4/0), appears |
| 250- | + - | - | 0 | 00 | ΙL | | | | |
| | | | | | | | | | |
| - | † - | | | | \top | ML | Clayey Silt and Si (Ism and Tm): da | Ity Clay, trace to some fine sand, trace coark brown (10YR 3/3); appears very moist a | rse sand and fine gravel |
| | 20 | | | | | CL | lower contact occ | ars between runs | and sum to very sum; |
| - | - 30 - | 2 | 9 | 100 | | | | | |
| | L _ | | | | | | | | |
| | | | | | \square | | | | |
| - | - 1 | | | | | | | | |
| | | | | | | | | | |
| 245 — | - | 2 | 10 | 100 | | | | | |
| | | | | | | | At 34' Groundwa | ter encountered during drilling | |
| - | - | | | | ++ | ML | | Silt, trace coarse sand and fine gravel (Jsm | and Tm): lightly mottled |
| | | | | | | | color variable, ma | inly brown (10YR 5/3) to strong brown (7 | |
| - | - 35 - | _ | | _ | | | At 34.0 to 34.5': 0 | tiff; lower contact is gradational bravelly bed, clasts 10-20%, up to 3/4-inch | , mainly subangular slate |
| | | 3 | 11 | 96 | | | (Jsm) and subrout | nded shale (Tm) | |
| - | + - | | | | | | | | |
| | | | | | ╎╎ | | | | |
| - | + - | | | | | ML | | | |
| | | 3 | 12 | 100 | | | brownish gray (10 | o some clay, trace coarse sand; brown (10) YR 6/2) mottling; appears very moist to w | YR 5/3) with light yet and stiff; well sorted; |
| 240- | + - | 5 | 12 | 100 | | | lower contact is g | | |
| | | | | | | | | | |
| - | - - | | | | | | | | |
| | L 40 - | | | | | | | | |
| | 40 - | | | | | N | | Geologist: DB/M Prepared/Date: M | IF/MW (N/WL/AR 10/13/2011 |
| | | | | | | (CON | TINUED ON FOLLOW | TING FIGURE) Checked/Date: M | /W/MF 10/13/2011 |
| | Wests | | | | sion | | amed | | F BORING |
| | Los A | ugeres, | | orma | | | GINE | Project No.: 4953-10 | -1561 Figure: T1-B3 |

| | | | | | | Jet Drilling | G COMPANY/DRILL | | | BORING NO |
|----------------|--------|---------|--------|----------|---------------------|--------------|------------------------------------|--|---|--|
| | | | | | | - | G METHOD | BORFHOI | E LOCATION | — T1-B3 |
| N (fi | (ft) | | | 3R Y | OC. | Hollow Ster | | See Plate 3 | EDUCTION | (Continued |
| [O]] | I) H. | # > | RUN # | OVI | ΈL | DATES DE | - | HOLE DIA | METER | GROUND EL |
| VAJ | DEPTH | BOX # | RU | RECOVERY | SAMPLE LOC. | | 5/22/11-6/24/11 | 8 inches | | 278 feet |
| ELEVATION (ft) | | | | % R | SAI | | WATER READINGS | I | | |
| Η | | | | | | Encountere | d at 34-feet and measur | red at 17.6 feet during | drilling. | |
| | | 3 | 13 | 100 | \square | ML | Qfo Continued | | | |
| | | | | | | | | | | |
| - | | | | | | | | | | |
| - | | | | | | | | e | 1 1 1 1 1 (10) | |
| | | | | | | | At 42.0 to 43.2 : N (7.5YR 4/4) | lottling more distinct, | dark grayish brown (10Y | R 4/2) to brown |
| 235 — | + - | 3 | 14 | 100 | | | | | | |
| | | | | | | SM | Silty Sand, fine gr | ained; mottled, grayis | h brown $(\overline{2.5Y}, \overline{5/2})$ to strong ; lower contact appears no | ong brown (7.5YR |
| - | - | | | | \parallel | | (not intact) | and dense, well solled | , iower contact appears II | anowry gradadollal |
| | | | | | | | At 11 6 to 15 0'- C | rades to Sandy Silt | ith Clay | |
| - | - 45 - | _ | | | | ML SM | | rades to Sandy Silt w ittle or no mottling, g | rayish brown (10YR 5/4) | |
| | | 3 | 15 | 80 | | GW GW | OLDER FLUVIA | L DEPOSITS [Qfof |] | -late and the |
| - | + - | | | | ∟ | | subrounded slate | Jsm), some subround | 60-70%, up to 1 ¹ /2-inch; m ed shale and fine sandstor | ne (Tm), quartzite |
| | | | | | \square | <u> </u> | sand; very dark gr | ayish brown (10YR 3 | y clast-supported; soil ma /2); appears wet and dens | trix is fine to coarse e; abundant |
| - | + - | | | | | | manganese oxide | staining; lower contac | t occurs between runs | |
| 000 | | 3 | 16 | 80 | | | | | | |
| 230- | † - | | | | | | | | | |
| _ | L - | | | | | | At 48.5 to 49.5': S | oil matrix grades to cl | ayey sand, fine to coarse | grained |
| - | | | | | | | | | | |
| _ | - 50 - | | | | | | | | | |
| | | 4 | 17 | 80 | | <u>Č</u> | | | | |
| - | - | | | | L | | | | | |
| | | | | | $\left \right $ | SP | At 51.5 to 52.5' P | oorly Graded Sand· fi | ne to medium grained, ye | llowish brown |
| - | + - | | | | | | (10YR 5/4) | , <u> </u> | | |
| | | 4 | 10 | 70 | | C GW | | | | |
| 225 — | + - | 4 | 18 | 72 | L | N Q | | | | |
| | | | | | | | | | | |
| - | + - | | | | $\uparrow \uparrow$ | Qo | | | | |
| | | | | | | | | | | |
| - | - 55 - | 4 | 19 | 52 | ΙL | | At 55.3 to 56.5': N | o recovery | | |
| - | ļ _ | | | | | | AL 33.5 10 30.5 : N | o recovery | | |
| | | | | | $\left \right $ | / ML/ | ESTLADINE DE | POSITS - FINE GR | | |
| - | + - | | | | | CL MIL | Silty Clay and Cla | yey Silt, trace to some | e fine grained sand, trace of | coarse grained sand $\mathbf{P}_{\mathbf{A}}(A)$ |
| | | | | 10- | | | moist and very sti | | al clay beds; brown (7.5Y) | K 4/4), appears very |
| 220- | + - | 4 | 20 | 100 | | ML | At 58.0 to 58.8': C | rades to Sandy Silt w | ith Clay | |
| | | | | | | | | - | - | |
| - | + - | | | | \parallel | ML/ CL | At 59.0 to 60.0': L | ightly mottled, brown | (7.5YR 4/4) to yellowish | brown (10YR 5/4) |
| | _ 60 | | | | | | | | | |
| | L 60 — | | | - | | N. | | | Geologist: DB/MF/M Propagad (Data: XN/A) | W 71 / AD 10/12/2011 |
| | | | | | | (CONT | INUED ON FOLLOW | ING FIGURE) | Prepared/Date: YN/W Checked/Date: MW/M | AF 10/13/2011 |
| | West | | | | ion | | 2000 | 0. | LOG OF I | BORING |
| | Los A | ngeles, | Califo | rnia | | | amed | | | Figure: T1-B3 |



| | | | | | 1 1 | et Drilling / (| COMPANY/DRILL CME 75 | | | BORING NO |
|----------------|-------------------|---------|---------|----------|--------|-----------------|---|---|--|------------------------|
| ť) | | | | ~ | | DRILLING | | BOREHOI | E LOCATION | T1-B3 |
| L (f | (ft) | | | ER | | Iollow Stem | | See Plate 3 | | (Continued |
| OLI | H | # > | RUN # | IVO | H | DATES DRI | - | HOLE DIA | METER | GROUND EL |
| VAJ | DEPTH | BOX # | RU | RECOVERY | SAMPLE | /7/11 and 6/2 | 22/11-6/24/11 | 8 inches | | 278 feet |
| ELEVATION (ft) | | | | % R | SA | GROUNDW | ATER READINGS | | | |
| щ | | | | | E | Encountered a | at 34-feet and measur | ed at 17.6 feet during | g drilling. | |
| | | | | | | SM/ | Qe Continued | | | |
| - | | | | | | ML | appears moist and At 80.2': Gravelly | medium dense layer (1 inch thick); | ght olive brown (2.5Y 5/ very dark grayish brown ick-red sandstone clast | |
| 195 — | | 1 | 1 | 100 | | | At 82.6 to 83.7': Ir gradational | terbedded clayey silt | (2-6 inches thick); lowe | contact is narrowly |
| - | + - | | | | 0 | M | At 83.9 to 84.2': S | and with Gravel; classone (Tm); appears ver | ts mainly angular slate (. | lsm), subangular shale |
| | | | | | | ML | Clayey Silt; olive | (5Y 4/3), trace manga | inese staining, mottled or | idation; appears moist |
| - | - 85 - | | | | | | and stiff | | | |
| | | | | | | | | | | |
| - | | | | | | | At 86.3': Sharp co | ntact with sand laver | (1 inch thick), fine grain | ed, trace fine gravel |
| - | ļ - | | | | | | | | , | |
| | | 1 | 2 | 100 | | | | | | |
| 190 — | + - | 1 | <u></u> | 100 | | | | | | |
| | | | | | | | At 88 5' Gilty Son | d laver (3 inches this | k), some clay, trace fine | rravel: dark gravish |
| - | - | | | | | | brown (2.5Y 3/2); | appears moist and st | iff; trace manganese stair | ning, slight mottled |
| | | | | | | | oxidation | and to olive (EV 1/2) | boomes conderwith 1 | nth |
| - | - 90 - | | | | + | SM | OLDER FLUVIA | L FAN DEPOSITS |), becomes sandy with de [Ofof]] | • |
| | | | | | | | Silty Sand with so | me clay, coarsens do | wnward, increasing grave stone (Tm); appears very | |
| - | + - | | | | | | contact is narrowl | | (), appould (of | |
| | | | | | | | | | | |
| - | T - | | | 10- | | | | | | |
| 185 — | ļ _ | 1 | 3 | 100 | | | | | | |
| 105 | | | | | | So sw | Well Graded Sand subangular | with Gravel, clasts 1 | 5-30%, up to 3/4inch, m | ainly angular to |
| - | - | | | | | | ······································ | | | |
| | | | | | | | | | | |
| - | 95 - | | | <u> </u> | H | | At 94.6': Cobble, § | granitic | | |
| | | | | | | | | | | |
| - | + - | | | | | | At 95.8 to 96.5': C | lasts mainly angular | to subangular, granitic ro | ock and slate (Jsm), |
| | | | | | | GM | | | rzite; appears very mois h, mainly subangular sla | |
| - | + - | | | | | | sandstone (Tm); n very moist and der | natrix is fine to coarse | e silty sand; dark brown (| 10YR 3/3); appears |
| | | 2 | 4 | 90 | 0 | | , monse and doi | | | |
| 180- | + - | | | | | | | | | |
| | | | | | 0 | 29 I | | | | |
| - | T - | | | | | | | | | |
| | \lfloor_{100} – | | | | | <u>z</u> H | | | | |
| | 100 - | | | | | N | | | Geologist: DB/MF/N Prepared/Date: YN/ | |
| | | | | | | (CONTI | NUED ON FOLLOW | ING FIGURE) | Checked/Date: MW | MF 10/13/2011 |
| | Wests | | | | sion | | 2000 | O. | LOG OF | BORING |
| | Los A | ngeles. | Califo | rnia | | 1 | amed | | Project No.: 4953-10-150 | 51 Figure: T1-B3 |

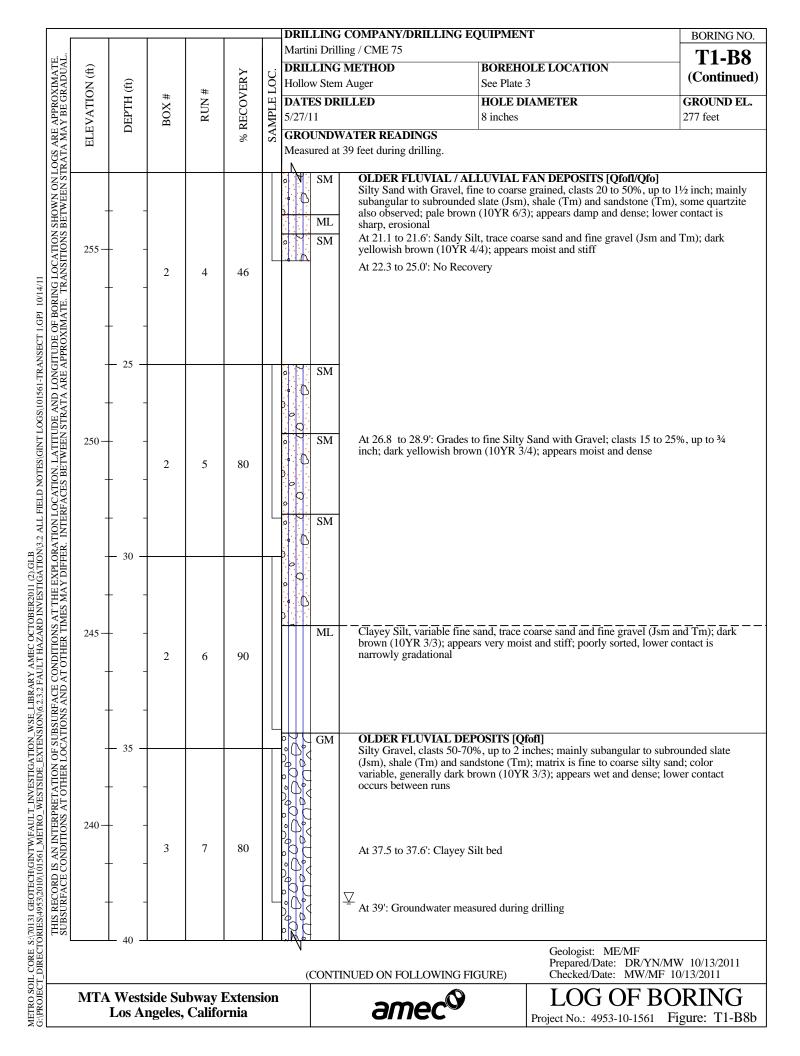
| | | | | | | Jet Drilling | G COMPANY/DRILL / CME 75 | | BORING NO |
|----------------|--------------------|--------|--------|------------|---------------------|--|--|--|--------------------------|
| (IJ | | | | X | ri | - | G METHOD | BOREHOLE LOCATION | T1-B3 |
|)N(| (ft) | | # | ER | ГŎ | Hollow Ste | m Auger | See Plate 3 | (Continued |
| VTIC | HT | BOX # | RUN # | NOC | LE] | DATES D | | HOLE DIAMETER | GROUND EL |
| ELEVATION (ft) | DEPTH | BO | RI | % RECOVERY | SAMPLE LOC. | | 6/22/11-6/24/11 | 8 inches | 278 feet |
| EL | | | | % | S≜ | | WATER READINGS ed at 34-feet and measured | red at 17.6 feet during drilling. | |
| | | | | | | N | | ed at 1710 feet daring arming. | |
| | | | | | | N SP | Qfofl Continued | | |
| - | - + | | | | | | | | |
| | | | | | | ML | | (5Y 4/3); some fine sand | |
| - | + - | | | | | | At 101.8-105': No | recovery | |
| | | 2 | 5 | 36 | | | | | |
| 175 - | + - | | | | | | | | |
| - | ļ _ | | | | | | | | |
| | | | | | | | | | |
| - | - 105 - | | | | $\left \right $ | :::::::::::::::::::::::::::::::::::::: | BASAL OLDEP | ALLUVIAL FAN UNIT [Qfob] | |
| | | | | | | ML | At 105': Silty Sand | d to Sandy Silt, fine grained; olive (5Y 5/4); ravel; poorly sorted | appears moist and |
| - | + - | | | | | | | iavoi, poorty soiteu | |
| | | | | | | | At 106.6': Thin Cl | ay bed; appears to dip approximately 15 de | grees |
| - | † - | | | | | | | • • • • | |
| 170- | L - | 2 | 6 | 94 | | | | | |
| 170- | | | | | | | At 108.2': Increasi | ng gravel | |
| - | - | | | | | ML | At 108.5 to 111.9' increasing with de | : Sandy Silt, varying amount of clay and fir pth, lower contact is gradational | e sand, sand content |
| | | | | | | | | | |
| - | - 110 - | | | | + | | | | |
| | | | | | | | At 110.4-112.4': C | Calcium carbonate nodules and trace manga | nese staining |
| - | + - | | | | | | | | |
| _ | L _ | | | | | | Cilty Cond Fire - | ained come silt trace class trace come | d and fine grovel (large |
| | | 3 | 7 | 100 | | SM | and Tm); dark yel | ained, some silt, trace clay, trace coarse san lowish bown (10YR 4/4) to yellowish brow | n (10YR 5/3); appears |
| 165 — | + - | | | 100 | | | moist and dense, t | race calcium carbonate nodules; lower cont | act is gradational |
| | | | | | | | | | |
| - | + - | | | | | | | | |
| | | | | | | | | | |
| - | - 115 - | | | | $\uparrow \uparrow$ | | | | |
| _ | L _ | | | | | | | | |
| - | | | | | | | | | |
| - | - | | | | | | | | |
| | | 3 | 8 | 100 | | | | | |
| 160- | + - | | | | | | | | |
| | | | | | | | | | |
| - | + - | | | | | | | ay bed, appears near horizontal | |
| | L ₁₂₀ _ | | | | | CL- | Silty Clay; dark g | rayish brown (2.5Y 4/2); appears moist and | very stiff; |
| | - | | | | | N (CON | TINUED ON FOLLOW | | N/WL/AR 10/13/2011 |
| | West | | | | sion | | 2000 | LOG OF | F BORING |
| | I og A | ngeles | Califo | rnia | | | amed | Project No.: 4953-10-1 | |

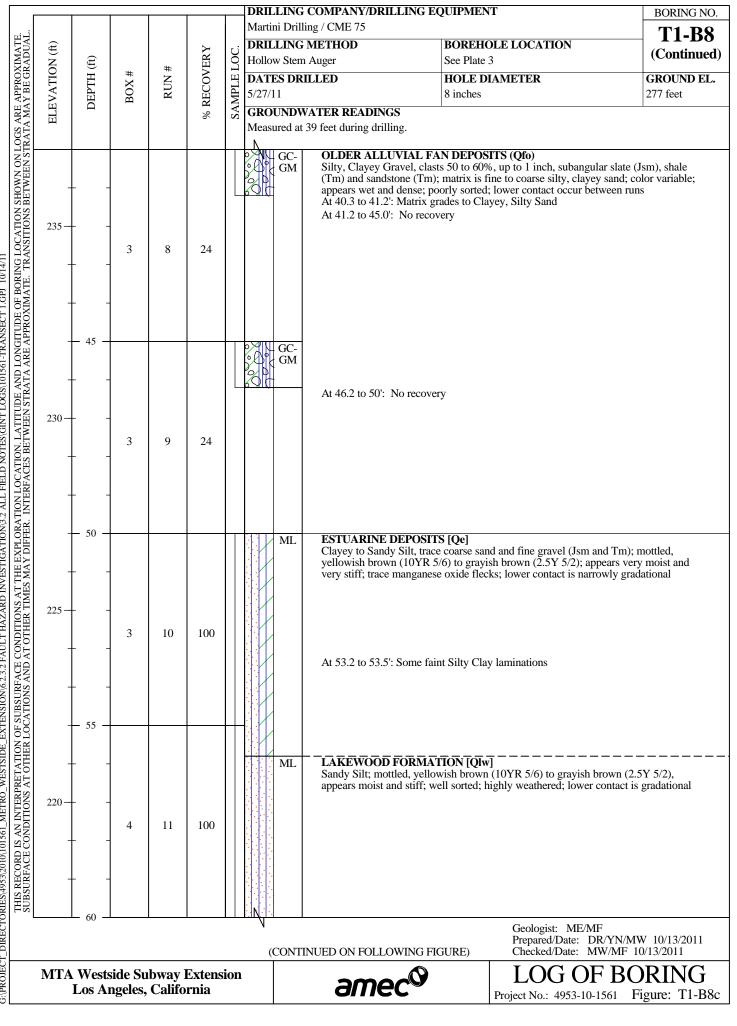


| | | 1 | 1 | | | | | COMPANY/DRILLING E | QUIPMENT | BORING NO. |
|---|------------|---------|--------|------------|-------------|----------|-------|--|---|--------------------------|
| AL. | | | | | | | - | CME 75 METHOD | DODELLOI E LOCATION | — T1-B3 |
| ARE APPROXIMAT MAY BE GRADUA ELEVATION (ft) | £ | | | RΥ | С. | | | Auger | BOREHOLE LOCATION See Plate 3 | (Continued) |
| IO GRA | H (f | # | # 7 | OVE | ELC | | | ILED | HOLE DIAMETER | GROUND EL. |
| APR BE | DEPTH (ft) | BOX # | RUN # | ECC | IPLJ | | | /22/11-6/24/11 | 8 inches | 278 feet |
| RE A MAY LEV | D D | | | % RECOVERY | SAMPLE LOC. | | | ATER READINGS | | |
| E | | | | 0 | | | | at 34-feet and measured at 1' | 7.6 feet during drilling. | |
| TRA | | | | | | | | Och Continued | | |
| AT THE EXPLORATION LOCATION. LATITUDE AND LONGITUDE OF BORING LOCATION SHOWN ON LOGS ARE APPROXIMATE. MES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL 01 01 01 01 01 01 01 01 01 01 01 01 01 | | | | | | | | Qeb Continued At 140-141.0': No sample | ing | |
| MOH | + - | | | | | | CL | Clay: black (5Y 2 5/1): at | opears damp to moist and very stiff; thi | n to laminated |
| IS BE | | | | | | | | oxidized layers/lenses; so | me (5-10%) calcium carbonate nodules | , up to $1/4$ inch, some |
| OILE | + - | - | | | | | | fine oxidized silt pockets | | |
| ANSI | | | | | | <u> </u> | SP | At 142.5 to 142.8': Poorly | Graded Sand; fine grained | |
| 02 135- | + - | 5 | 13 | 95 | | | CL | | | |
| ATE. | | | | | | | | | | |
| XIM | + - | - | | | | | | | | |
| PRODE | | | | | | | | | | |
| EAP | + 145 - | | | | | | | At 145.0 to 147.0': Clay a | ppears sheared punky texture with war | xy parting surfaces; |
| AAR | | | | | | | | black (5Y 2.5/2); appears | damp and stiff | |
| ANI RAT/ | + - | - | | | | | | | | |
| UDE V STI | | | | | | | | | | |
| VEEN | + - | | | | | | | At 147.0': soft, possibly s | sheared, zone, (1/2-inch thick) | |
| BETV. | | 5 | 14 | 70 | | | | At 147.5 to 148.5': Some | Silty Sand interbeds (gradational transi | tion to unit below) |
| I 130- | + - | | | | | | | | | |
| OC/ RFA(| | | | | | | | At 148.5 to 150.0': No rec | covery | |
| INI | + - | - | | | | | | | | |
| R. II | | | | | | | | | | |
| AT THE EXPLORATION LOCATION. LATITUDE AND LONGITUDE OF BORING I MES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRA 132 - 001 | + 150 - | | | | | | SP | SAN PEDRO FORMAT | TON [Qsp] to medium grained; black (N 2.51); ap | maara wat and dance |
| EEX | | | | | | | | At 150.5': Becomes grave | lly | pears wet and dense |
| T TH SE M | T I | | | | | | | At 150.9 to 155.0': No rec | covery | |
| VS A' | | | | | | | | | | |
| HER | T | | | | | | | | | |
| | | 5 | 15 | 20 | | | | | | |
| D ATC | | | | | | | | | | |
| SAN | ļ . | | | | | | | | | |
| TON | | | | | | | | | | |
| F SUI | - 155 - | | | | | | | | | |
| THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TI 100-0710005 AT OTHER LOCATIONS AND AT OTHER TI | | | | | | 0 0 | SP | | Gravel; fine to medium grained, suban unded to subangular slate (Jsm) | gular fine to coarse |
| ATIC | ļ . | - | | | | | SP | At 155.9 to 156.1': Poorly | Graded Sand, some silt, very fine grai | |
| AT C | | | | | | | | | Graded Sand with Gravel bed, fine to (Jsm) gravel; appears wet and medium | |
| IERF | + - | - | | | | ···· | | At 156.3 to 156.8': Poorly | Graded Sand; fine to medium grained | |
| | | 5 | 16 | 36 | | | | medium dense At 156.8 to 160.0': No rec | covery | |
| SOO 120- | + - | | | 50 | | | | | | |
| ACE (| | | | | | | | | | |
| JRF/ | + - | - | | | | | | | | |
| HIS I UBS(| | | | | | | | | | |
| N.S. | L 160 - | | | | | L | | | | MX 7 |
| | | | | | | • | | | Geologist: DB/MF/M Prepared/Date: YN/V | WL/AR 10/13/2011 |
| THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TI 150- | | | | | | ((| CONTI | NUED ON FOLLOWING FI | , | |
| MTA | A West | | | | sion | | | amec® | LOG OF | BORING |
| | Los A | ngeles, | Califo | ornia | | | | סוווכני | Project No.: 4953-10-156 | 51 Figure: T1-B3h |
| | | | | | | | | | | |

| | | | | | | DRILLING COMPANY/DR Jet Drilling / CME 75 | ILLING EQUIPMENT | BORING NO |
|----------------|------------|---------|--------|---|-------------|--|--|--|
| | | | | | | DRILLING METHOD | BOREHOLE LOCATION | T1-B3 |
| N (fi | £ | | | ſRΥ | OC. | Hollow Stem Auger | See Plate 3 | (Continued |
| IOI | H (f | # | # 7 |)VE | ΕĽ | DATES DRILLED | HOLE DIAMETER | GROUND EL |
| ELEVATION (ft) | DEPTH (ft) | BOX # | RUN # | % RECOVERY | SAMPLE LOC. | 3/7/11 and 6/22/11-6/24/11 | 8 inches | 278 feet |
| LE/ | DE | В | | 6 RI | AM: | GROUNDWATER READIN | | |
| EI | | | | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | S | | asured at 17.6 feet during drilling. | |
| | | | | | - | N END OF BOR | ING AT 160 FEET | |
| | | | | | | NOTES: Boring backfil | led with cement/bentonite grout from bottom u | o and patched. |
| | | | | | | -Munsell color -Where observ | s listed in order of predominance (most predom red, contacts and bedding appear subhorizontal | inant color first). unless otherwise noted. |
| | | | | | | noted. | intervals are assumed to occur at the bottom of Slate (Jsm) clasts are generally very dark gray. | |
| 115 - | + + | | | | | subrounded sla white to pale y | ate unless otherwise noted. Modelo Formation (ellow to tan, subangular to subrounded shale a | Tm) clasts are generally |
| | | | | | | otherwise note -The term "cla -Beds are gene | d. sts" herein describes gravel-size rock fragments rally massive unless otherwise noted. | (larger than 1/4 inch). |
| | - 165 - | | | | | Boring extende | ed from 84-feet to 160-feet on 6/22/11-6/24/11. | offset from original |
| | | | | | | | approximately less than 1-foot, north east. | |
| - | 1 | | | | | | | |
| - | + | | | | | | | |
| 110- | | | | | | | | |
| | | | | | | | | |
| | † 1 | | | | | | | |
| | - 170 - | | | | | | | |
| - | | | | | | | | |
| | | | | | | | | |
| - | † 1 | | | | | | | |
| 105 - | + $+$ | | | | | | | |
| | | | | | | | | |
| | † 1 | | | | | | | |
| | - 175 - | | | | | | | |
| | | | | | | | | |
| | † 1 | | | | | | | |
| | + | | | | | | | |
| 100 | | | | | | | | |
| 100- | † 1 | | | | | | | |
| | + | | | | | | | |
| | | | | | | | | |
| | | | | | | | Geologist: DB/MF Prepared/Date: YI Checked/Date: M | N/WL/AR 10/13/2011 |
| MTA | Wests | | | | sion | ame | LOG OF | BORING |
| | Los Ai | ngeles, | Califo | rnıa | | | Project No.: 4953-10-1 | 561 Figure: T1-B3 |

| | | | | | | | COMPANY/DRILLI ing / CME 75 | ING EQUIPMENT | BORING NO |
|--|------------|-------|----------------|------------|----------|-------------|---|--|---|
| (ff) | | | | Y | | DRILLING | - | BOREHOLE LOCATION | T1-B8 |
| ELEVATION (ft) | (ft) | # | # | % RECOVERY | | Hollow Stem | - | See Plate 3 | |
| ATIC | DEPTH (ft) | BOX # | RUN # | CO | PLE | DATES DR | ILLED | HOLE DIAMETER | GROUND EL |
| EV. | DEI | B(| N N | RE | | 5/27/11 | ATER READINGS | 8 inches | 277 feet |
| EL | | | | % | | | 39 feet during drilling. | | |
| | | | | | | | 18 inch thick Asph | altic Concrete | |
| | | | | | | | Hand augered to 6 | feet | |
| IES MAT DIFFEK. INTERFACES BEI WEEN STRATA AKE AFFROALMATE. IKANSILIONS BEI WEEN STRATA MAT BE GRADUAL | | | | | | ML | inches, (mainly Jsn | ilt, variable coarse sand and fine gravel, cla n and Tm); color variable, mainly dark yell to very moist and very stiff; trace asphalt a | owish brown (10YR |
| | | | | | | | NOTE: | | |
| - | | | | | | | Jsm = Santa Monic Tm = Modelo Form See end of log for r | | |
| 270- | - | | | | | | | | |
| | | 1 | 1 | 100 | | | | | |
| LALDE | | | | | | | | | |
| | + - | | | | | | | | |
| | - 10 - | | | | | | | | |
| | - 10 - | | | | | | | | |
| | + - | | | | | | | | |
| | | | | | | | | | |
| 265 — | | 1 | | 100 | | | | | |
| | | 1 | 2 | 100 | | | | | |
| 265 – 265 – | | | | | | | | | |
| | + - | | | | | | | | |
| | - 15 - | | | | | | | | |
| | | | | | | | | | |
| - 15 | + - | | | | | ML | OLDER ALLUVI | AL FAN DEPOSITS [Qfo] | |
| | | | | | | | Sandy Silt, trace to yellowish brown (1 | some clay, trace coarse sand and fine grave (0YR 3/4); appears damp to moist and very | el (Jsm and Tm); dark stiff; lower contact |
| 260- | † - | _ | | | | | occurs between run At 17.0 to 17.3' and | ns d 18.6 to 19.2': Gravel increase to 20-25%, | |
| | | 1 | 3 | 90 | | | brick-red sandstone | e (Tm) | |
| ALE | | | | | | | | | |
| | + - | | | | | | | | |
| | | | | | | N | | | |
| L | L 20 - | | | | <u> </u> | (CONTI | NUED ON FOLLOWI | | R/YN/MW 10/13/2011 |
| | Wests | | bway Califo | | ion | | amec | , | F BORING 561 Figure: T1-B |



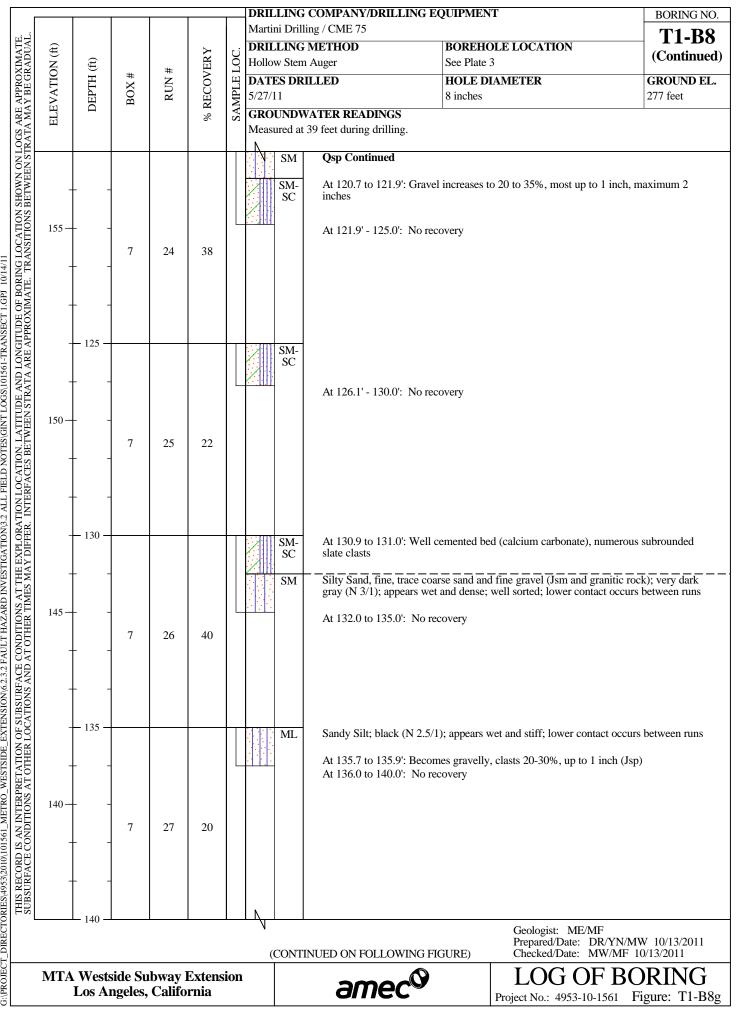


METRO SOIL CORE 5:/70131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB G:/PROJECT_DIRECTORIES/4953/2010/101561_METRO_WESTSIDE_EXTENSION/6.2.3.2.FAULT HAZARD INVESTIGATION/3.2 ALL FIELD NOTES/GINT LOGS/101561-TRANSECT 1.GPI 10/14/11

| (ii) NOLLEAATIE | | | | RY | DC. | DRILLING COMPANY/DRILI Martini Drilling / CME 75 DRILLING METHOD Hollow Stem Auger | BOREHOLE LOCATION See Plate 3 | BORING NO. T1-B8 (Continued) |
|-----------------|------------|-------|-------|------------|-------------|---|---|--|
| ELEVATION (ft) | DEPTH (ft) | BOX # | RUN # | % RECOVERY | SAMPLE LOC. | DATES DRILLED 5/27/11 GROUNDWATER READINGS | HOLE DIAMETER 8 inches | GROUND EL. 277 feet |
| 215 | | 4 | 12 | 100 | | 5-10% manganese At 61.6 to 62.3': C CL/ CH hard; abundant ma up to ¼ inch | ay; olive brown (2.5Y 4/4); appears very mo oxide flecks; highly weathered olor becomes brown (7.5YR 4/4) - Clay; dark gray (5Y 4/1); appears very mo inganese oxide flecks and staining; trace cal 0 to 30% cemented manganese oxide nodule | ist and very stiff to |
| | - 65 - | | | | | 4/4) to white (10) development, calc | - Carbonate Soil Horizon - Clay and Silty R 8/1); appears moist and very stiff; extensi ium carbonate occurs as dispersed deposits i calcium carbonate 70 to 90%; lower contact | ve calcium carbonate and cemented nodules |
| - | | 4 | 13 | 100 | | At 69.1 to 71.2': C | alcium carbonate decreases to about 30 to 5 | 50% |
| - 205 | | 5 | 14 | 100 | | dense; calcium ca inch, total calcium At 72.6 to 72.7': C Clay; olive gray (: | ne grained; light brownish gray (2.5Y 6/2); bonate occurs as dispersed deposits and cer carbonate 25 to 50% alcium carbonate >80%, cemented concretivity $4/2$), occasional strong brown (7.5YR 5/8 at and very stiff to hard; variable (0-10%) ma additional | nented nodules up to $\frac{3}{4}$ ons up to $\frac{1}{2}$ inches 3) mottling; appears |
| - | - 75 - | | | | | At 72.8 to 73.1': C deposits and conc At 73.4 to 73.7': F | alcium carbonate-rich bed, calcium carbonat etions up to 1 inch, total calcium carbonate ighly oxidized bed; strong brown (7.5YR 5, olor becomes dark grayish brown (10YR 4/ | 60-70% /8) predominant |
| 200 — | | 5 | 15 | 100 | | CL At 76.9 to 77.9': S appears moist and At 77.5': soft/shea At 77.9 to 78.6': I | rades to Clayey to Sandy Silt ilty Clay, dark greenish gray (10Y 3/1) to ol very stiff; some waxy parting surfaces red clay seam, seam is wavy, subhorizontal ncreasing sand; gradational transition to unit ind with Silt, fine grained; greenish gray (100 | to 10 degrees t below |
| 205 | 80 - | | | | | SM and dense | rades to fine to medium Poorly Graded San Geologist: ME/MF | d; light greenish gray |
| | Wests | | | | sion | (CONTINUED ON FOLLOW | ING FIGURE) Checked/Date: M | BORING 561 Figure: T1-B8 |

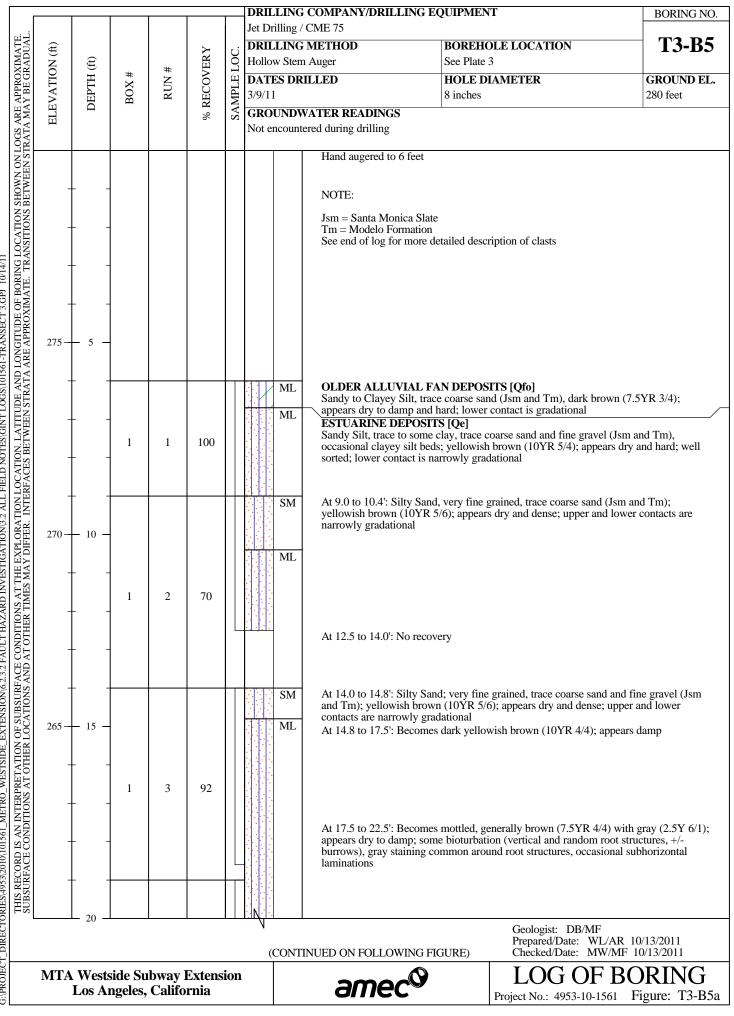
| шIJ | | | | | | | Martin | ni Dril | COMPANY/DRILLING EQ ling / CME 75 | | BORING NO. T1-B8 |
|--|----------------|-----------------|-------|-------|------------|----------|----------------------|-----------|---|--|----------------------------|
| KIMAT KADUA | ELEVATION (ft) | (ft) | | # | ERY | LOC. | | | METHOD | BOREHOLE LOCATION See Plate 3 | (Continued) |
| PPROX BE GF | ATIO | DEPTH (ft) | BOX # | RUN # | % RECOVERY | SAMPLE I | DAT 5/27/1 | | ILLED | HOLE DIAMETER 8 inches | GROUND EL. 277 feet |
| GS ARE A ATA MAY | ELEV | DE | В | Н | % RI | SAM | GRO | UNDV | VATER READINGS 39 feet during drilling. | | 2771000 |
| I ON LO | | | | | | | | | Qlw Continued | | |
| OCA | - 195 | | 5 | 16 | 44 | | | SM- SC | At 81.2 to 82.2': Increasing clayey, silty sand; dark gre At 82.2 to 85.0': No recove | | o medium grained, |
| RANSECT GITUDE APPROX | - | - 85 - | | | | | | SP- | | | |
| r LOGS/101561-TI rude and lon N STRATA ARF | - | | | | | | | SM | At 85.3 to 86.0': Marker I brownish gray (2.5Y 6/2); At 86.0': 3 ¹ / ₂ inch rounded At 86.0 to 90.0': No recove | | ed Sand; light 1 gravel |
| L FIELD NOTES/GINT LOCATION. LATIT ERFACES BETWEEI | 190- | | 5 | 17 | 20 | | | | | | |
| STIGATION/3.2 AL E EXPLORATION AY DIFFER. INT | _ | - 90 - | | | | | | SM | micaceous; lower contact is | | |
| RD INVE IS AT TH TIMES M | 105 | | | | | | | | yellowish red (5Y 4/6) | oxidized, mottled, light yellowish bro | wn (2.5Y 6/4) to |
| G:/PROJECT_DIRECTORIES/4953/2010/101561_JMETRO_WESTSIDE_EXTENSION/6.2.3.2 FAULT HAZARD INVESTIGATION;3.2 ALL FIELD NOTES/GINT LOGS/101561-TRANSECT 1.GPI 10/14/11 THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. LATITUDE AND LONGITUDE OF BORING I SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRA | - 185 | | 6 | 18 | 70 | | | SM/ ML | | ON (Qsp) very fine grained, dark greenish gray g; appears wet and medium stiff; mic | |
| DE_EXTENSION OF SUBS | - | - 95 - | | | | | | | At 95.0 to100.0': No recove | ery | |
| ERPRETATI ISPRETATI INS AT OTH. | - 180 | | | | | | | | | | |
| VI01561_MET | - | | 6 | 19 | 0 | | | | | | |
| ES/4953/2010 IIS RECORI IBSURFACI | - | | | | | | | | | | |
| | | _ 100 _ | | | | | | | INUED ON FOLLOWING FIC | Geologist: ME/MF Prepared/Date: DR/ GURE) Checked/Date: MW | YN/MW 10/13/2011 |
| | | Wests Los Ai | | | | sion | | | amec [©] | | BORING |

| | | | | | | | | COMPANY/DRILLING EQUI ing / CME 75 | PMENT | BORING NO. |
|--|-------------------|-------|-------|------------|-----|--------|------------------------|---|---|--|
| DUAL. | | | | X | C. | DRII | LING | METHOD BC | DREHOLE LOCATION | (Continued) |
| ONIN GRAI | (ft) | # | # | VER | ELO | | | • | e Plate 3 DLE DIAMETER | GROUND EL. |
| ARE APPROXIMAT MAY BE GRADUA ELEVATION (ft) | DEPTH (ft) | BOX # | RUN # | % RECOVERY | | 5/27/1 | | | nches | 277 feet |
| ELEV | | щ | | % R | SAN | | | ATER READINGS | | |
| OGS / | | | | | | Measu | ured at | 39 feet during drilling. | | |
| AT THE EXPLORATION LOCATION. LATITUDE AND LONGITUDE OF BORING LOCATION SHOWN ON LOGS ARE APPROXIMATE. MES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL 0. BLEVATION (f) | | 6 | 20 | 30 | | | SM/ ML | Osp Continued At 100.2 to 100.6': Grades to 0 brown (7.5YR 4/6) mottling; a At 101.5 to 110.0': No recover | | Y 4/1) with strong |
| ND LONGITUDE OF B TA ARE APPROXIMA | - 105 - | | | | | | | | | |
| OCATION. LATITUDE A RFACES BETWEEN STR/ - 0.01 | | 6 | 21 | 0 | | | | | | |
| AT THE EXPLORATION MES MAY DIFFER. INTE | - 110 - | | | | | | SP- SM CL- CH | and dense; slightly micaceous | fine grained, very dark gray (2.5Y; lower contact is sharp, dips approx \overline{k} (2.5Y 2.5/1); appears moist and y hes; lower contact is gradational | ximately 5 degrees |
| OF SUBSURFACE CONDITIONS LOCATIONS AND AT OTHER TI | | 6 | 22 | 56 | | | SM- SC | Clayey, Silty Sand, fine graine up to ½ inch, mainly granitic 1 and dense; lower contact is gr. At 112.8 to 115.0': No recover | | avel, clasts 5-20%, appears very moist |
| IS AN INTERPRETATION OF SUB CONDITIONS AT OTHER LOCATI | - 115 - | | | | | | SM- SC | At 116.0 to 117.7': Gradationa becomes moderately cemented | al lightening of color, grades to dar l (calcium carbonate) | k gray (N 4); |
| THIS RECORD IS AN INTE SUBSURFACE CONDITIO | | 6 | 23 | 84 | | | SM | below At 117.7 to 120.7': Silty Sand, | g coarse sand and gravel, gradatior fine grained; greenish gray (N 5/1 cemented (calcium carbonate), fra |) to dark gray (N 4); |
| | L 120 - | | • | | · | | CONTI | NUED ON FOLLOWING FIGUF | Geologist: ME/MF Prepared/Date: DR/Y RE) Checked/Date: MW/ | |
| | A Wests Los Ai | | | | ion | | | amec® | LOG OF Project No.: 4953-10-156 | |



METRO SOIL CORE 5:/70131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB G:/PROJECT_DIRECTORIES/4953/2010/101561_METRO_WESTSIDE_EXTENSION/6.2.3.2.FAULT HAZARD INVESTIGATION/3.2 ALL FIELD NOTES/GINT LOGS/101561-TRANSECT 1.GPI 10/14/11

| | | | | | 1 | | | | COMPANY/DRILLING I | EQUIPMENT | BORING NO. |
|---|----------------|-----------------|-------|-------|------------|--------|---------|----|---|--|--|
| μĻ | - | | | | | | | | ling / CME 75 | | T1-B8 |
| MAT DU/ | [[t] | æ | | | RY | LOC. | | | n Auger | BOREHOLE LOCATION See Plate 3 | (Continued) |
| OXII GRA | ION | H (fi | # | # 7 | OVE. | ELC | | | | HOLE DIAMETER | GROUND EL. |
| APR BE | /AT | DEPTH (ft) | BOX # | RUN # | ECC | IPLI | 5/27/ | | ILLED | 8 inches | 277 feet |
| RE A MAY | ELEVATION (ft) | DF | щ | | % RECOVERY | SAMPLE | | | VATER READINGS | | |
| GS A | Щ | | | | | | | | 39 feet during drilling. | | |
| ON SHOWN ON LC NS BETWEEN STR | - | | | | | | | SM | gray (N 3/1); appears we | mes well cemented, fractured in 1 to 2 | |
| D INVESTIGATION(3.2 ALL FIELD NOTES/GINT LOGS/101561-TRANSECT 1.GPI 10/14/11 AT THE EXPLORATION LOCATION. LATITUDE AND LONGITUDE OF BORING LOCATION SHOWN ON LOGS ARE APPROXIMATE. MES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL | | | 7 | 28 | 30 | | | | | | |
| -TRANSECT ONGITUDE RE APPROJ | - | — 145 — | | | | | | SM | | | |
| JDE AND LOSTRATA A | - | | | | | | | | | | |
| TES\GINT I N. LATITU BETWEEN | 130- | | 7 | 29 | 36 | | <u></u> | | At 146.9' - 150.0': No re | covery | |
| L FIELD NO LOCATIO ERFACES 1 | - | | | | | | | | | | |
| TON(3.2 ALI CORATION FFER. INTI | - | - 150 - | | | | | | | END OF BORING AT 1 | 50 FEET | |
| EXPI | | | | | | | | | NOTES: | | |
| THE | - | | | | | | | | | | |
| TONS AT | 125— | | | | | | | | -Munsell colors listed in | ement/bentonite grout from bottom up order of predominance (most predomi cts and bedding appear subhorizontal u | nant color first). |
| G:(PROJECT_DIRECTORES/4953/2010/1016/LMETRO_WESTSIDE_EXTENSION)6.2.3.2 FAULT HAZARD THIS RECORD IS AN INTERPRETATION OF SUBSURFACE CONDITIONS. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIN | - | | | | | | | | -Non-recovery intervals noted. -Santa Monica Slate (Jsn | are assumed to occur at the bottom of n n) clasts are generally very dark gray, otherwise noted. Modelo Formation (T | run cunless otherwise subangular to |
| THIS RECORD IS AN INTERPRETATION OF SUBSURFACE SUBSURFACE SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND | - | | | | | | | | white to pale yellow to ta otherwise noted. | an, subangular to subrounded shale an | d sandstone unless |
| SUBS | | 155 | | | | | | | | a describes gravel-size rock fragments of sive unless otherwise noted. | iaigei uiali 1/4 illeii). |
| R LO(| - | — 155 — | | | | | | | | | |
| ATIO | - | | | | | | | | | | |
| PRET AT C | | | | | | | | | | | |
| IONS | 120- | | | | | | | | | | |
| AN IP | | | | | | | | | | | |
| D IS, | - | | | | | | | | | | |
| 3/201(3/201(3/20R | | | | | | | | | | | |
| IS RE BSUR | - | | | | | | | | | | |
| | | 160 | | | | | | | | | |
| | | | | | | | | | | Geologist: ME/MF Prepared/Date: DR Checked/Date: MV | /YN/MW 10/13/2011 //MF 10/13/2011 |
| G:\PROJEC | | Wests Los Ai | | | | sion | | | amec [©] | | BORING Figure: T1-B8h |

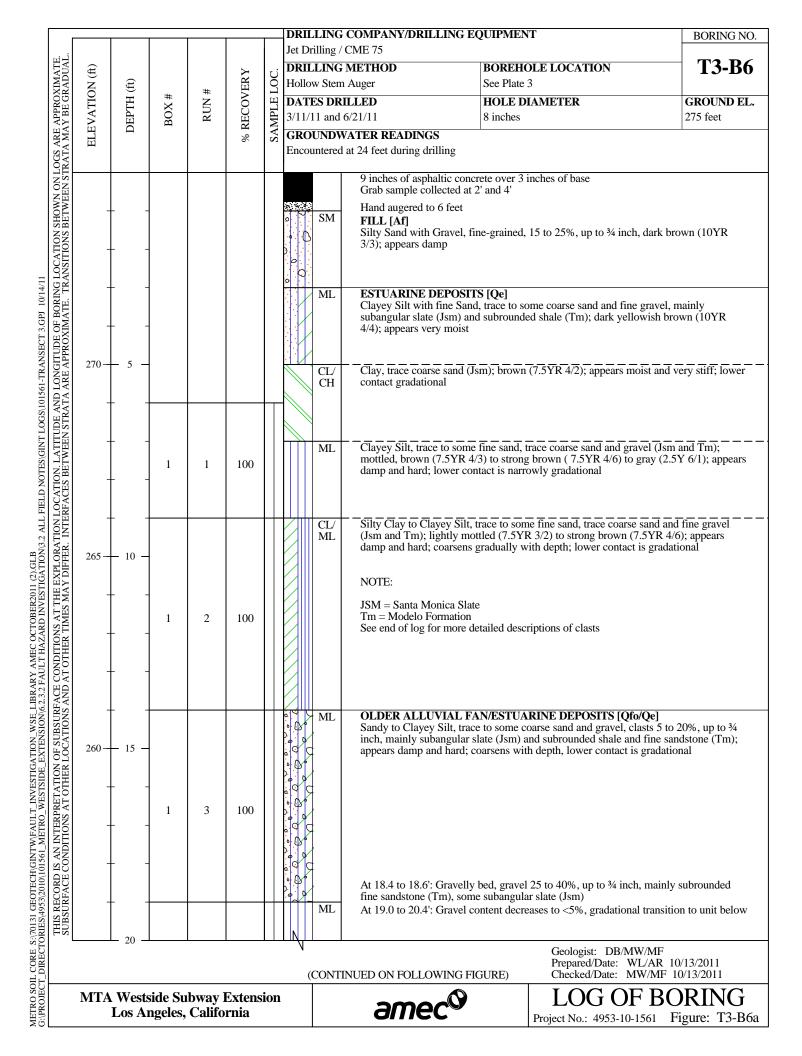


METRO SOIL CORE 5:/70131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB G:/PROJECT_DIRECTORIES/4953/2010/101561_METRO_WESTSIDE_EXTENSION/6.2.3.2.FAULT HAZARD INVESTIGATION/3.2 ALL FIELD NOTES/GINT LOGS/101561-TRANSECT 3.GPI 10/14/11

| | | | | | | Jet Drilling | COMPANY/DRILI | LING EQUIT MENT | BORING NO |
|---|--------------|---------|-----------|------------|----------|--------------|---|---|--------------------------|
| (1) (I) | | | | 7 | | DRILLING | | BOREHOLE LOCATION | T3-B5 |
| | (ff | | * | ER | | Hollow Sten | n Auger | See Plate 3 | (Continued |
| TIC | HT | BOX # | RUN # | 20V | LEI | DATES DR | ILLED | HOLE DIAMETER | GROUND EL |
| MAY BE GRADUA ELEVATION (ft) | DEPTH (ft) | BO | RI | % RECOVERY | | 3/9/11 | | 8 inches | 280 feet |
| S MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL C C C C C C C C C C C C C | | | | % | SA | | WATER READINGS bered during drilling | | |
| LSN | | | | | | N ML | Qe Continued | | |
| WEE | | | | | | | | | |
| BEI | | | | 0.0 | | | | | |
| NOL | + | 2 | 4 | 86 | | | | | |
| LISN | | | | | | ML | Paleosol - Marko | er Bed M _G - Clayey Silt, trace to some sand | · lightly mottled dark |
| TRA | + | - | | | | IVIL | grayish brown (10 |)YR 4/2) to reddish brown (5YR 5/4); appe | ars damp and hard; some |
| ATE. | | | | | | | contact appears g | l laminations; weak ped development, some radational (not intact) | ciay mins, lower |
| MIX | + | - | | | | | | | |
| PPRC | | | | | | | | | |
| V 25: 25: 25: 25: | 5 - 25 | 1 | | | | | | | |
| TAA | \downarrow | | | | | | At 25.5 to 26.4': A | Appears damp to moist and very stiff | |
| TRA | | | _ | | | М | At 26 1 to 27 5' V | Veathering zone, gradational transition to La | kewood Formation |
| JENS | + | 2 | 5 | 92 | | ML | below | reactoring zone, grauational transition to La | ikewoou Poliiialioii |
| STWI | | | | | | CN// | LAKEWOOD F | ORMATION [Qlw] | |
| ES BE | + | - | | | | SM/ ML | Silty Sand and Sa | ndy Silt; very fine-grained, mottled, pale bro | own (2.5Y 8/3) to yellow |
| FACI | | | | | | | subhorizontal oxid | ars dry to damp and dense/very stiff; well so lized laminations; lower contact occurs betw | veen runs |
| NTER | + | + | | | + - | | | | |
| R. L | | | | | | | | | |
| 표 250 표 250 | 0 + 30 | 1 | | | | | | | |
| IAYI | | | | | | | | | |
| | | 2 | 6 | 86 | | | | | |
| R TIN | + | - 2 | 0 | 80 | | | | | |
| THE | | | | | | | | | |
| ATC | + | - | | | | | | | |
| AND | | | | | | | | | |
| SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIM 55 | † | 1 | | | \top | SM | Silty Sand, fine g | rained, trace coarse sand; brownish yellow ($25X7/2$) mottling; appears dry and day | 10YR 6/6) with |
| CATI | 5 - 35 | | | | | | occasional light g | ray (2.5Y 7/2) mottling; appears dry and der ray, subhorizontal laminations, lower contact | t appears narrowly |
| | 5 - 35 | 3 | 7 | 40 | | | At 35.0 to 36.5': N | tact) | |
| THE | 1 | | | | | | Note: Marker Bec | M _F not observed. (shell bed). Possibly occu | Irs in non-recoverv zone |
| ATC | | | | | | | above based on st | ratigraphic position in other borings. | |
| ONS | + | - | | | | | | | |
| ITIU | | | | _ | | SP- SM | Poorly Graded Sa | nd with Silt; fine grained, very pale brown (contact appears narrowly gradational (not ir | 10YR 7/4); appears dry |
| COL | + | 3 | 8 | 80 | | SM | and dense; lower | contact appears narrowry gradadonal (not if | nact) |
| FACE | | | | | | | | | |
| SUR | † | 1 | 1 | | $+ \top$ | | | | |
| SUB | 10 | | | | | | | | |
| | 40 | | | | | N. | | Geologist: DB/MI Propagad/Data: W | T /AD 10/12/2011 |
| | | | | | | (CONT | INUED ON FOLLOW | /ING FIGURE) Prepared/Date: W Checked/Date: M | W/MF 10/13/2011 |
| M | ſA Wes | | | | sion | | 2004 | LOG OF | FBORING |
| | Los A | Angeles | s, Califo | ornia | | | amed | | 1561 Figure: T3-B5 |

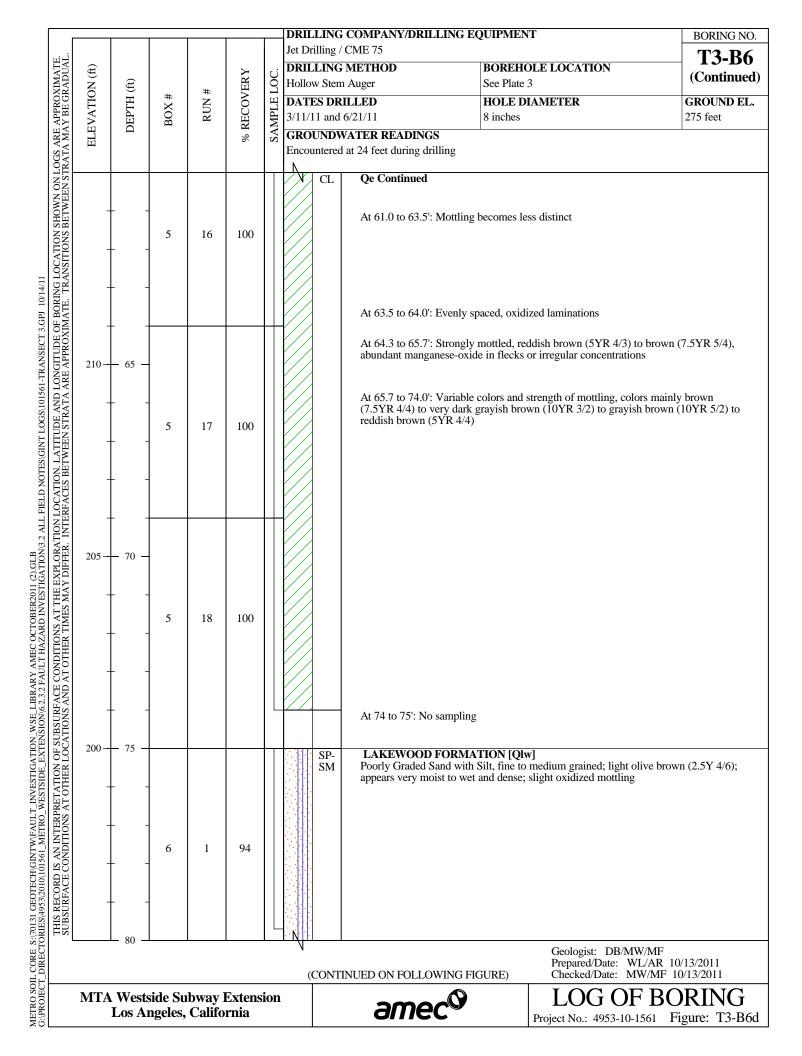
| | | | | | | | I G COMPANY/DRILL g / CME 75 | | BORING NO |
|----------------|------------|---------|--------|----------|-----------|-----------|--|--|--------------------------|
| (f) | | | | ~ | | | IG METHOD | BOREHOLE LOCATION | T3-B5 |
| N E | (tt | | | ER | LOC. | Hollow St | | See Plate 3 | (Continued |
| OFT |) HI | # X | RUN # | OV | ΞEI | DATES I | ORILLED | HOLE DIAMETER | GROUND EL. |
| SVA | DEPTH (ft) | BOX | RU | RECOVERY | SAMPLE | 3/9/11 | | 8 inches | 280 feet |
| ELEVATION (ft) | Г | | | % H | SA | | DWATER READINGS | | |
| | | | | | | Not encou | intered during drilling | | |
| | | 3 | 9 | 68 | | N SF | | | |
| | | | | | | SN | Poorly Graded San | d with Silt, fine-grained; pale brown (2.5Y nd dense; variable subhorizontal lamination | |
| | | | | | | | sharp | in dense, variable subiorizontal farmination | s, lower contact appears |
| _ | | | | | | | At 41.8 to 42.0': M | anganese oxide-rich bed; pale brown (2.5Y | 7/4) to dark gray |
| | | | | | | | (10YR 4/1) | | |
| - | | 3 | 10 | 72 | | | oxidized lamination | Tarker Bed M _E - Manganese oxide-rich lan hs; light yellowish brown (2.5Y $6/3$) to dark | |
| | | | | | | | (10YR 4/6) to pale | brown (2.5Y 8/3) stinct lenses defined by variable oxidation | |
| - | | | | | | | At 45.5 to 44.0. Di | sunct lenses defined by variable oxidation | |
| | | | | | | | | | |
| 235 - | - 45 - | _ | | | | SN | 1 Marker Bed Mr | Silty Sand, fine grained, trace to some clay | , variable coarse sand |
| | | 3 | 11 | 60 | | | and fine gravel, cla | sts 2 to 20%, moist $<\frac{1}{2}$ inch, maximum $1\frac{1}{2}$ sp) and subrounded quartzite, meta-basalt a | inches, mainly |
| + | | | | | | | (10YR 5/3); appear | dry and stiff; lower contact occurs betwee | |
| | | | | | | 220 | At 45.5 to 46.5': No |) recovery | |
| + | | | | | | | | | |
| | | 3 | 12 | 60 | | | At 47.5 to 48.0': Su | bhorizontal laminations | |
| 1 | | | | | | | At 48.0 to 49.0': No |) recovery | |
| | | | | | | | | | |
| | | | | | | ° SN | subangular slate (J | avel, very fine grained, clasts 15 to 35%, up sm) and subrounded quartzite, meta-basalt | |
| 230- | - 50 - | | | | | | (10YŘ 7/6); appea | rs dry and dense | - |
| | | 4 | 13 | 60 | L | | At 50.5 to 51.5': No | | |
| + | | | | | | | 7 x 50.5 to 51.5 . No | , 1000 YOL Y | |
| | | | | | + | 0 | | | |
| + | | | | | | • 0 | At 52.0 to 52.5': So | il matrix becomes Sandy Silt; light gray (10 |)YR 7/2) |
| | | 4 | 14 | 68 | | 0 | At 52.5 to 54.0': Be | ecomes mottled, very pale brown (10YR 7/2 | 3) to yellow (10YR 7/6) |
| + | | + | 14 | 00 | L | 0 | | | |
| | | | | | | • 0 | | | |
| + | | | | | \square | | Refusal at 54.0' on | gravel/cobbles | |
| 225 | _ 55 | | | | | | END OF BORING | AT 54 FEET | |
| 225- | - 55 - | | | | | | NOTES: | | |
| | | | | | | | Boring backfilled v | vith cement/bentonite grout from bottom up | and patched. |
| | | | | | | | | ed in order of predominance (most predom contacts and bedding appear subhorizontal u | |
| - | | | | | | | -Non-recovery inte | rvals are assumed to occur at the bottom of | |
| | | | | | | | | e (Jsm) clasts are generally very dark gray, | |
| + | | | | | | | | nless otherwise noted. Modelo Formation (w to tan, subangular to subrounded shale ar | |
| | | | | | | | otherwise noted. | herein describes gravel-size rock fragments | |
| - | | | | | | | | massive unless otherwise noted. | |
| | | | | | | | | | |
| I | 60 - | | I | I | 1 | <u> </u> | 1 | Geologist: DB/MF | |
| | | | | | | | | Prepared/Date: WI Checked/Date: MV | L/AR 10/13/2011 |
| мта | West | side Su | bwav | Extens | sion | | | | BORING |
| | | | Califo | | | | amec | | 561 Figure: T3-B5 |

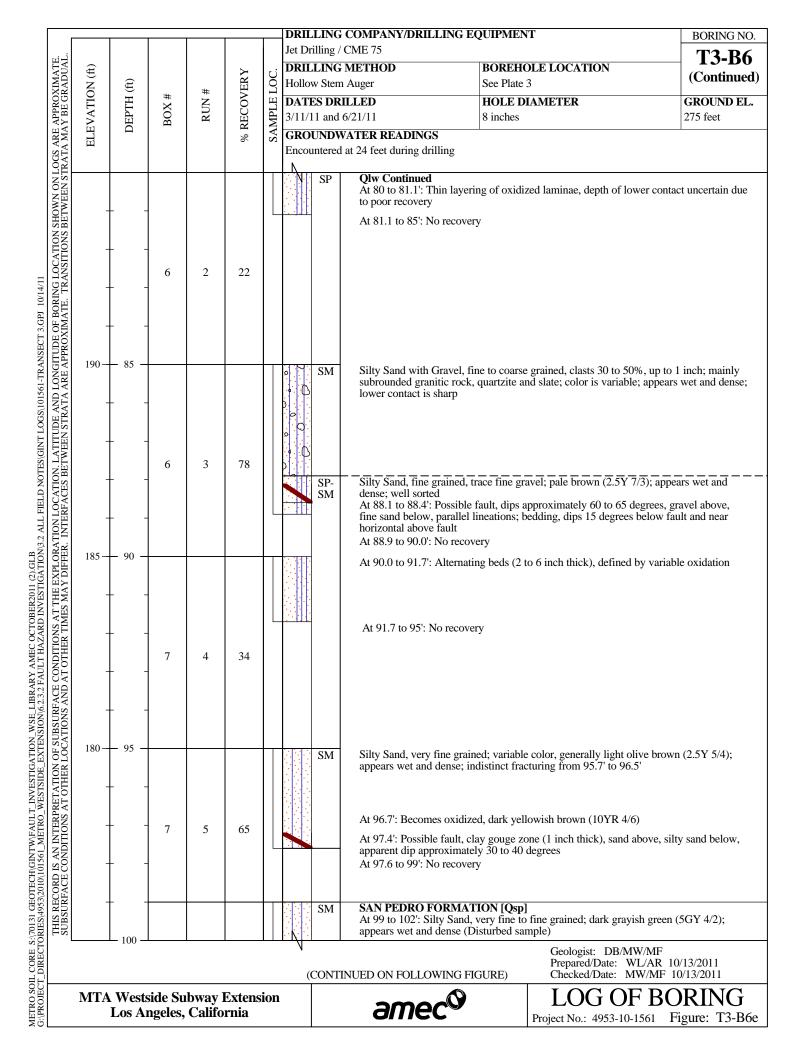
\GINT L.OGS\101561-TRANSECT 3.GPI 10/14/11 METRO SOIL CORE S:/70131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB G-/PROTECT DIRECTORIES495320101/01561 METRO WESTSIDE EXTENSION(6.2.32 FAULT HAZARD INVESTIGATION)3.2 ALL FIELD NOTES

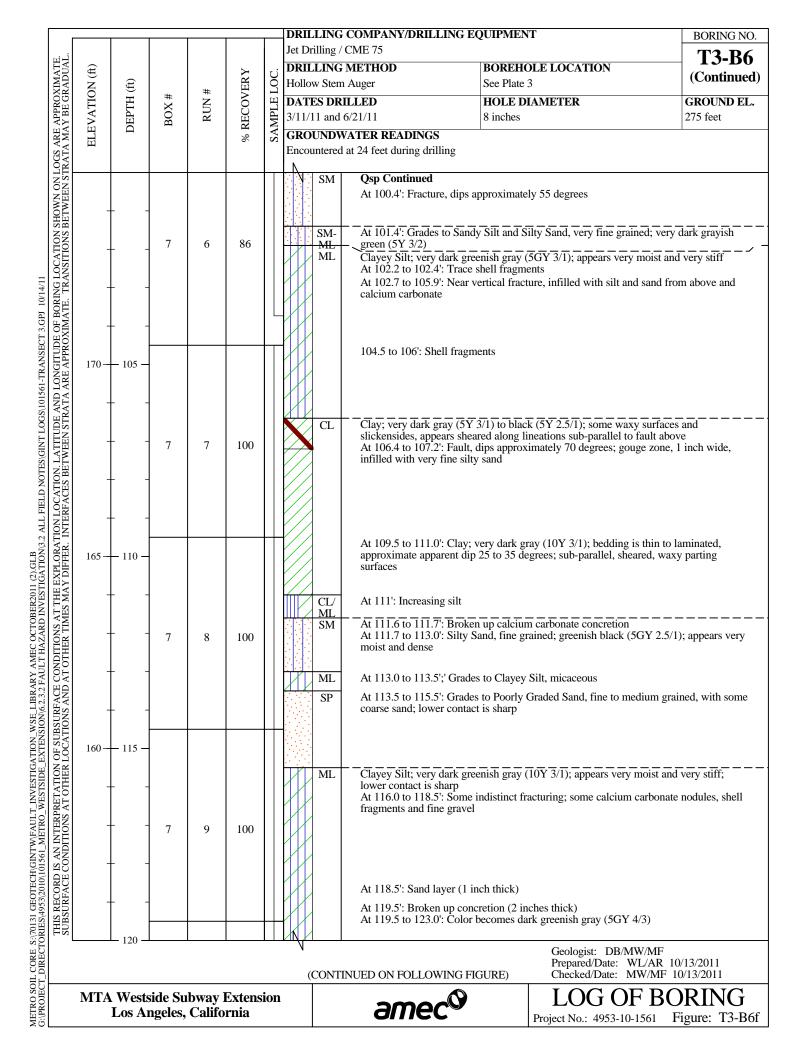


| | | | | | | Jet Drilling | G COMPANY/DRILI | ING EQUIPMENT | BORING NO |
|----------------|------------|---------|--------|------------|------------------|--------------|--|---|---|
| t) | | | | ~ | | | G METHOD | BOREHOLE LOCATION | T3-B6 |
| N (f | (ft) | | | ER | LOC. | Hollow Ste | | See Plate 3 | (Continued |
| DIT | LH (| # X | RUN # | NO | ΈI | DATES D | RILLED | HOLE DIAMETER | GROUND EL. |
| ELEVATION (ft) | DEPTH (ft) | BOX | RL | % RECOVERY | SAMPLE | 3/11/11 an | d 6/21/11 | 8 inches | 275 feet |
| ELF | Ι | | | [% | SA | | WATER READINGS ed at 24 feet during drill | ing | |
| | | | | | | | Ū. | - | |
| | | | | | | ML | Qfo/Qe Continue | POSITS [Qe] | |
| _ | | | | | | | Sandy to Clayey S brown (7.5YR 4/3 | Silt, trace coarse sand (Jsm and Tm); lightly to strong brown (7.5YR 4/6), with occasi | mottled, generally onal gray (10YR 5/1); |
| | | 2 | 4 | 100 | | | appears moist and bioturbation with | very stiff; well sorted; occasional root strug grav staining | ctures or other |
| - | | | | | | | | | |
| | | | | | | SC | At 22.7 to 23.1': C | layey Sand with Gravel; fine to coarse grai | ned, clasts 30 to 40%, up |
| | | | | | | ML | | subangular shale (Jsp) and subrounded fine ay, trace coarse sand (Jsm and Tm); mottle | |
| _ | | | | | | | \Box dark grayish brow manganese oxide | n (10YR 4/2); appears wet and soft to med | ium stiff; some |
| | | | | | | | At 24': Groundwa | ter encountered during drilling | |
| 250- | - 25 - | | | | | | | | |
| | | | | | | SM | Silty Sand, fine gr | ained, trace to some clay, dark yellowish bi | rown (10YR 4/4); |
| - | | | | | | | appears wet and n contact occurs bet | nedium dense; trace manganese oxide staini | ng; well sorted; lower |
| | | 2 | 5 | 64 | | | | Coarse Sand and Gravel content increases, g | ravel 10 to 20%. up to $\frac{1}{2}$ |
| - | | | | | | | inch, mainly suba | ngular slate (Jsm) and subrounded quartzite ct occurs between runs | |
| _ | | | | | | | At 27.2 to 29.0': N | | |
| | | | | | | | Contact depth upo | ertain due to poor recovery | |
| - | | | | | $\left \right $ | s SC | Clayey Sand with | Gravel, fine to coarse grained, gravel 30 to | |
| | | | | | | · 0 | | subangular slate (Jsm), and subangular to subangular to subangular to subangular to subangular to subangular to | subrounded fine |
| 245 — | - 30 - | | | | | 6 | | 1 | |
| | | | | | | CL | | ilty Clay; lightly mottled, dark grayish brow 10YR 4/6); appears wet and soft; upper and | vn (10YR 4/2) to dark 1 lower contacts are |
| | | 2 | | | | SM | sharp | | |
| - | | 2 | 6 | 64 | | ML | brown (7.5YR 5/6 | ilty Sand, fine-grained; lightly mottled, bro); appears wet and medium dense; lower co | ontact appears erosional |
| | | | | | | | mottled, gray (2.5 | Silt, trace coarse sand and fine gravel (Jsm a Y 6/1) to yellow (2.5Y 7/6) to strong brown | n (7.5YR 5/8); appears |
| - | | | | | | | very moist and ve gradational | ry stiff; occasional manganese oxide stainin | g; lower contact is |
| | | | | | | | At 32.2 to 34.0': N | lo recovery | |
| - | | | | | | | At 34.0 to 37.0': D | Distinct varve-like bedding | |
| 240- | - 35 - | | | | | | | | |
| 240- | 55 - | 2 | 7 | 64 | | | | | |
| - | | | | | | | | | |
| | | | | | | | | | |
| _ | | | | | | | | | |
| | | 3 | 8 | 100 | | | | | |
| - | | 5 | 0 | 100 | | | | | |
| | | | | | | | | | |
| - | | | | | | | At 20 5 + 40 01 0 | lightly finge mainterstances the state of | turn officer to be 3 1 1 |
| | _ 40 _ | | | | | | At 39.5 to 40.0': S | lightly finer, mainly clayey silt, gradational | |
| | | | | | | (CON | TINUED ON FOLLOW | Geologist: DB/M Prepared/Date: W TNG FIGURE) Checked/Date: M | W/MF /L/AR 10/13/2011 /W/MF 10/13/2011 |
| МТА | Wests | side Su | bway | Extens | sion | | ame | | FBORING |
| | | | Califo | | | | amor | | |

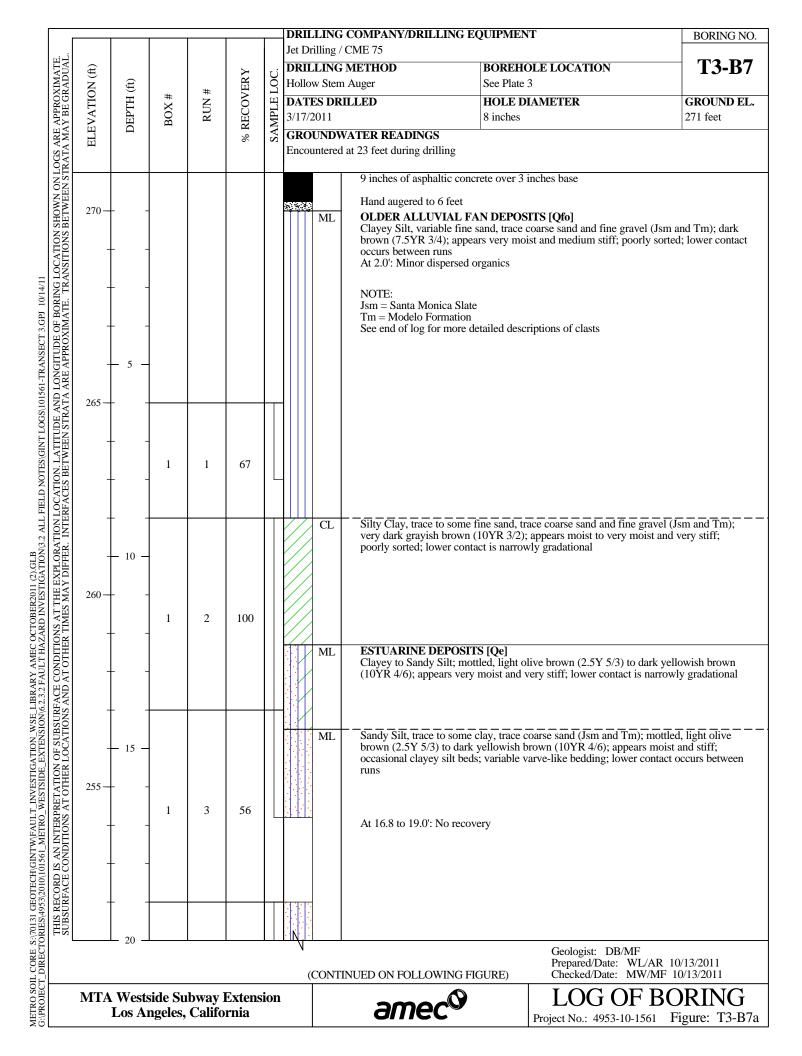
| V (ft) | (ft) | | | ßY | LOC. | Jet Drilling / C DRILLING M Hollow Stem | METHOD | BOREHOLE LOCATION See Plate 3 | BORING NO. T3-B6 (Continued |
|----------------|-----------------|------|-------|------------|----------|---|---|---|---|
| ELEVATION (ft) | DEPTH (f | BOX# | RUN # | % RECOVERY | SAMPLE L | DATES DRI 3/11/11 and 6 GROUNDW | LLED | HOLE DIAMETER 8 inches | GROUND EL. 275 feet |
| - | | 3 | 9 | 100 | | ML/ CL | coarse sand and fir (5YR 4/4) to strong manganese oxide s | ty Clay, variable fine sand, occasionally gra le gravel (Jsm and Tm); mottled, strongly o g brown (7.5YR 5/6); appears moist and sti taining; possible weak soil development; lo | xidized reddish brown ff; occasional |
| - | | 3 | 10 | 100 | | | gradational | | |
| (ii) NOLLEAN | | 3 | 11 | 66 | | SM/ ML | brown (10YR 4/6) medium dense/med | y Silt, fine grained, trace to some clay; mott to light yellowish brown (2.5Y 6/3); appea lium stiff; well sorted; variable subhorizont ns and varve-like bedding; some manganese veen runs | rs very moist and al bedding, some |
| 225- | | 4 | 12 | 100 | | SP- SM CL | 3/4); appears wet a oxide stained sand ESTUARINE DE | d with Silt, fine to medium grained; dark ye ind dense; lower contact is sharp, erosional, layer (½ inch thick) at contact POSITS - FINE GRAINED [Qef] - (possi e fine to coarse sand; strongly mottled; gray | black, manganese ble sag pond deposits?) |
| - | | 4 | 13 | 88 | | SP- SM CL | strong brown (7.5%) stiff; numerous sub appear organic rich occurs between run At 51.5 to 52.3': Po | VR 5/8) to very dark gray (7.5Y 3/1); appear oborizontal laminations exhibit above colors a, also possible black manganese oxide stair as porly Graded Sand with Silt bed, similar to manganese oxide-stained sand at lower cont | rs very moist to wet and s, very dark gray layers hing, lower contact bed at 49.0 to 49.9', up |
| - 220 – | | | 15 | 00 | | CL | brown (10YR 3/4) | and fine sand; trace coarse sand; strongly m to gray (N5) to brown (7.5YR 4/4); appear anganese oxide flecks | ottled, dark yellowish s very moist and very |
| 220 | | 4 | 14 | 100 | | | | | |
| - | | 4 | 15 | 100 | | | 3/4 inch, calcretion mass | alcium carbonate occurs as filaments and un is up to ½ inch, total calcium carbonate up t race widely scattered calcium carbonate fila | to about 15% of soil |
| | 60 | | | | | (CONTIN | NUED ON FOLLOW | Geologist: DB/MV Prepared/Date: W | V/MF L/AR 10/13/2011 |
| | Wests Los Ai | | | | sion | | amed | | BORING |



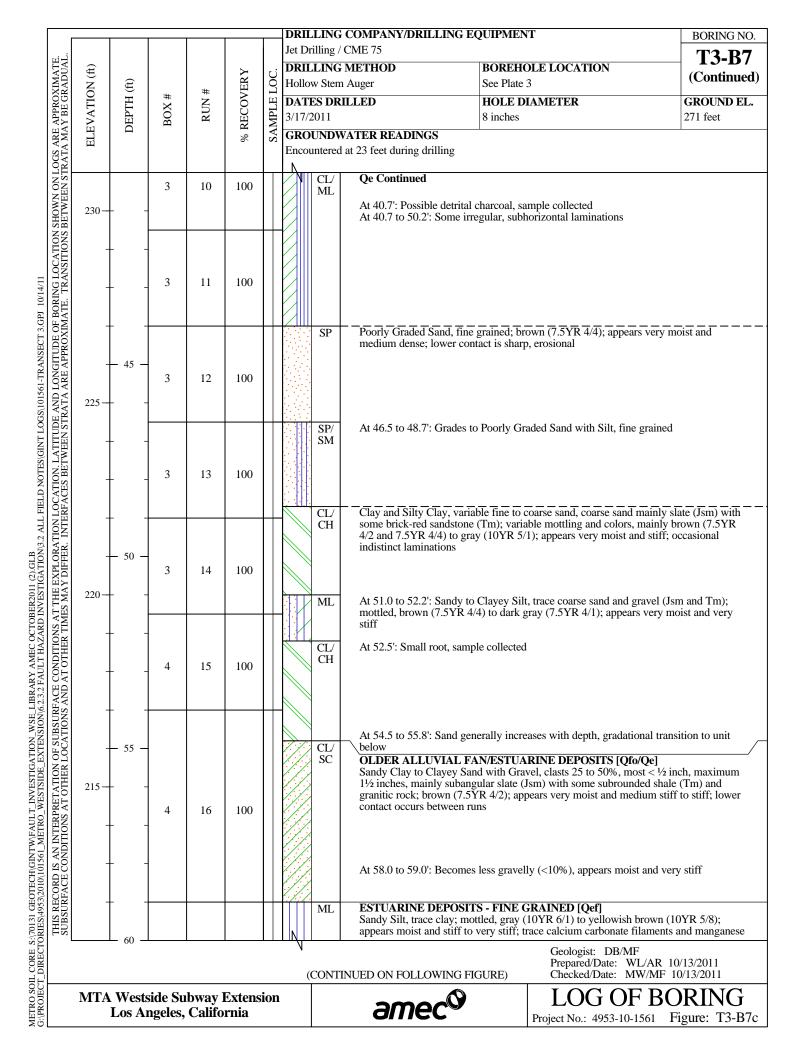




| | | | | | | Jet Drilling / | COMPANY/DRILI CME 75 | | BORING NO | | |
|----------------|---------|---------|--------|-------------------|-------------|----------------|---|---|------------------------------------|--|--|
| (ţ) | | | | Х | <i>r</i> ; | | | BOREHOLE LOCATION | T3-B6 | | |
| Ň | (ft) | | * | RECOVERY | ğ | Hollow Sten | | See Plate 3 | (Continued | | |
| DIE | HT | BOX # | RUN # | NO: | LE] | DATES DR | | HOLE DIAMETER | GROUND EL | | |
| ELEVATION (ft) | DEPTH | BO | RI | REC | SAMPLE LOC. | 3/11/11 and | | 8 inches | 275 feet | | |
| ELF | | | | [% | SA | | VATER READINGS | | | | |
| | | | | | | Encountered | l at 24 feet during dril | ling | | | |
| | | | | | Π | N ML | Osp Continued At 120 to 120 6 | Grades to Sandy Silt | | | |
| - | L - | 8 | 10 | 100 | | | At 120.6': Some f | ine gravel and sand | | | |
| | | | | | | | | | | | |
| - | | | | | | | | | | | |
| | | | | | | | | | | | |
| - | + - | | | | | SP | Sand fine to med | ium grained; very dark greenish gray (5G 2 | 5/3/1): appears wet and | | |
| | | | | | | | dense | granned, for y dain groundin gruy (50 2 | , appears wet und | | |
| - | + - | | | | | | | | | | |
| | | | | | + | 1413-1] | END OF BORIN | G AT 1241/2 FEET | | | |
| 150 - | - 125 - | | | | | | NOTES: | | | | |
| | | | | | | | | with cement/bentonite grout from bottom u | p and patched. | | |
| - | † - | | | | | | -Munsell colors li | sted in order of predominance (most predom | ninant color first). | | |
| | | | | | | | Non-recovery in | contacts and bedding appear subhorizontal ervals are assumed to occur at the bottom o | run unless otherwise noted. | | |
| - | | | | | | | noted. -Santa Monica Sl | ate (Jsm) clasts are generally very dark gray | , subangular to | | |
| - | L _ | | | | | | subrounded slate | unless otherwise noted. Modelo Formation (ow to tan, subangular to subrounded shale a | Tm) clasts are generally | | |
| | | | | | | | otherwise noted. | herein describes gravel-size rock fragments | | | |
| - | | | | | | | -Beds are general | ly massive unless otherwise noted. | | | |
| | | | | Boring extended f | | | | led from 75 to 124 ¹ / ₂ feet on 6/20/2011. Offset from original boring eximately 1-foot north east. | | | |
| 145 — | - 130 - | | | | | | location approxim | latery 1-root north east. | | | |
| | | | | | | | | | | | |
| - | | | | | | | | | | | |
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| - | + - | | | | | | | | | | |
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| 140 - | - 135 - | | | | | | | | | | |
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| - | + - | | | | | | | | | | |
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| - | + - | | | | | | | | | | |
| | | | | | | | | | | | |
| - | + - | | | | | | | | | | |
| | | | | | | | | | | | |
| | L 140 - | | 1 | 1 | 1 | | | Geologist: DB/M | W/MF | | |
| | | | | | | | | Prepared/Date: W Checked/Date: M | L/AR 10/13/2011 W/MF 10/13/2011 | | |
| MTA | Wests | side Su | bway] | Extens | sion | | ame | LOG OF | FBORING | | |
| | | | Califo | | | | ano | | | | |



| | | | | | | | NG COMPANY/DRILL ng / CME 75 | ING EQUIPMENT | BORING NO T3-B7 | | |
|-------------------------------------|---------|---|-------|------------|--------------|--------------------------|--|---|---------------------------|--|--|
| (ft) | | | | ۲۲ | Ų. | | NG METHOD | BOREHOLE LOCATION | (Continued | | |
| NO | [(ft) | + | # | VER | L0 | | tem Auger | See Plate 3 | | | |
| ATI | DEPTH | BOX # | RUN # | CO | PLE | DATES 3/17/201 | DRILLED | HOLE DIAMETER 8 inches | GROUND EL. 271 feet | | |
| ELEVATION (ft) | DE | Ā | | % RECOVERY | SAMPLE LOC. | | DWATER READINGS | o incres | 2711661 | | |
| (II) NOLLEA 250 - 245 - 240 - 240 - | | | | % | S | | ered at 23 feet during drill | ing | | | |
| | | | | | \mathbf{H} | N N | | ariable sand, trace coarse sand and fine grav | el (Ism and Tm): | | |
| 250- | + - | | | | | | mottled, grayish b | rown (2.5Y 5/2) to brown (7.5YR 4/4); appropriate the boorly consolidated; variable varve-like bedd | ears very moist to wet | | |
| | | 2 | 4 | 100 | | | occurs between ru | ns | | | |
| | + - | | | | | | | | | | |
| | ļ _ | | | | | | $\overline{\underline{\nabla}}$ At 22's Group dura | an an assumption of during duilling | | | |
| | | At 23: Groundwater encountered during d | | | | | d 24.0 to 24.9': Silty Sand, fine grained, so | ne coarse sand and | | | |
| | + - | | | | ┼┼ | | | ; appears very moist to wet and medium de | | | |
| | 25 - | | | | | N | | | | | |
| | | | | | | | | | | | |
| 245 - | + - | | | | | | At 25.8 to 29.0': N | o recovery | | | |
| | \bot | 2 | 5 | 36 | | | | | | | |
| | T - | | | | | | | | | | |
| | + - | | | | | | | | | | |
| | | | | | | | - | ncertain due to poor recovery | | | |
| Ť | T - | | 2 6 | 6 100 | | S S | M appears very mois | nd with Silt, fine grained; dark yellowish bro t to wet, and medium dense; well sorted; occ | casional silt beds as | | |
| | - 30 - | 2 | | | | | gradational | eds exhibit prominent varve-like bedding; lo | | | |
| • • • | | | | 100 | | | | At 30.3 to 31.0': Becomes siltier, some coarse sand and gravel, gravel 5 to 15%, up to $\frac{1}{2}$ inch, mainly subangular slate (Jsm) | | | |
| 240- | T - | | | | | N | grayish brown (2.5 | 3.2 to 34.0', and 36.0 to 36.5': Clayey to Sat 5Y 5/2) to brown (7.5YR 4/4); appears very | moist and stiff; upper | | |
| | + - | | | | | | P/ contacts are sharp. | erosional; some manganese oxide staining | at 43.2 to 44.0' | | |
| | | 2 | 7 | 100 | | | | | | | |
| | † - | | | | | N | IL | | | | |
| | + - | | | | | | P At 34.0 to 35.3': G | rades to fine to medium grained, trace coard | se sand (Jsm) | | |
| | | | | | | | | | | | |
| | - 35 - | 2 | 8 | 100 | | | L At 35.3 to 36.0' an | At 35.3 to 36.0' and 37.3 to 38.0': Gradational zones (grades from sand to clayey silt) | | | |
| 235 - | + - | | | | | i i i i i i | | | | | |
| | | | | | + | | P/ | | | | |
| | † - | | | | | S | M | | | | |
| | μ. | 2 | 9 | 100 | | | | Clay with variable fine and trace as | and (Iom and heist and | | |
| | | | | | | | L Tm sandstone); m | V Clay with variable fine sand, trace coarse s ottled, with variable colors, mainly brown (7 to gray (10YR 5/1); appears very moist and | 7.5YR 4/4) to yellowish | | |
| | + - | | | 1 | + | | occasional faint va | rve-like bedding; lower contact is gradation olor primarily dark gray (10YR 3/1), possib | al | | |
| | L 40 - | | | | | | | | | | |
| | | | | | | N | | Geologist: DB/MF Prepared/Date: W ING FIGURE) Checked/Date: M | L/AR 10/13/2011 | | |
| MT | A Wests | side Su | ibwav | Extens | sion | | NTINUED ON FOLLOW | | BORING | | |
| | Los A | | | | | | amed | | 561 Figure: T3-B7 | | |

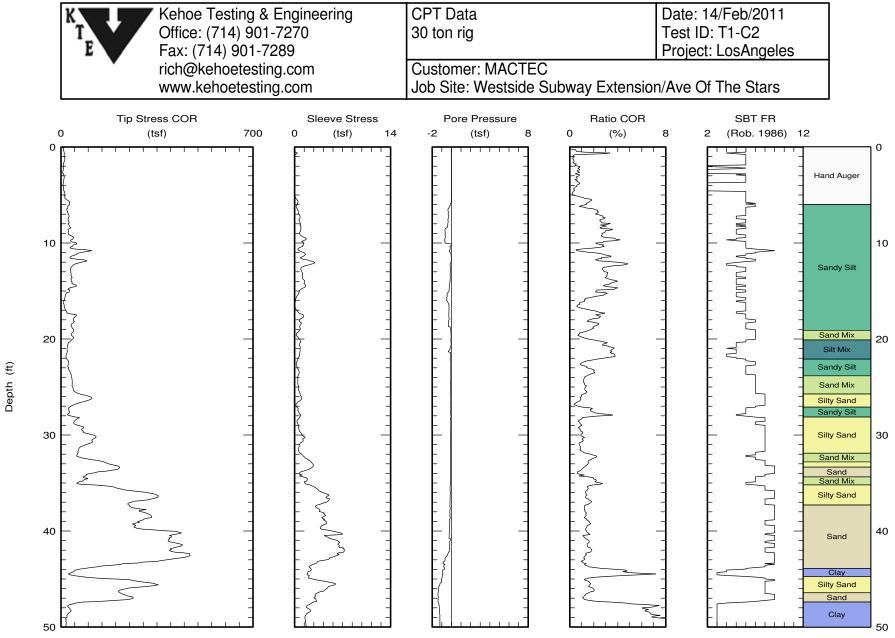


| | | | | | | Jet Drilling / | COMPANY/DRILI CME 75 | | BORING NO |
|----------------|------------|---------|--------|----------|------------|----------------|---|---|---|
| ft) | | | | 2 | | DRILLING | | BOREHOLE LOCATION | T3-B7 |
| E N | (jt) | | | ER | Q | Hollow Sten | | See Plate 3 | (Continued |
| OII | H | # X | RUN # | 0 V | ΕI | DATES DR | ILLED | HOLE DIAMETER | GROUND EL |
| VA | DEPTH (ft) | BOX | RL | RECOVERY | SAMPLE LOC | 3/17/2011 | | 8 inches | 271 feet |
| ELEVATION (ft) | | | | % F | SA] | | VATER READINGS | | |
| - | | | | | | Encountered | at 23 feet during drill | ing | |
| | | | | | | N ML | oxide staining; lov | ver contact occurs between runs | |
| | | | | | | | Qef Continued At 60.1': Sand be | l (1 inch thick); subhorizontal, upper-contac | t is narrowly |
| 210- | † - | | | | | | gradational, lower | contact is sharp | - |
| | | 4 | 17 | 100 | | CL | | Lay content increases, sand decreases (grada Lay and Silty Clay, trace coarse sand and fin | |
| - | + - | | | | | | mottled, brown (7 stiff | .5YR 4/4) to dark gray (10YR 4/1); appears | very moist and very |
| | | | | | | | Sull | | |
| - | + - | | | | | ML | At 63.0 to 64.0': 7 | race coarse sand and fine gravel (Jsm and T | m) |
| | | | | | | | | | |
| | † - | | | | ╀┶ | | At 64.0 to 66.0': N | lo sampling | |
| | | | | | | | | | |
| | - 65 - | 0 | 0 | 0 | | | | | |
| | | | | | | | | | |
| 205 - | † - | | | | + | CL | | ilty Clay with Sand; mottled, brown (7.5YR | 4/4) to dark gray |
| | | | | | | ML | | ars very moist and very stiff ecovered only slough | |
| - | † - | | | | | | 12 00.0 to 09.0 . F | | |
| | | 5 | 18 | 20 | | | | | |
| - | † - | | | | | | | | |
| | | | | | | | Contact uncertain | due to poor recovery | |
| - | † - | | | | \top | CL | Clay; yellowish b | cown (10YR 5/4); appears very moist and so | ft; some calcium |
| | | | | | | CL | | nd uncemented nodules, contact below is sh sand and fine gravel (Jsm and Tm); dark br | |
| | <u></u> | | | | | | appears very mois | t and stiff; appears to have high organic con | tent; lower contact is |
| 200 | | | | | | | narrowly gradatio At 70.3 to 72.0': 0 | nai Organics decrease (minimal), trace fine grave | l (Jsm and Tm) |
| 200- | T - | | | | | | | | |
| | L _ | 5 | 19 | 100 | | | | | |
| | | | | | | | ESTUARINE DI At 72.0 to 72.3': 0 | EPOSITS [Qe] Bravelly bed, gravel 20 to 30%, up to ½ inch | mainly slate (Ism) |
| | ļ _ | | | | | | shale and sandsto | ne (Tm) | - |
| | | | | | | | Sandy to Clayey S 4/4) to gray (2.5Y | Silt, trace coarse sand and fine gravel (Jsm at 5/1); appears very moist and very stiff | na Im); brown (7.5YR |
| | ļ _ | | | | | | | | |
| | | | | | | | END OF BORING | э АТ 74 FEET | |
| | - 75 - | | | | | | NOTES: Boring backfilled | with cement/bentonite grout from bottom up | and natched |
| | | | | | | | - | | - |
| 195 - | + - | | | | | | -Where observed, | sted in order of predominance (most predom contacts and bedding appear subhorizontal | unless otherwise noted. |
| | | | | | | | -Non-recovery int noted. | ervals are assumed to occur at the bottom of | run unless otherwise |
| - | + - | | | | | | -Santa Monica Sla | ate (Jsm) clasts are generally very dark gray, unless otherwise noted. Modelo Formation (| |
| | | | | | | | white to pale yell | by to tan, subangular to subrounded shale an | |
| - | + - | | | | | | otherwise noted. -The term "clasts' | herein describes gravel-size rock fragments | (larger than ¹ / ₄ inch). |
| | | | | | | | | y massive unless otherwise noted. | _ ^ |
| | + - | | | | | | | | |
| | | | | | | | | | |
| | L 80 - | | | | | | | 0.1 | |
| | | | | | | | | Geologist: DB/MF Prepared/Date: W | L/AR 10/13/2011 |
| | | | | | | | | Checked/Date: MV | W/MF 10/13/2011 |
| MTA | West | side Su | bway i | Extens | sion | | ame | 🔊 LOG OF | F BORING |
| | LOS A | ngeles. | Califo | rnia | | | מוופט | Ductorst No. 1052 10 1 | 561 Figure: T3-B7 |

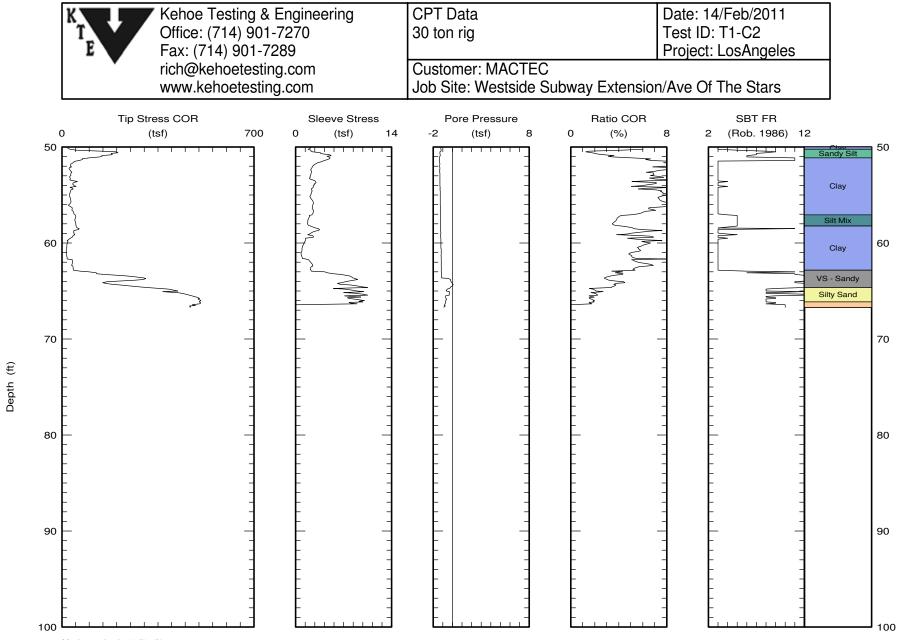
11 METRO SOIL CORE 5://0131 GEOTECH/GINTW/FAULT_INVESTIGATION_WSE_LIBRARY AMEC OCTOBER2011 (2)/GLB

APPENDIX C

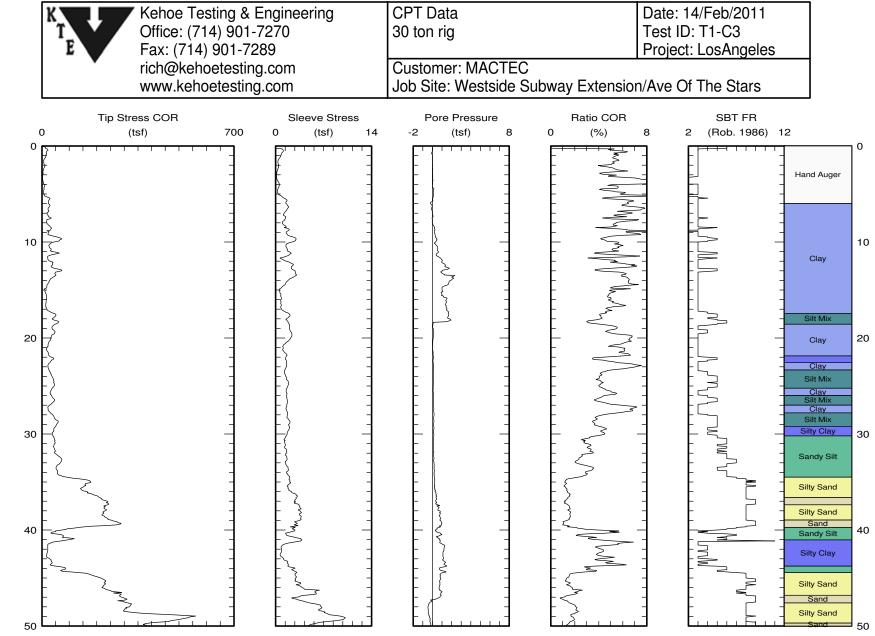
PREVIOUS CPT DATA



Maximum depth: 66.73 (ft) Page 1 of 2

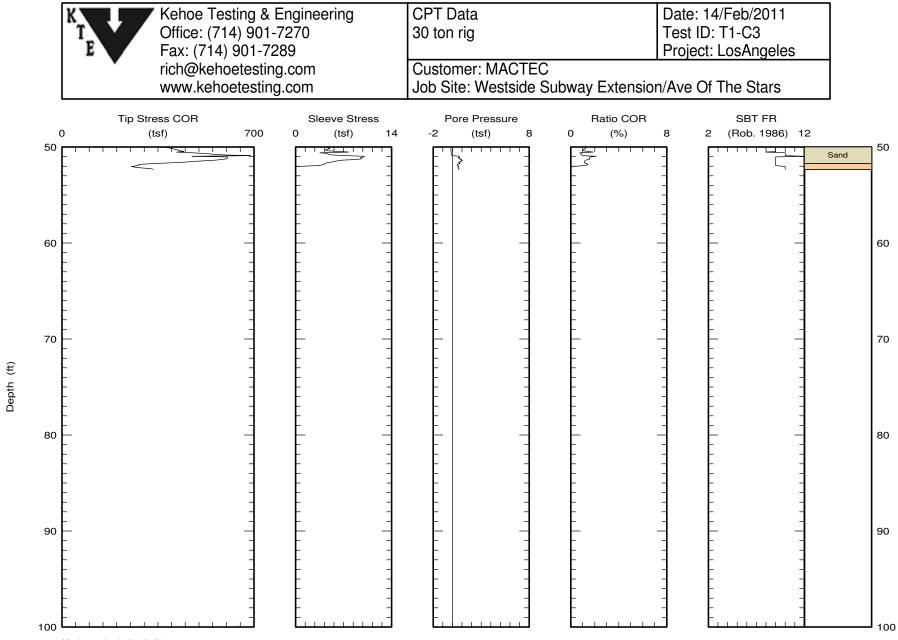


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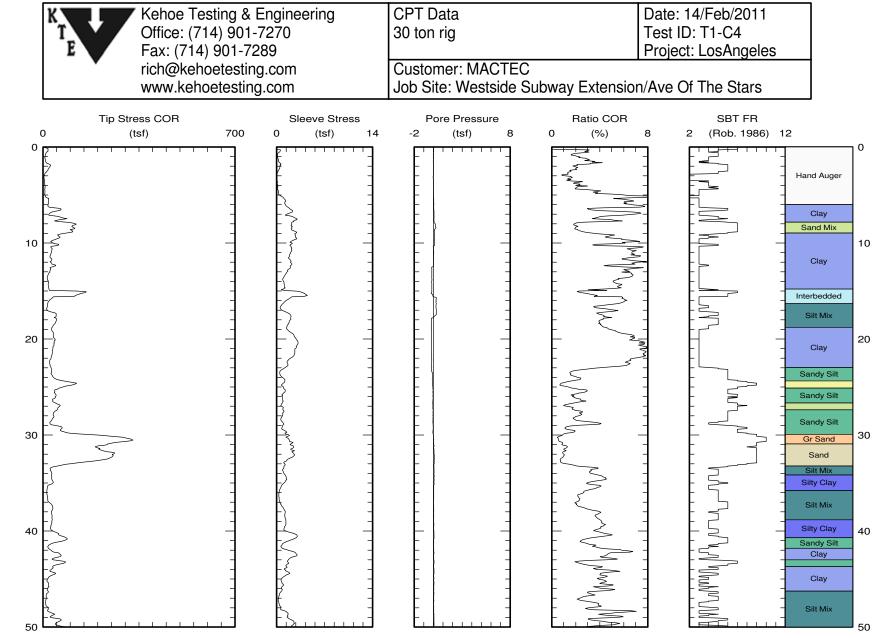


Maximum depth: 52.35 (ft) Page 1 of 2

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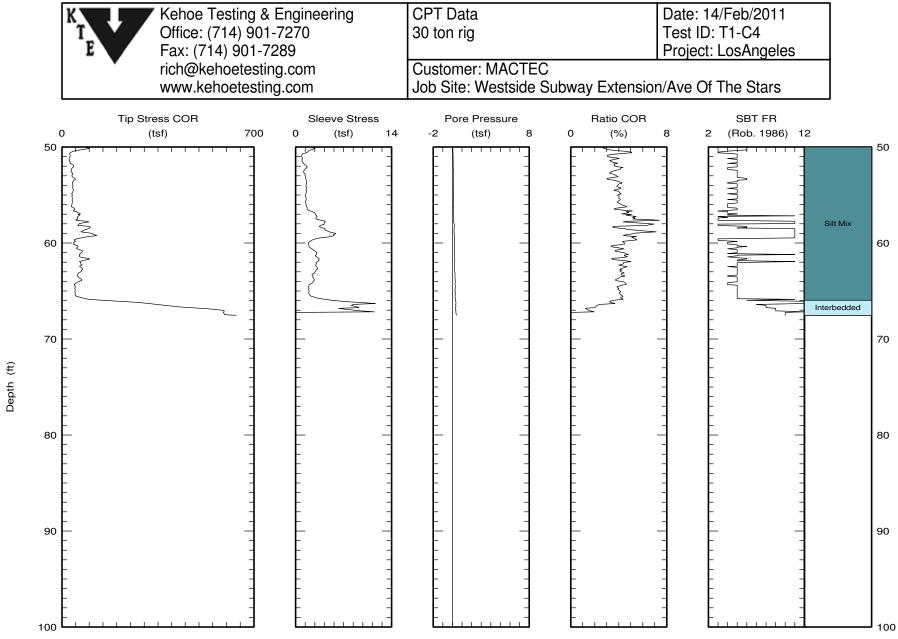


Maximum depth: 52.35 (ft) Page 2 of 2

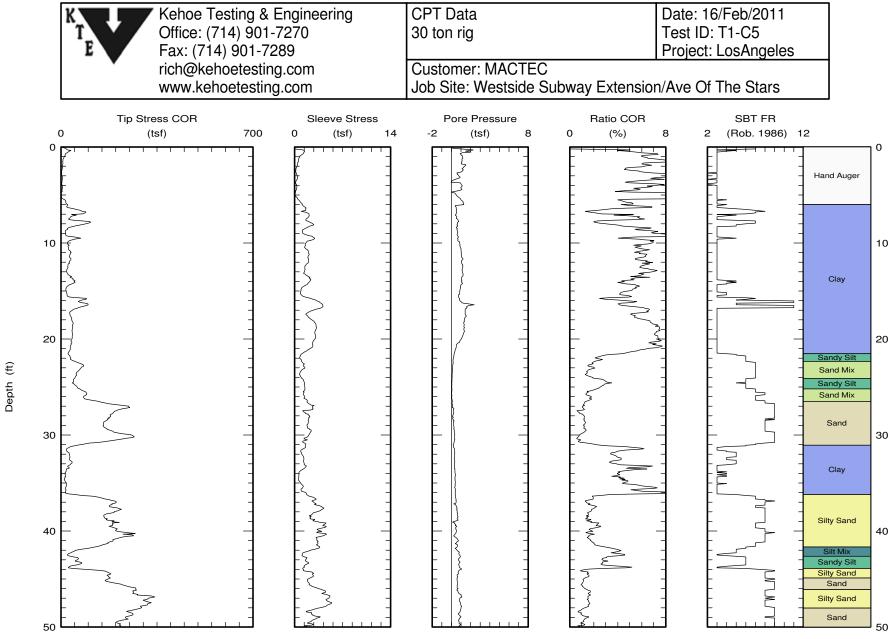


Maximum depth: 67.54 (ft) Page 1 of 2

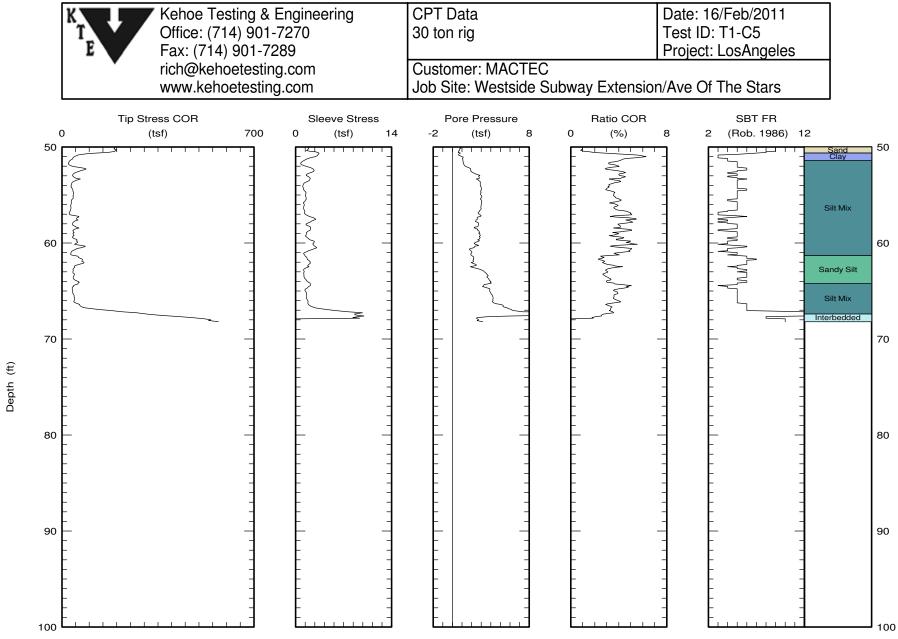
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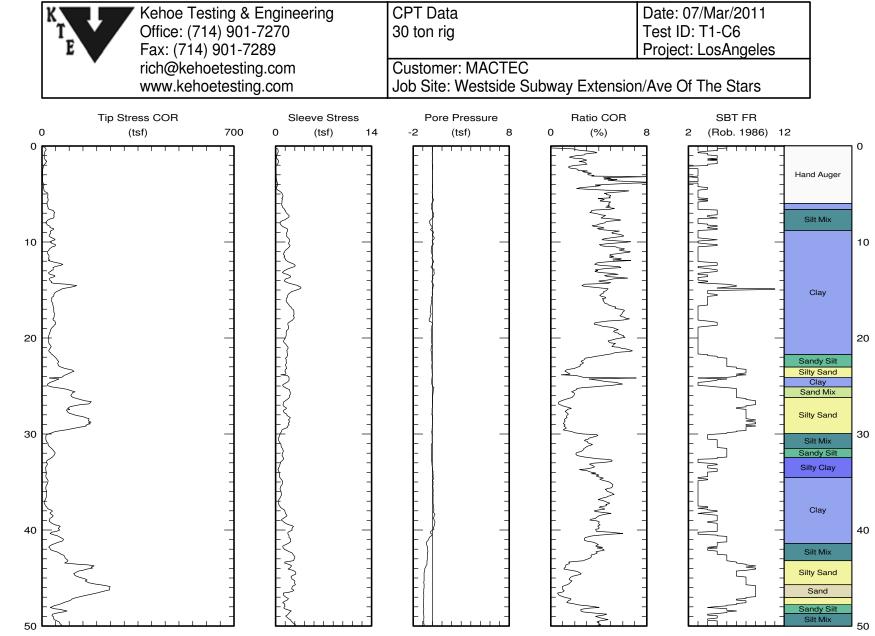
Maximum depth: 67.54 (ft) Page 2 of 2



Maximum depth: 68.22 (ft) Page 1 of 2

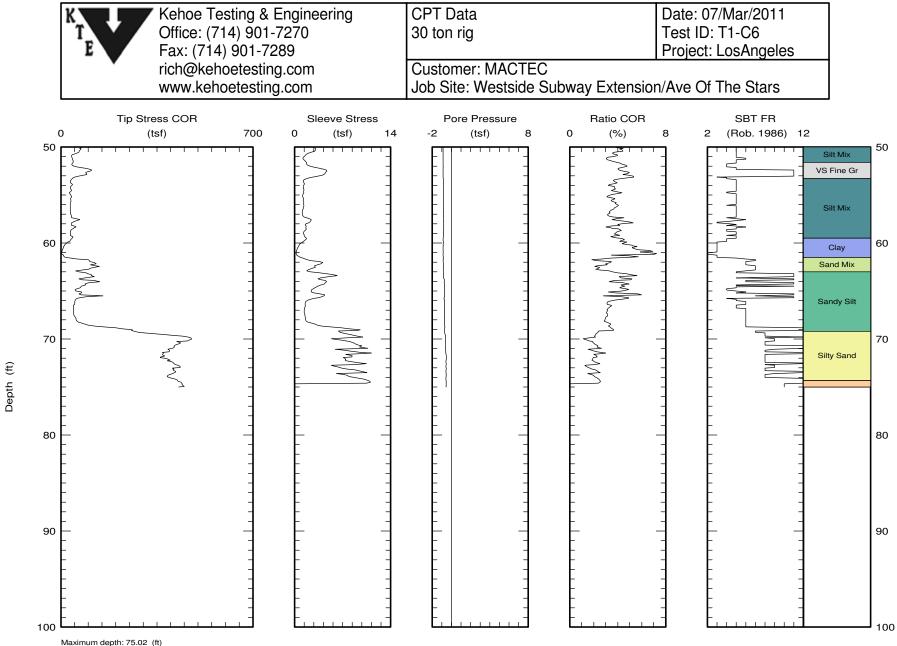


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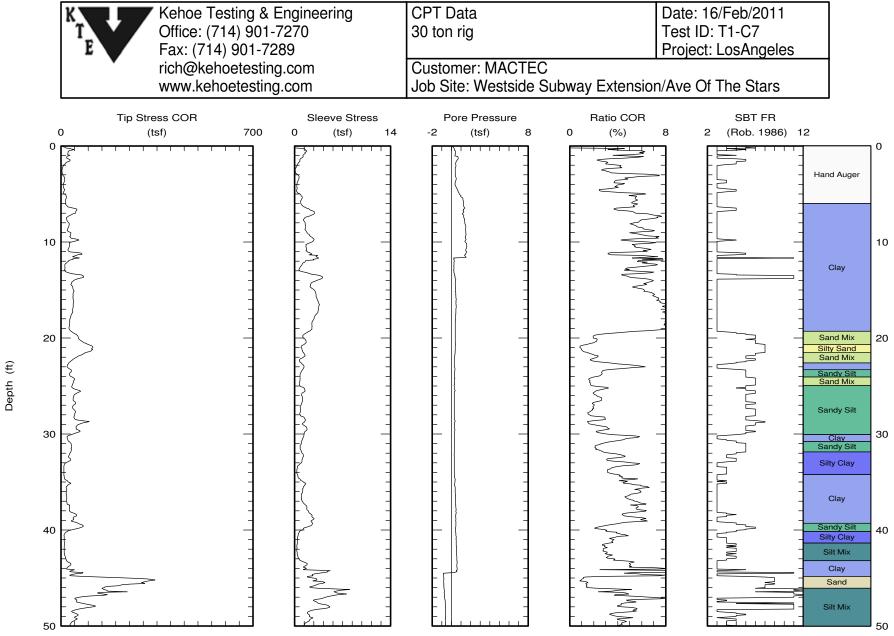


Maximum depth: 75.02 (ft) Page 1 of 2

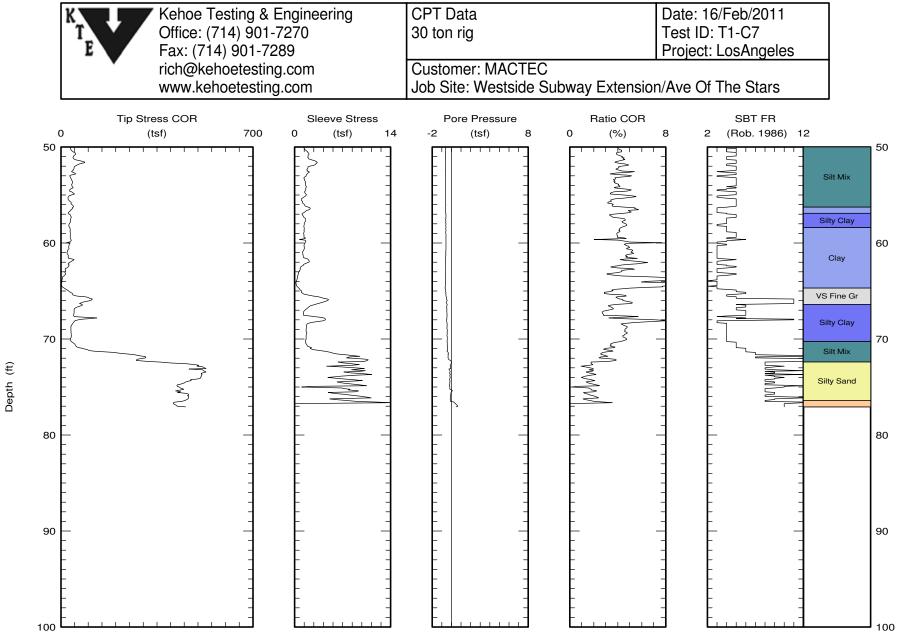
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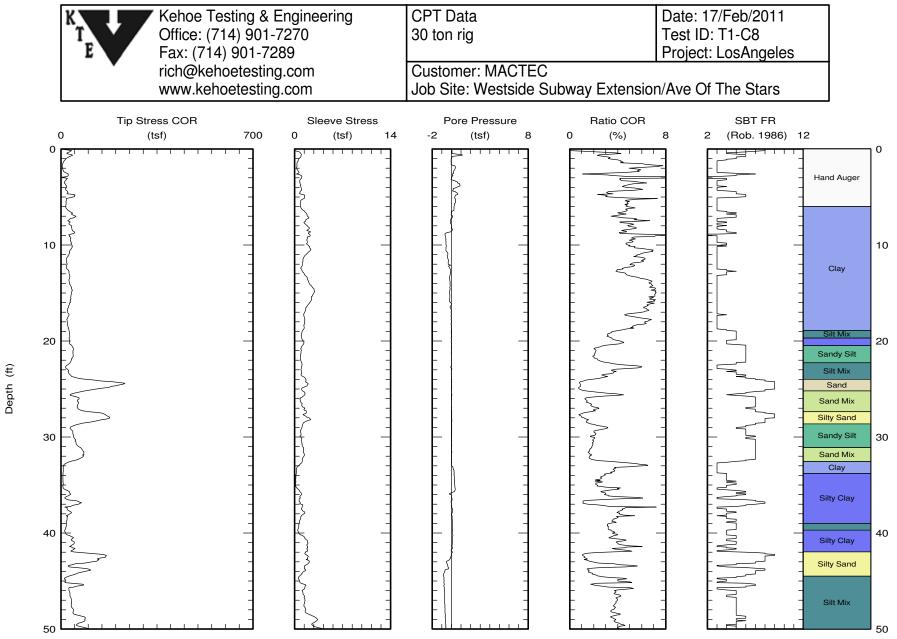
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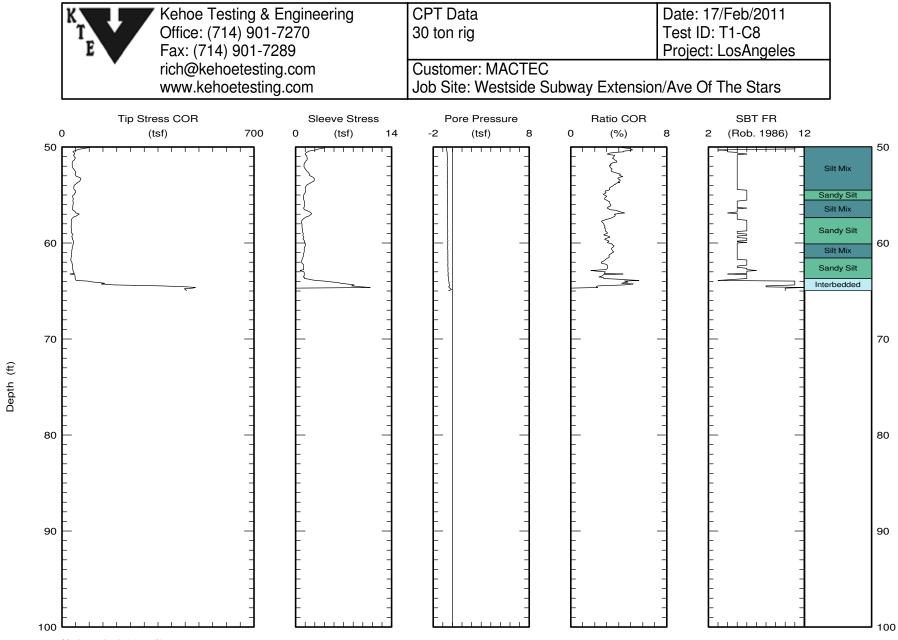
Maximum depth: 77.08 (ft) Page 1 of 2



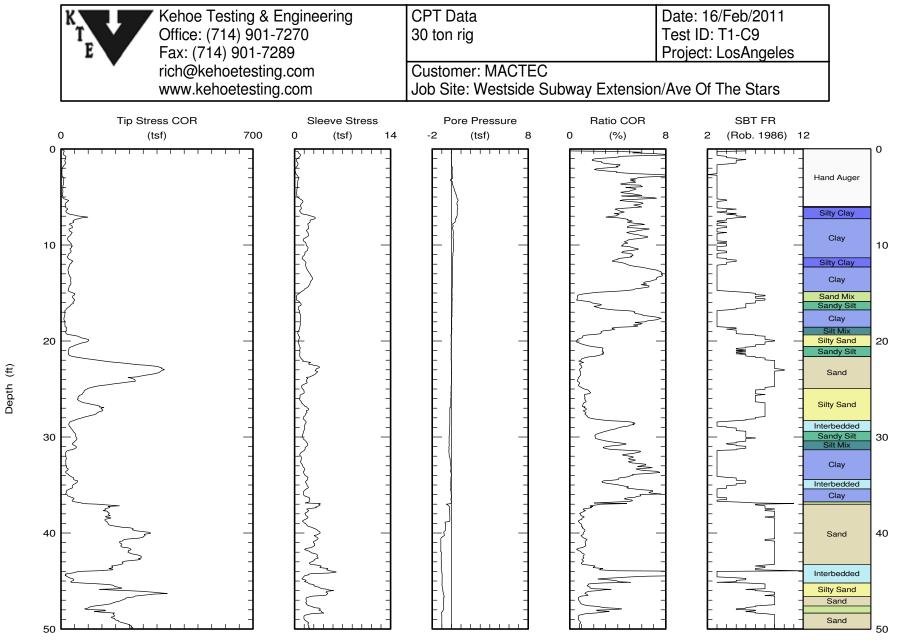
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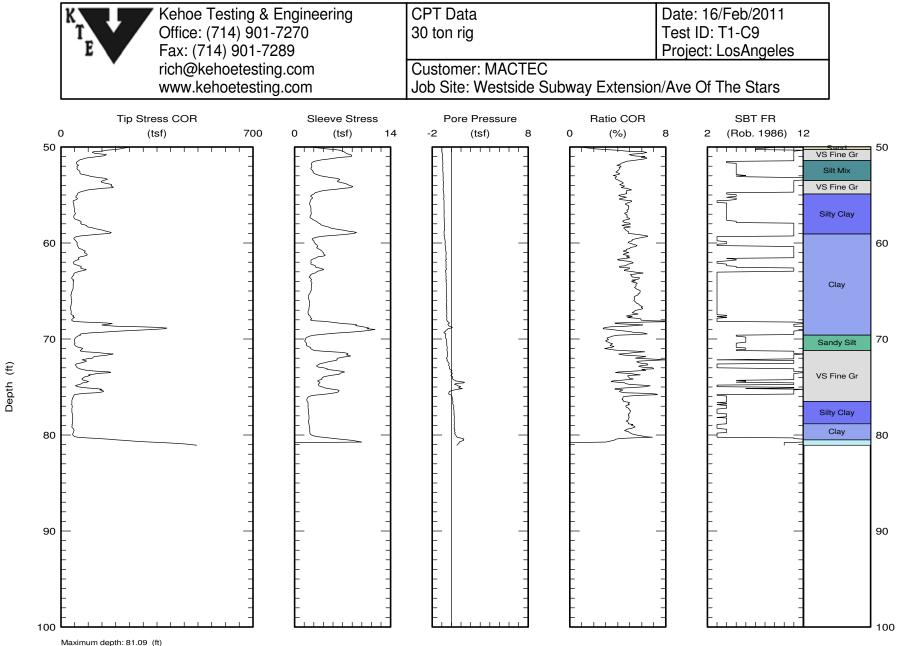
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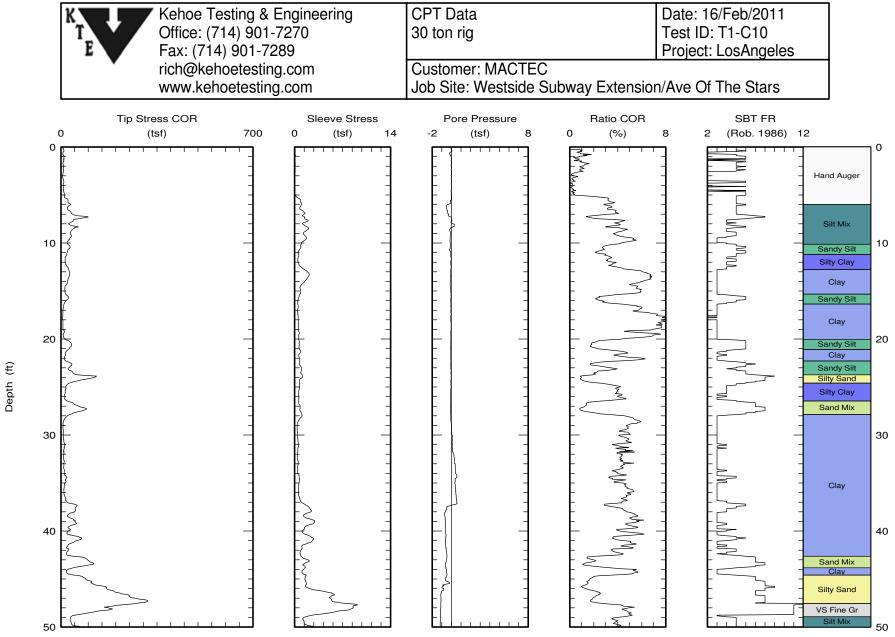
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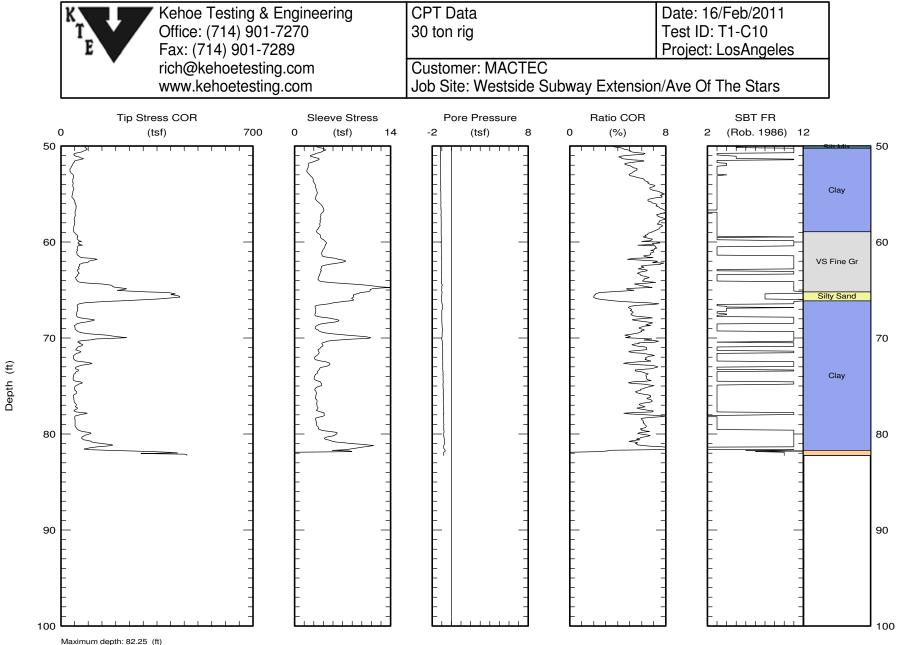
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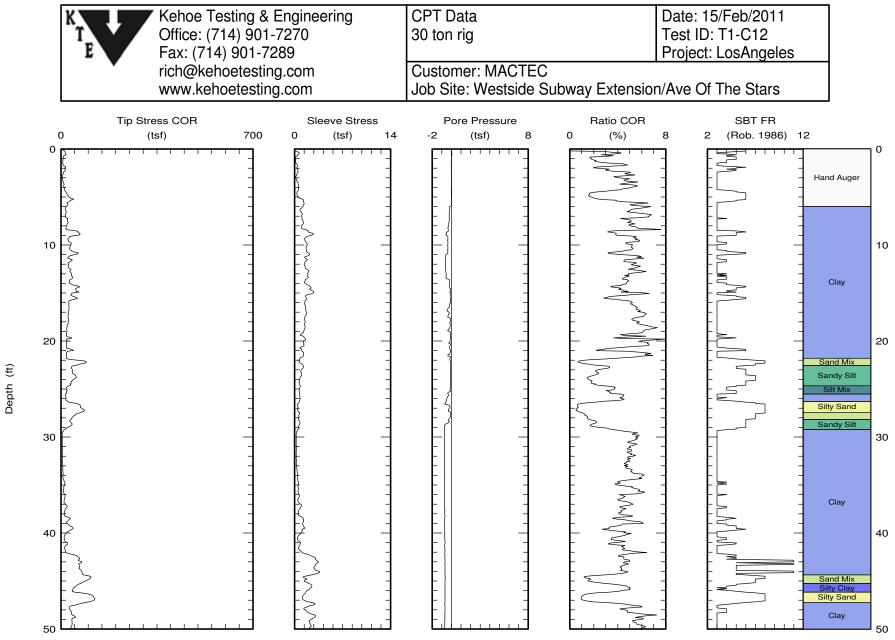
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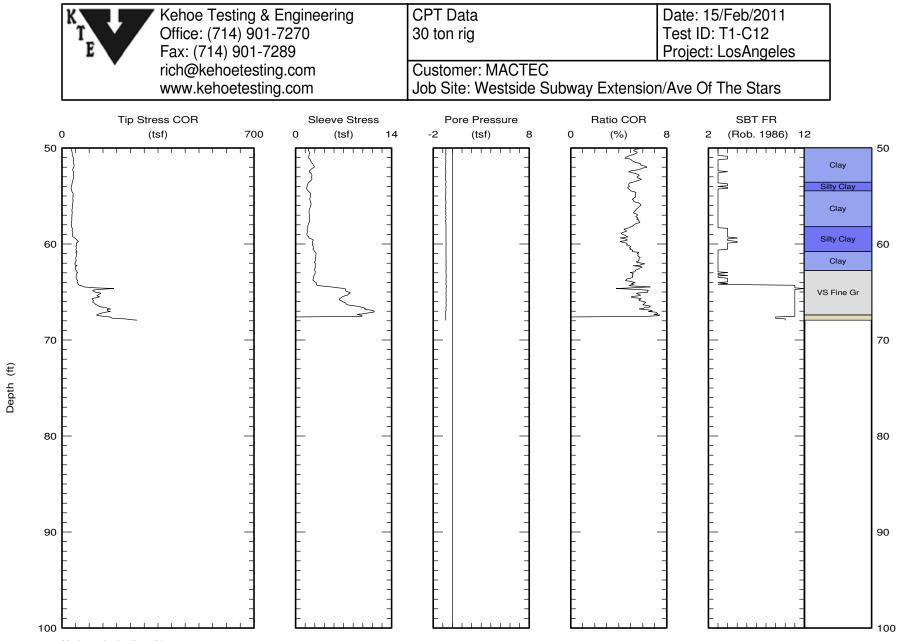
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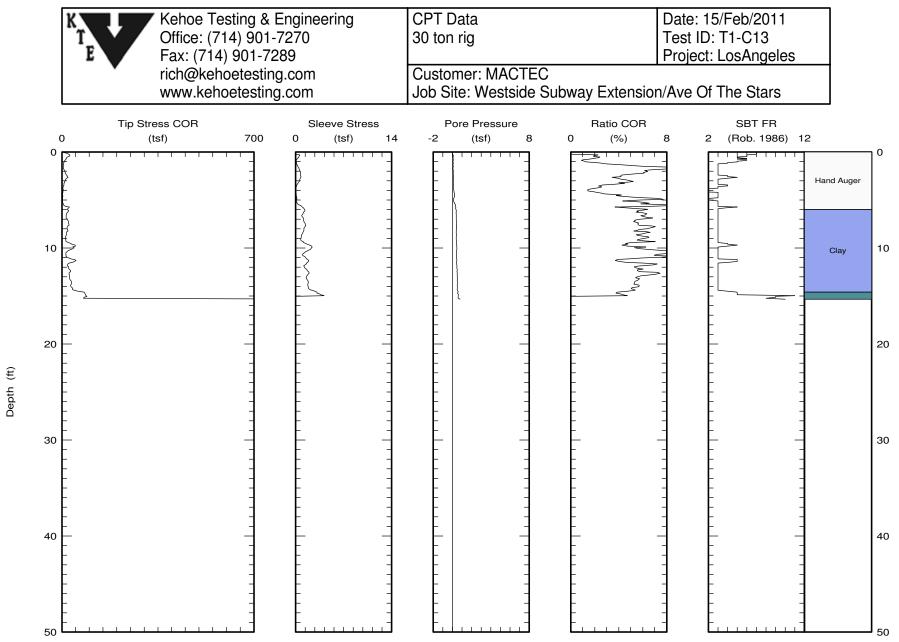
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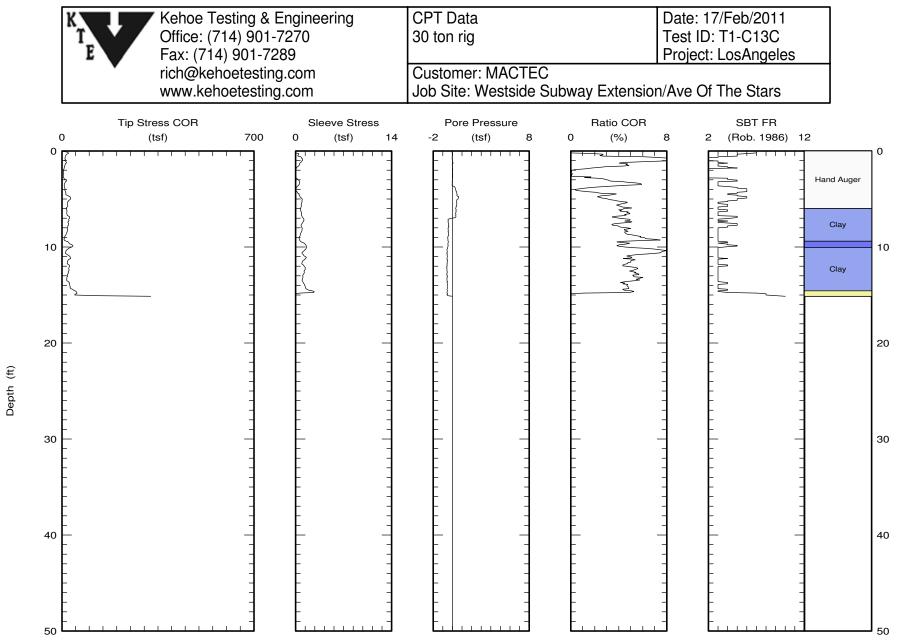
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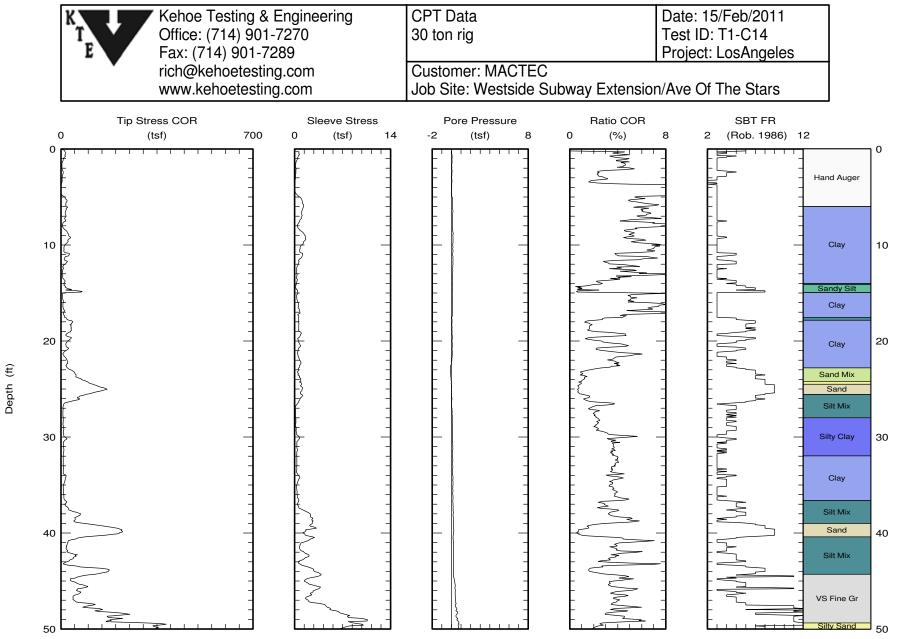
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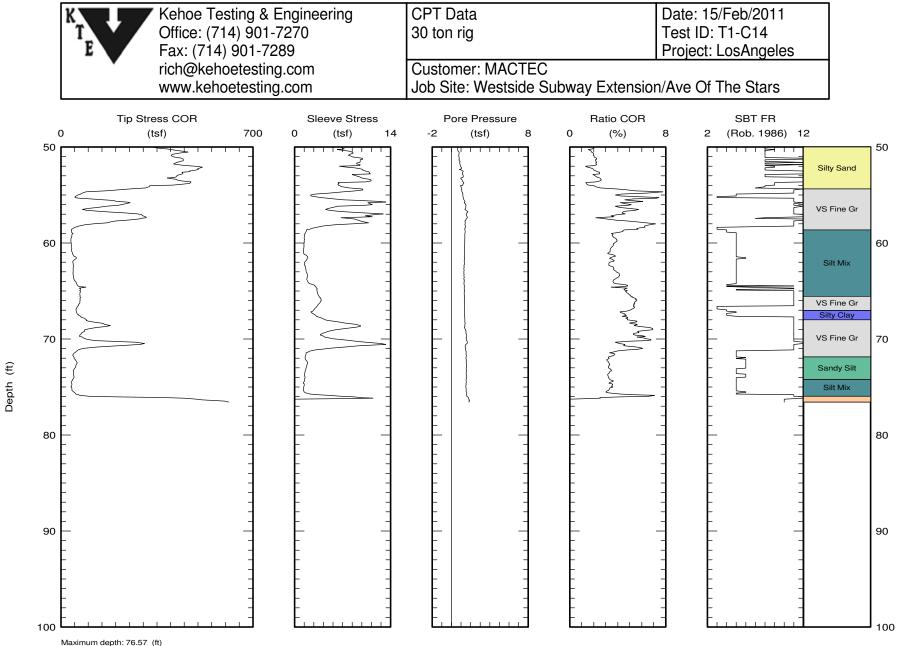
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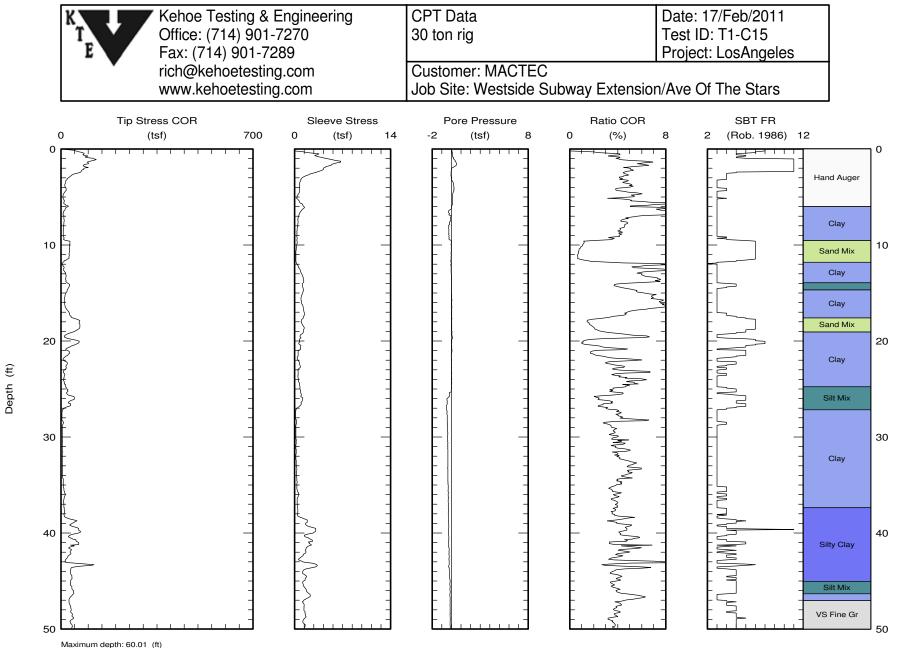
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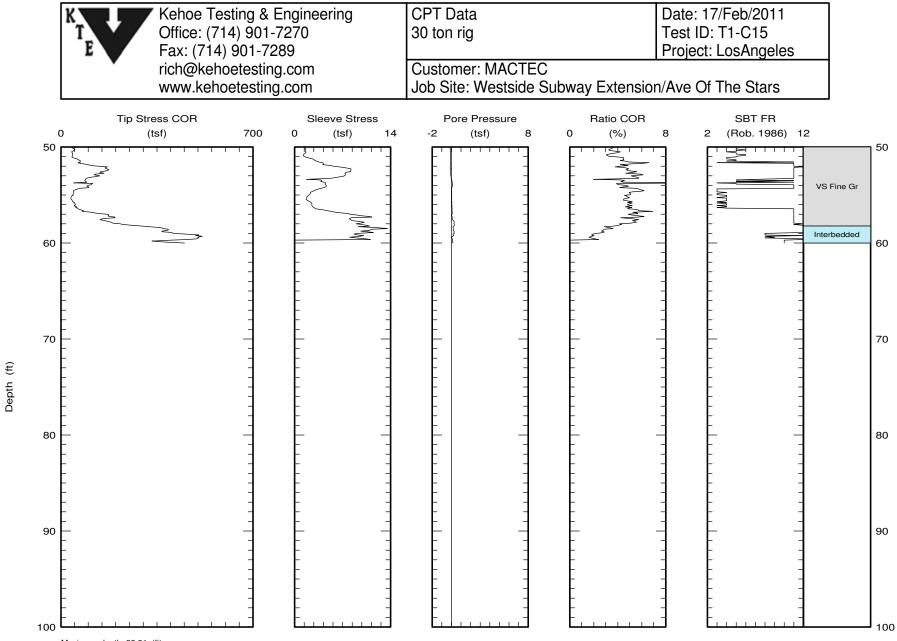
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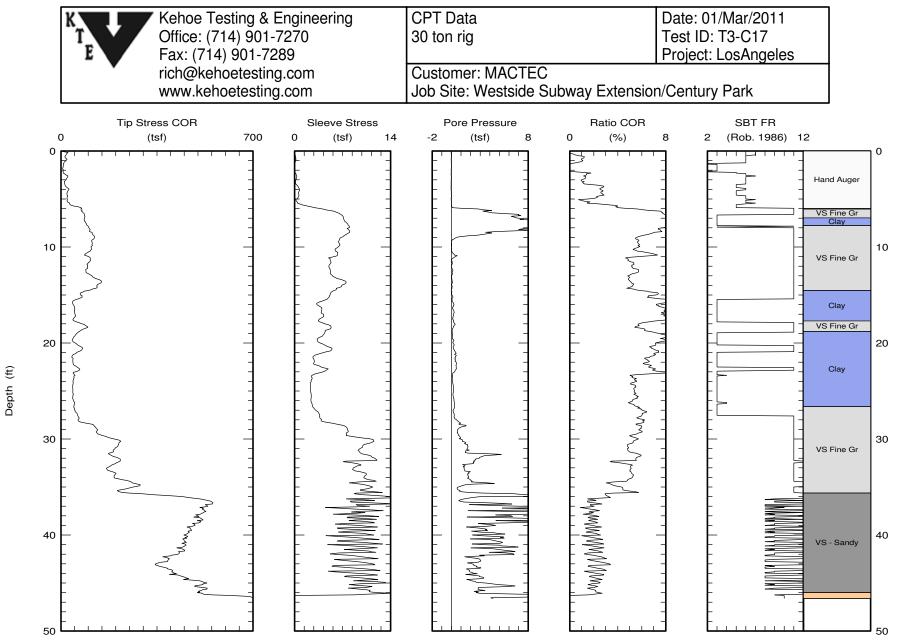
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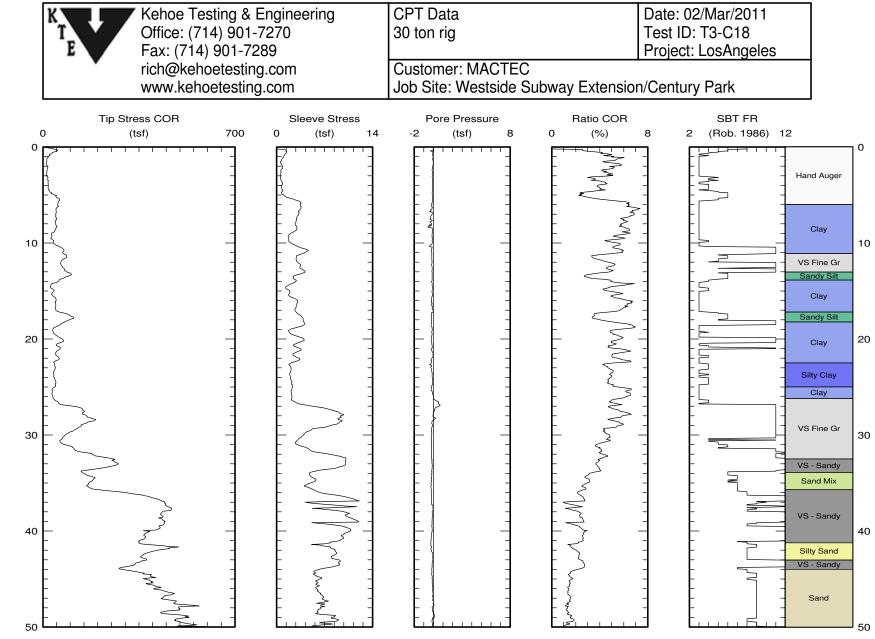
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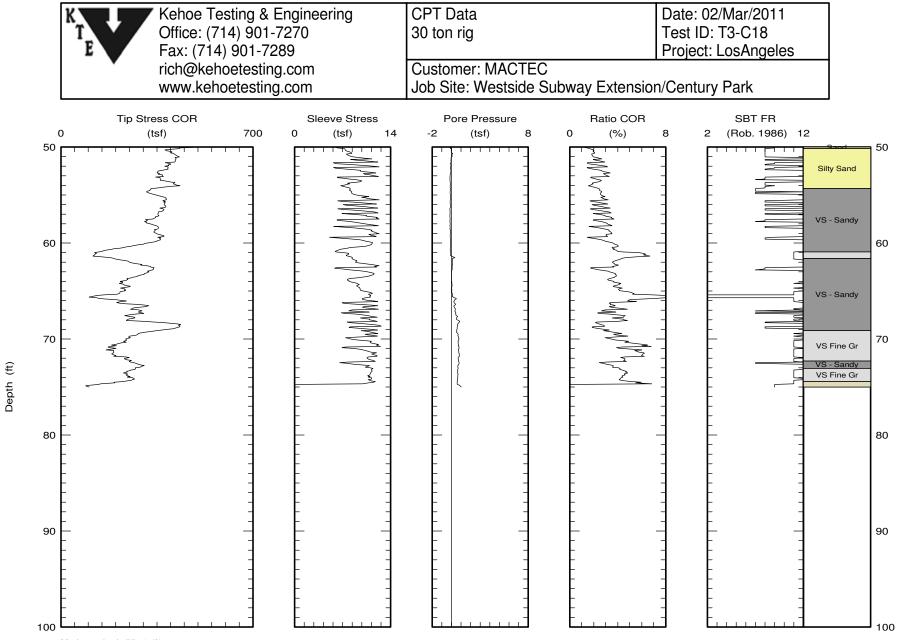


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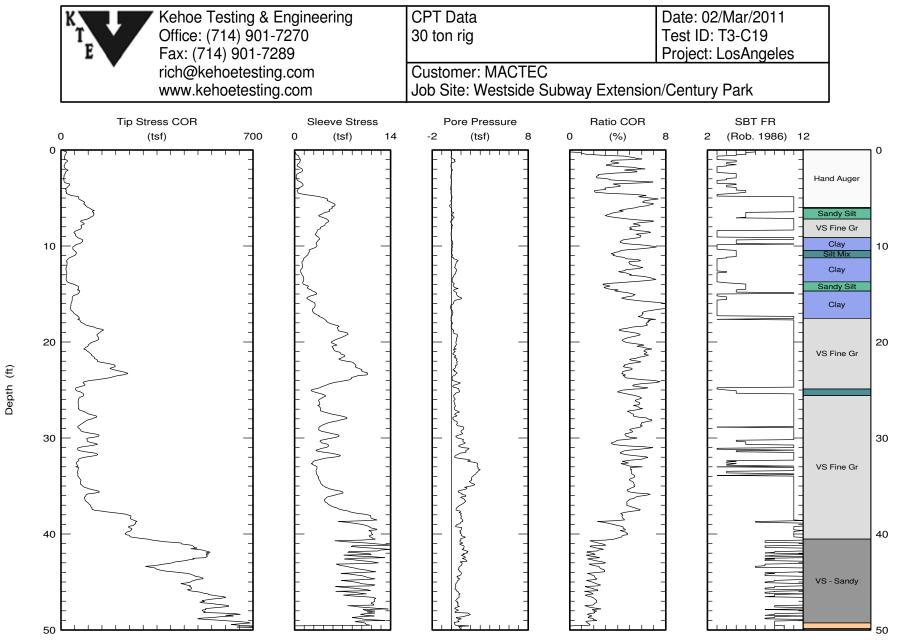


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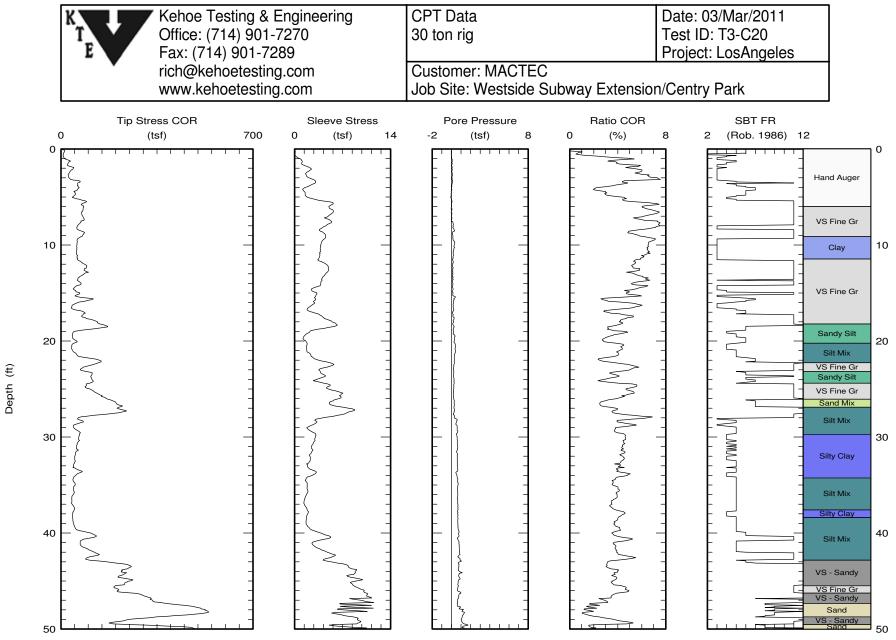
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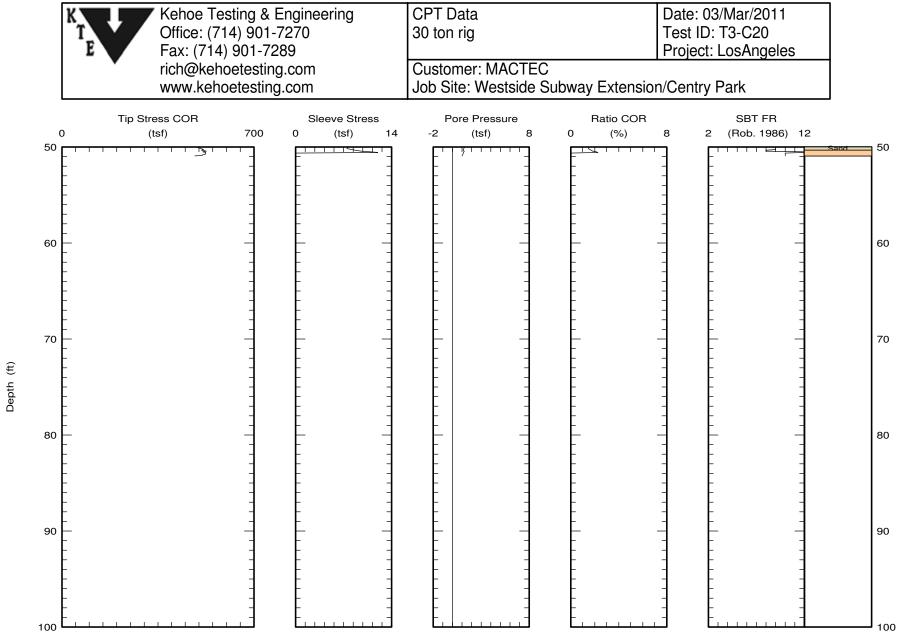
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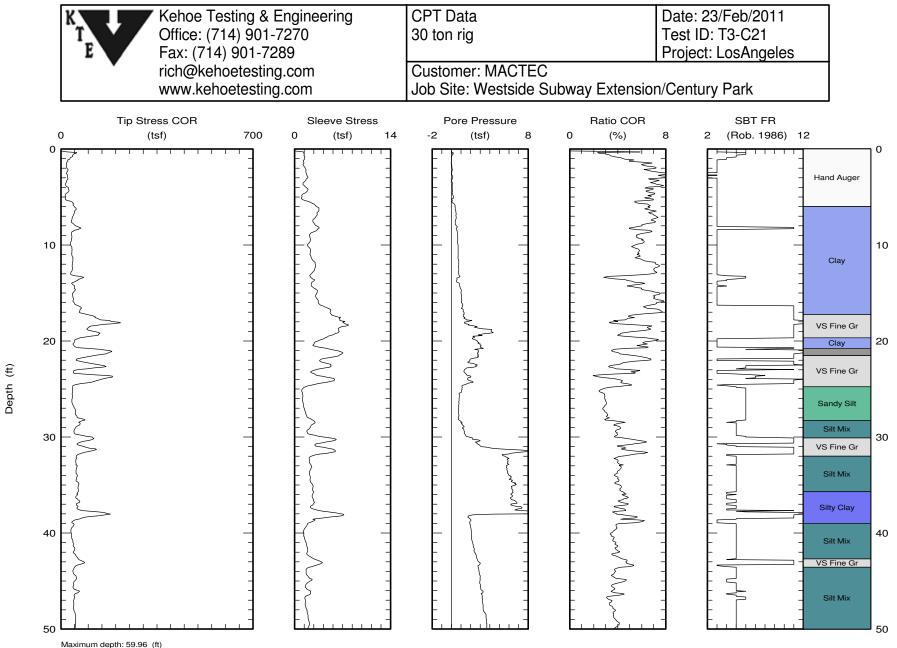
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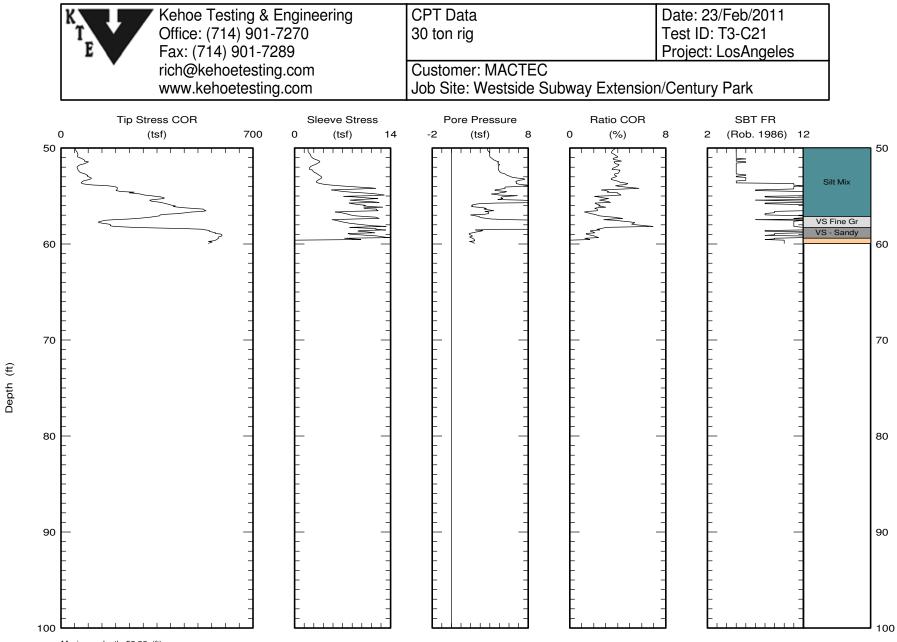
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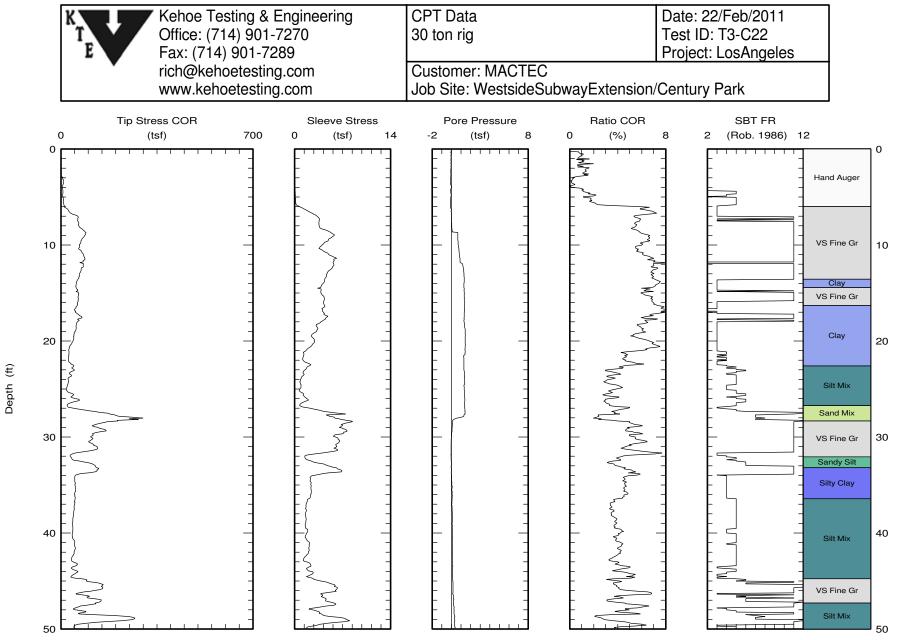
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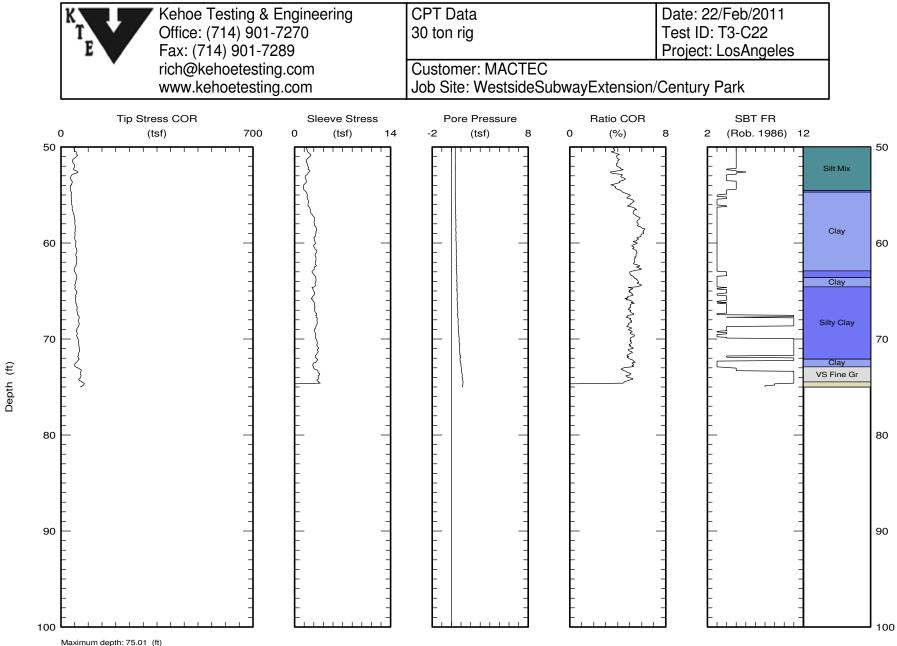
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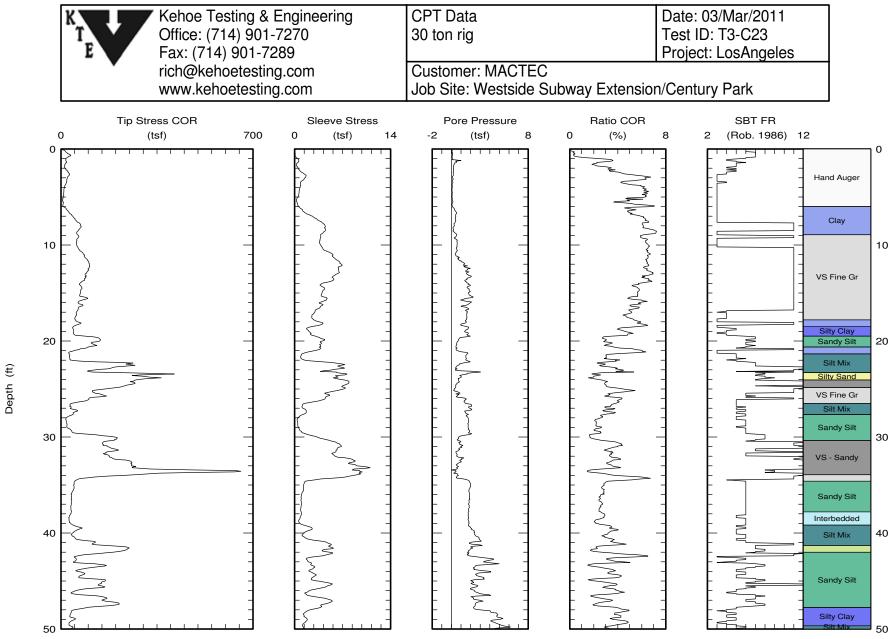
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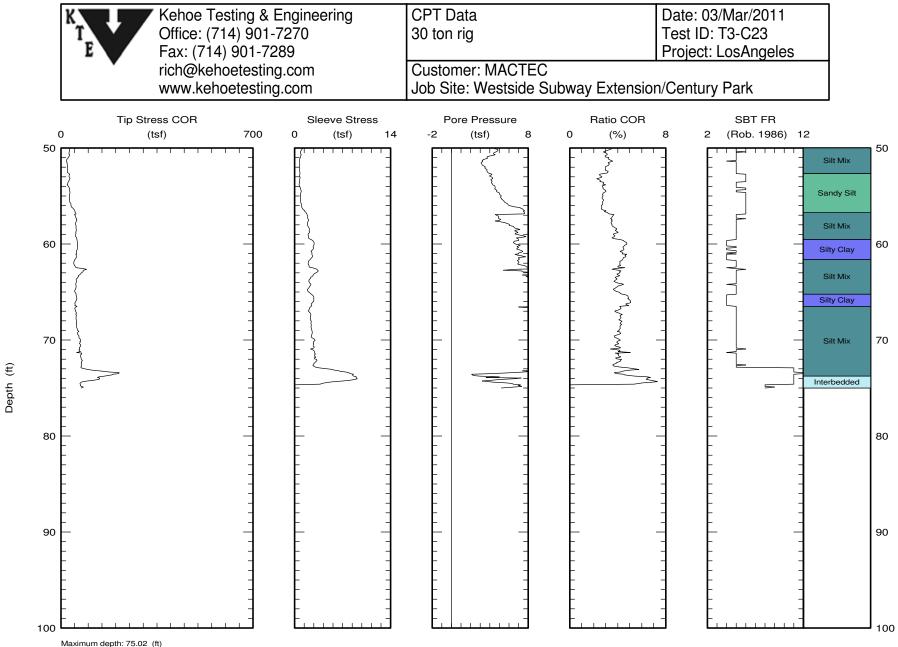
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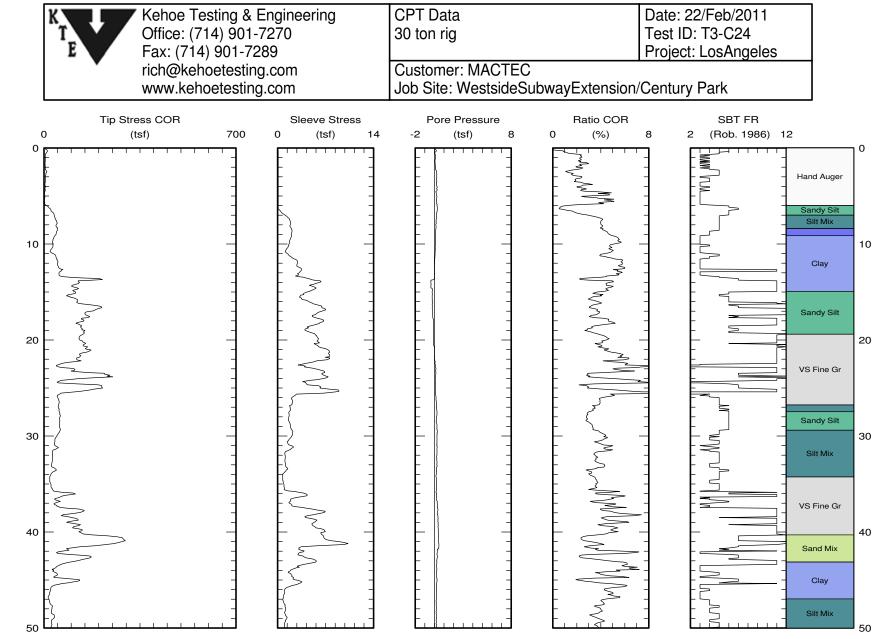
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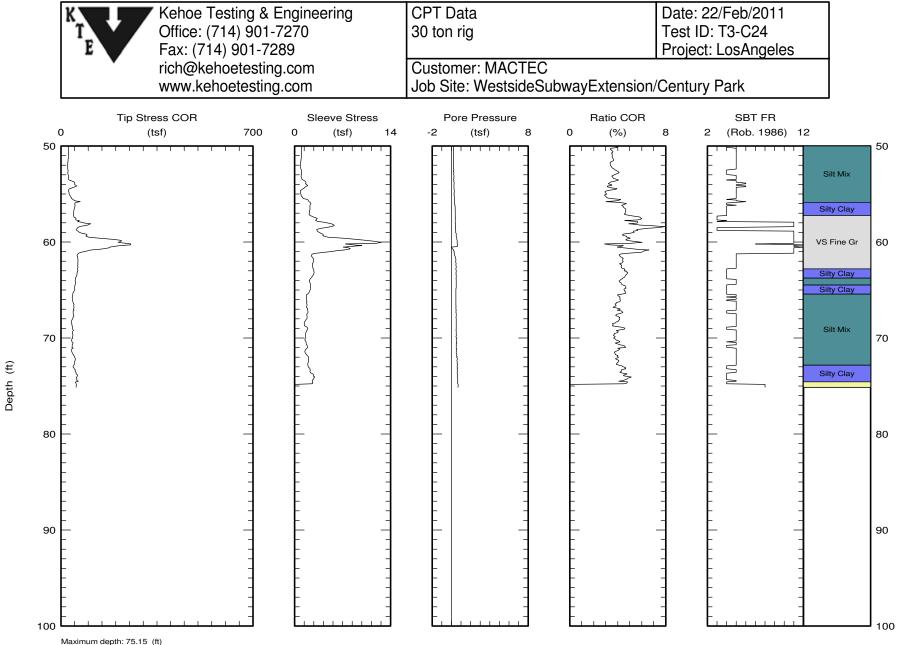


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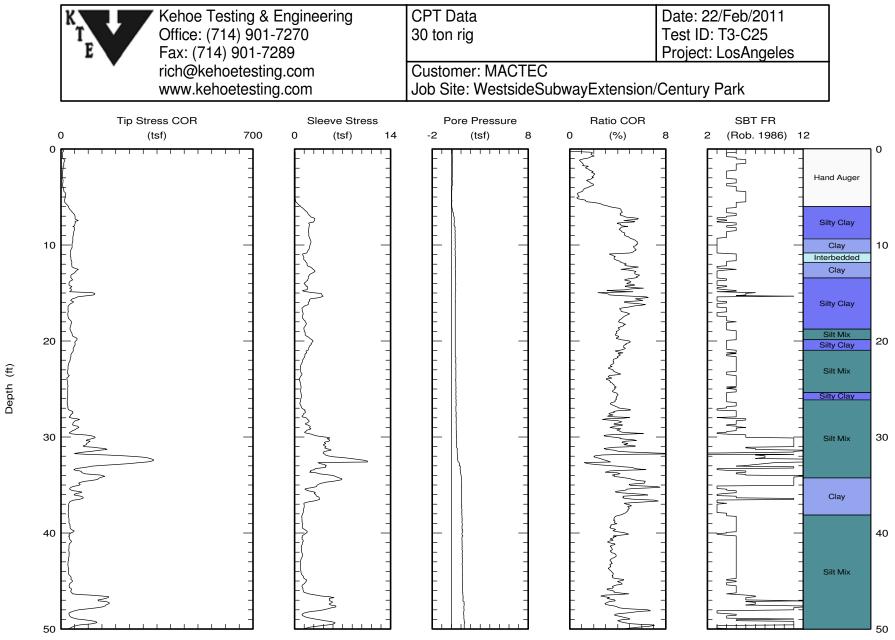


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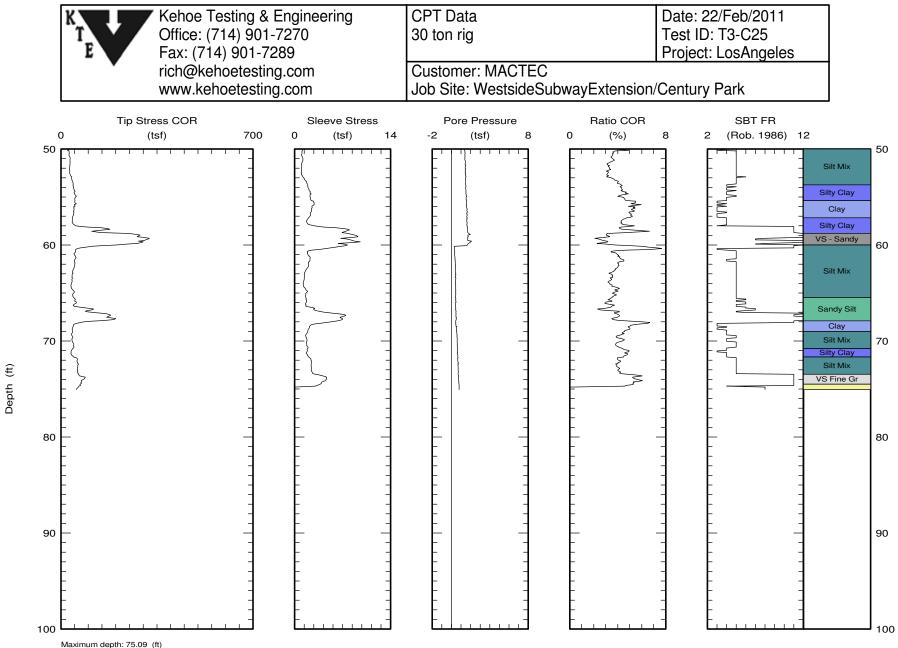
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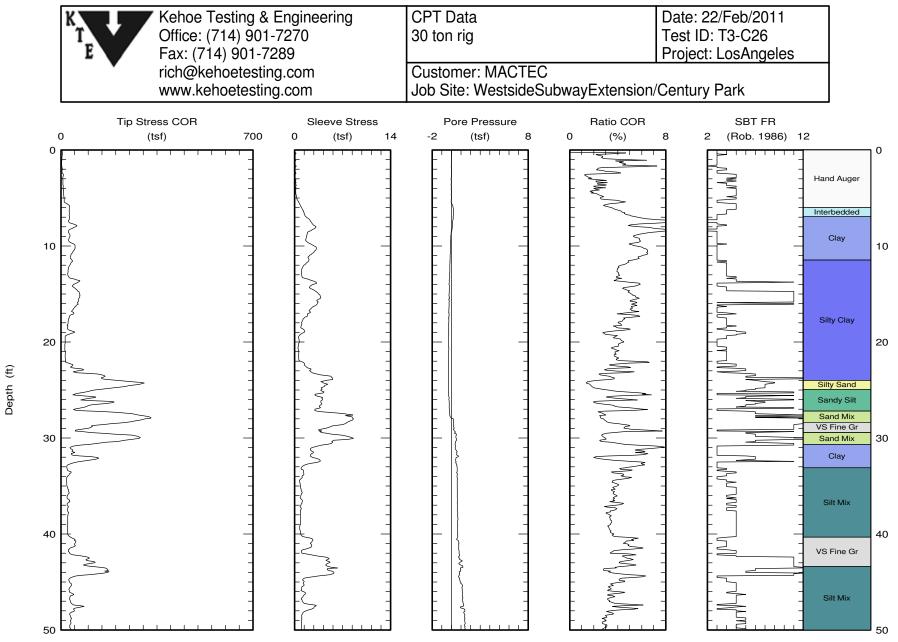
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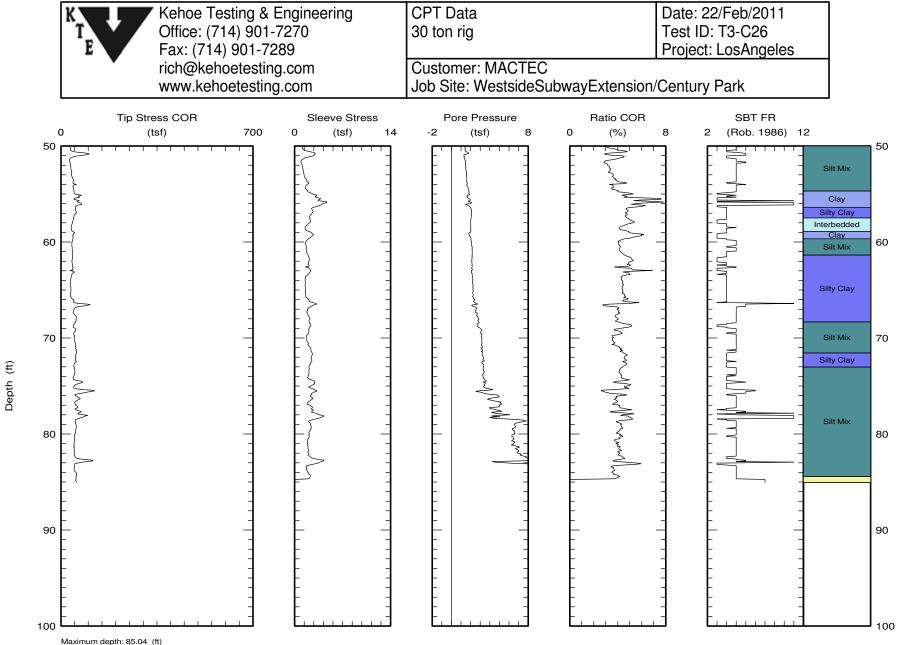
Maximum depth: 75.09 (ft) Page 1 of 2



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Maximum depth: 85.04 (ft) Page 1 of 2



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APPENDIX D

SOIL STRATIGRAPHIC STUDY AND RELATIVE AGE ESTIMATES

Soil Stratigraphy Study And Relative Age Estimates For A Fault Rupture Hazard Investigation At Westfield Century City Mall, 1801 Avenue Of The Stars, 10250 Santa Monica Boulevard, And 1930 Century Park West, Century City - Los Angeles, California

Prepared by:

John Helms, CEG 40344 Wood Court, Palmdale, California 93551 Voice & FAX (661)718-3646

Submitted to:

Ms. Susan Kirkgard GEOCON, Inc. 3303 North San Fernando Boulevard, Suite 100 Burbank, CA 91504

July 26, 2013

John Helms, CEG

40344 Wood Court, Palmdale, CA 93551;(661) 206-5860

July 26, 2013

Ms. Susan Kirkgard GEOCON Inc. 3303 North San Fernando Boulevard, Suite 100 Burbank, CA 91504

Subject: Soil Stratigraphy Study And Relative Age Estimates For A Fault Rupture Hazard Investigation At Westfield Century City Mall, 1801 Avenue Of The Stars, 10250 Santa Monica Boulevard, And 1930 Century Park West, Century City - Los Angeles, California

Dear Ms. Kirkgard:

I am pleased to present to you this soil stratigraphic study and relative-age estimates to be used with your fault rupture hazard investigation at the Westfield Century City Mall, in Century City and the City of Los Angeles, California. This information presents relative age estimates for the deposits in six locations along two separate transects of borings.

Geocon retained John Helms CEG to describe and assist in correlations of the soil stratigraphy from continuously cored bore hole samples and to assign relative age dates for the deposits identified across the site. The continuously cored bore hole samples were obtained from two separate transects of borings, transect A (along Avenue Of The Stars) and transect B (along Century Park West). Four boreholes are completely described from transect A and two are completely described from transect B. The soil descriptions are used to calculate various soil development indices (or SDIs). The SDI values were then compared to the SDI values from similar described soils with known ages to estimate age ranges for the soils understudy.

The attached report classifies each described soil profile, identifies stratigraphic relationships, defines soil chronosequences, and estimates relative age for each soil profile described across the study area. Calculated SDI's show strong correlations to the SDI values of other published, described, and dated soil profiles with similar parent materials.

Age estimates range from 58 to 135 ka for the young and thin alluvial stratigraphic section studied along the southern portion of transect A in borings B-5 and B-7. An older and thick alluvial section along the northern portion of Transect A in borings B-1 and B-4 has age estimates that range from 137 – 322 ka in age. This relationship carries across to Transect B where the thickest and older alluvial stratigraphic section is in the northern portion of the Transect in boring B-1 with relative ages ranging from approximately 165 to 371 ka. Along the southern portion of Transect B in boring B-3 a young and thin alluvial stratigraphic section ranges in relative age from approximately 92 to 191 ka.

The uppermost buried soils that can be correlated across the entire length of Transect A are well developed and truncated buried argillic soil profiles that range in relative age from 34 –

127 ka. A similar soil observed in Transect B is possibly exhumed at or near the ground surface and ranges in relate age from 9 - 30 ka. Please see Tables 11 and 14 in the attached report for a summary listing of all of the determined relative ages at the study site.

Thank you for this opportunity to be of service. Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

ED GA G No. 2272 u u CERTIFIED ENGINEERING EOFCALIF

John Helms, CEG 2272

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Soil Stratigraphy Study And Relative Age Estimates For A Fault Rupture Hazard Investigation At Westfield Century City Mall, 1801 Avenue Of The Stars, 10250 Santa Monica Boulevard, And 1930 Century Park West, Century City - Los Angeles, California.

INTRODUCTION

Six soil profiles have been studied for geomorphic characteristics and relative degrees of weathering to estimate deposit relative-ages. The relative age estimates are based on index value comparisons with other published and dated soil profile descriptions. The comparative soils are from areas with a similar climate and similar parent material to this study area. The estimated relative ages in this report will be used by GEOCON, Inc. to assess the recency and recurrence of faulting across the study area. Alluvial units are assessed chronostratigraphically across several borehole locations from two separate transects that span a majority of the project site area. In this study, the soil stratigraphy is defined with soil field description data, and no laboratory data. This study identifies the soil stratigraphy and estimates the relative ages of six stacked soil profiles. Four continuously cored and sampled boreholes have been described along Transect A, which is located along Avenue Of The Stars. Two additional continuously cored and sampled boreholes have been described along Century Park West. Both Transects are located along a graded and stripped alluvial surface.

For the Quaternary geologist, a soil can be defined as a natural body that consists of horizons of organic and/or mineral constituents which differ from it's parent material in some way (Birkland, 1984). A chronosequence is a group of soils for which all soil forming factors (such as topography, parent material, vegetation, and climate) except time is relatively equal (Jenny, 1941). Recent geologic studies in the coastal region of southern California provide age constraints for several deposits and geomorphic surfaces ranging in age from middle Pleistocene to recent (McFadden, 1982; Rockwell, 1988; and WLA, 1998). Often it has proven difficult to date older deposits due to changes in past climatic regimes. Studies on the impacts of glacial to interglacial climatic changes on soil development in specific regions (McFadden, 1982; Birkland, 1984; McFadden, 1988) indicate that soil development has occurred throughout the Quaternary.

This study is concerned with a section of alluvium along the southern range front of the Santa Monica Mountains, which is within the Transverse Ranges Geomorphic Province. A series of stacked and truncated argillic soil subsurface horizons within all of the stratigraphic sections studied indicates that the alluvial stratigraphic section across the entire study area is old. The thickness of the alluvial stratigraphic section in both Transects thickens to the north and increases in relative age to the north across the project site area. Age estimates range from 58 to 135 ka for the younger and thinner alluvial stratigraphic section studied along the southern portion of transect A in borings B-5 and B-7. An older and thicker alluvial section along the northern portion of Transect A in borings B-1 and B-4 has age estimates that range from 137 – 322 ka in age. This relationship carries across to Transect B where the thicker and older alluvial stratigraphic section is in the northern portion of the Transect in boring B-1 has relative age estimates that range from 165 to 371 ka. Along the southern portion of

Transect B in boring B-3, a younger and thinner alluvial stratigraphic section ranges in relative age from 92 to 191 ka.

The old alluvium is characterized by clay rich, hard to very hard, very fine-grained sand that is plugged with illuvial clay. Most of the surface soils encountered in this study classify as Alfisols, and relative age estimates range from 8 to 15 ka at the surface across a majority of the project site area. In the northern portion of the study area the surface soils encountered classify as Entisols and relative age estimates range from 1 to 8 ka for these surface soils. Soil relative age estimates have broad ranges, dependant upon the pool of comparative data used. Most of the buried soils across the study area fall into a great group classification (Soil Conservation Service, 2000) of Typic Haploxeralfs. Soil profiles were described from borings B-1, B-4, B-5, and B-7 in Transect A and from borings B-1 and B-3 in Transect B.

MATERIALS AND METHODS

Initial feasibility studies were carried out for this study by examining previously drilled continuous core samples by AMEC. AMEC Borings B-2, B-3, and B-8 along Transect A, and AMEC borings B-5, B-6, and B-7 along Transect B were reviewed on 6/12 - 13/2012 for the presence and continuity of soils. Although no detailed descriptions were generated from the AMEC core samples, the summary logs generated indicate that significant stratigraphic correlations may be present across the site.

Additional continuous core samples collected by GEOCON, Inc. were described in more detail. Four soil profiles from were described out of core samples from Transect A in GEOCON borings B-1, B-4, B-5, and B-7. Two additional soil profiles from were described out of core samples from Transect B in GEOCON borings B-1 and B-3. The soils were described using guidelines set by the Soil Survey Staff (1991 and 1999). Specific soil properties such as soil structure and soil horizon boundaries could not be accurately described the from core sample exposures. Thus, these soil qualifiers have not been described and do not factor into the estimated soil relative age comparisons.

Soil profile field description values quantify soil properties that are used to develop a soil development index (SDI) value as outlined by Harden (1982). Points are assigned to descriptive data for each of several observed soil properties, such as dry color, moist color, texture, dry, moist, and wet consistence, and clay film content, for every horizon in a profile relative to the horizon's thickness, and normalized to a common depth. The maturity of a soil profile is gauged through data collected from active wash deposits (or raw alluvium).

Table 1.1 through Table 4.1 and Table 7.1 to 8.1 list the soil description for each studied boring in longhand format. Table 1.2 through Table 4.2 and Table 7.2 to 8.2 list the soil using soil conservation service notation and shows the SDI calculations. These tables show the calculated SDI values, the soil profile description, and the normalization values for raw alluvium. SDI values are calculated by assigning point values to described soil properties. The points are summed for each soil horizon and divided by the total number of descriptive properties used. This equals the mean horizon index value (HI). HI values are multiplied by the corresponding soil horizon thickness. The SDI value equals the sum of the normalized horizon indices. The maximum horizon index (MHI) is the value of the horizon with the largest

summed descriptive value. MHI is independent of horizon thickness, and is usually the diagnostic subsurface soil horizon for most soil profiles. Table 1.2 through Table 4.2 and Table 7.2 to 8.2 list all of the determined HI, SDI, and MHI values for the soils under study.

SDI values have shown significant correlations to soil age in many recent studies (Harden, 1981; Rockwell *et al.*, 1985; Reheis *et al.*, 1990; Rockwell *et al.*, 1994). The soils described in this study are compared to soils described and dated by McFadden (1982 and 1987) in San Bernardino County near Mission Creek, by Rockwell (1988) in the Ventura River basin, and by William Lettis and Associates, Inc. (1998) in West Hollywood. SDI values are calibrated to a common depth of 7 feet.

The changes in the subsurface pedogenic properties of the alfisols soil order allows for relative age determinations by emphasizing specific soil properties (such as color and clay film content) that are most diagnostic. Soil properties that express themselves well through time are most often used in the assessment of soil relative ages through a specific soil property index such as the color or clay film index. MHI is a comparison of a soil pedons master (or diagnostic) subsurface horizon (typically an argillic or cambic horizon). Independent of horizon thickness, the MHI directly compares the properties of the soil profiles strongest soil horizon. The color index (Rockwell *et al.*, 1985, 1994) is used to quantify observed colors (in Mussel notation) of each profile in order to compare relative degrees of reddening. The color index is simply the summation of an entire profile's horizon index values for dry colors. The clay film index (Rockwell *et al.*, 1985, 1994) is used to quantify field descriptions of this soil property in order to compare relative profile maturity. The clay film index is simply the summation of an entire profile maturity. The clay film index is simply the summation of an entire profile maturity. The clay film index is simply the summation of an entire profile maturity.

SOIL RELATIVE AGE METHODS

Soil relative ages are calculated and compared independently for each soil profile described. The six soil profiles are located across different buried alluvial surfaces that differ in relative age, facies of deposition, and degrees of preservation. A series of stacked, buried, and truncated hard, clayey soils with advanced pedogenic structure and illuvial clays characterize all of the buried soil profiles on this project site.

All of the soil profiles described have a surface age implied by estimating the time of inception for the exposed surficial soil. All of the soils within this study area also contain a stacked or buried series of soils. In this case, a deposit age assessment is obtained by identifying and isolating the different parent materials (or deposits). Then comparing a set of abridged calculated indices to an additional suite of similar soils that have been radiometrically dated yields the equivalent to a surface age estimate. Such burial relationships are common along the southern Santa Monica Mountains range front; especially where soils developed into alluvial fan deposits and buries or locally truncates soils that have developed previously in older alluvial fan sediments. A cumlic soil profile estimated age can assess landform age, and has potential to assess rates of erosion, rates of landform evolution, and rates of tectonic activity across the study area.

Each described soil profile has an SDI value, which is used to estimate the soil relative age. Cumuli relative age estimates for a stacked or buried soil profile are specifically referred to as "deposit ages". The relative age estimate for the surface profile or modern soil is referred to as the "surface age". All of the relative age estimates given are considered minimum ages given that an unknown amount of erosion has occurred after the formation of and before the burial of each truncated soil studied.

SOIL SUMMARY DESCRIPTIONS

Soil summary descriptions were generated for most other borings that were not described in detail for this study. The summary descriptions record diagnostic pedogenic features for each soil horizon identified. This was done in order to assist with establishing stratigraphic correlations across the site. Relative age estimates were not generated for any of the listed soil summary descriptions. The soil summary descriptions for the GEOCON borings are listed in Tables 5.1 through 5.3 for Transect A and in Tables 9.1 through 9.4 for Transect B. In addition, the initial soil summary descriptions for the AMEC borings are listed in Tables 6.1 through 6.3 for Transect A and in Tables 10.1 through 10.3 for Transect B

DISCUSSION AND RESULTS

This section is broken up by each individual soil profile described. Each section contains a brief write up for each continuously cored boring described with tables designated for each soil profile. The attached Tables 1.1 through 4.1 and Tables 7.1 to 8.1 present the soil profile descriptions in longhand format. Tables 1.2 through 4.2 and Tables 7.2 to 8.2 present the results of the calculated SDI values. Table 11 is a summary of the soil relative age estimates for each soil profile under study. Table 12 is a compilation of the comparative data in a format that compares to the data generated for this study. Table 13 is a soil abbreviation key to be used in conjunction with the SDI calculation sheets. Table 14 lists the trench log unit relative ages.

Soil descriptions, SDI calculations, and relative age determinations follow for each of the soil profiles studied.

TRANSECT A BORINGS

Four soil profiles from were described out of core samples from Transect A in GEOCON borings B-1, B-4, B-5, and B-7. Age estimates range from 58 to 135 ka for the younger and thinner alluvial stratigraphic section studied along the southern portion of transect A in borings B-5 and B-7. An older and thicker alluvial section along the northern portion of Transect A in borings B-1 and B-4 has age estimates that range from 137 – 322 ka in age.

Boring 1

The core samples from GEOCON Transect A, Boring B-1 were reviewed on site on 5/23/2013. This boring is located on the northern end of Transect A, and is one of the thicker alluvial sections encountered. See Table 1.1 for a complete soil description of the continuously sampled boring, table 1.2 for the SDI index value calculations and relative age

estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect A at boring B-1 is a weakly developed Entisol that is characterized by juvenile argillic horizon development and has a estimated relative age of 4 - 8 ka. The uppermost buried soils that can be correlated across the entire length of Transect A are buried soil numbers 1 and 2 in boring B-1. These soils are well developed and severely truncated buried argillic soil profiles that range in relative age from 34 - 68 ka. The entire alluvial stratigraphic section in Transect A, boring B-1 has an estimated age that ranges from 156 - 322 ka, and is 95 feet thick. Differences in depths of burial and unit thicknesses due to differential erosion / truncation laterally along Transect A will cause a variance in relative age estimates between the individual borings. In order to control for this multiple soil descriptions were generated across each boring transect which assesses the same buried surfaces at differing depths of burial and in differing states of preservation.

Boring 4

The core samples from GEOCON Transect A, Boring B-4 were reviewed on site on 9/13/2012. This boring is also located on the northern end of Transect A, and is also one of the thicker alluvial sections encountered. See Table 2.1 for a complete soil description of the continuously sampled boring, table 2.2 for the SDI index value calculations and relative age estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect A at boring B-4 is a moderately well developed Alfisol that is characterized by a severely truncated and well developed argillic horizon and has a estimated relative age of 8 - 15 ka. The surface soil in boring B-4 is missing from the surface in boring B-1 along Transect A and may have been eroded off to the north. The uppermost buried soils that can be correlated across the entire length of Transect A are buried soil numbers 3 and 4 in boring B-4. These soils are stacked, well developed, and severely truncated buried argillic soil profiles that range in relative age from 58 - 127 ka. The entire alluvial stratigraphic section in Transect A, boring B-4 has an estimated age that ranges from 137 - 295 ka, and is 85 feet thick.

Boring 5

The core samples from GEOCON Transect A, Boring B-5 were reviewed on site on 9/18/2012. This boring is located in the southern portion of Transect A, and is a thin or truncated alluvial section. See Table 3.1 for a complete soil description of the continuously sampled boring, table 3.2 for the SDI index value calculations and relative age estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect A at boring B-5 is a moderately well developed Alfisol that is characterized by a severely truncated and well developed argillic horizon and has a estimated relative age of 8 - 15 ka. The surface soil in boring B-5 is similar to the surface soils encountered in borings B-4 and B-7 along Transect A. The uppermost buried soils that

can be correlated across the entire length of Transect A are buried soil numbers 2 and 3 in boring B-5. These soils are stacked, well developed, and severely truncated buried argillic soil profiles that range in relative age from 54 - 119 ka. The entire alluvial stratigraphic section in Transect A, boring B-5 has an estimated age that ranges from 58 - 127 ka, and is 50 feet thick.

Boring 7

The core samples from GEOCON Transect A, Boring B-7 were reviewed on site on 9/12/2012. This boring is located at the southern end of Transect A, and is also a thin or truncated alluvial section. See Table 4.1 for a complete soil description of the continuously sampled boring, table 4.2 for the SDI index value calculations and relative age estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect A at boring B-7 is also a moderately well developed Alfisol that is characterized by a severely truncated and well developed argillic horizon and has a estimated relative age of 8 - 15 ka. The surface soil in boring B-7 is similar to the surface soils encountered across the entire southern and central portions of Transect A. The uppermost buried soils that can be correlated across the entire length of Transect A are buried soil numbers 3 and 4 in boring B-7. These soils are stacked, well developed, and severely truncated buried argillic soil profiles that range in relative age from 58 - 127 ka. The entire alluvial stratigraphic section in Transect A, boring B-7 has an estimated age that ranges from 62 - 135 ka, and is 47.25 feet thick.

GEOCON BORING SUMMARY DESCRIPTIONS

Soil summary descriptions were generated for most of the other GEOCON borings that were not described in detail for this study. For Transect A the additional soil summary descriptions for the GEOCON borings are listed in Tables 5.1 through 5.3. Relative age estimates were not generated for any of these listed soil summary descriptions. These summary descriptions were generated to assist with establishing stratigraphic correlations across the site. The observations for the soil summary descriptions of borings B-2 and B-4 for Transect A were made on 9/12/2012, and the observations for the soil summary descriptions of borings along Transect A appear to contain artificial fill that is in contact with thin Early Holocene-aged channel scour and stream terrace deposits which overlies a stacked sequence of Pleistocene-aged soils.

AMEC BORING SUMMARY DESCRIPTIONS

The core samples from AMEC borings B-2, B-3, and B-8 along transect 1 were briefly reviewed for soil properties on 6/13/2012. These soil summary descriptions for the AMEC borings are listed in Tables 6.1 through 6.3. The AMEC borings along Transect A all appear to contain artificial fill that is in contact with thin Early Holocene-aged channel scour and stream terrace deposits that overlie Pleistocene-aged soils.

TRANSECT B BORINGS

Two soil profiles from were described out of core samples from Transect B in GEOCON borings B-1 and B-3. Age estimates range from 92 to 191 ka for the younger and thinner alluvial stratigraphic section studied along the southern portion of transect B in boring B-3. An older and thicker alluvial section along the northern portion of Transect B in boring B-1 has an age estimate that ranges from 165 - 321 ka in age.

Boring 1

The core samples from GEOCON Transect B, Boring B-1 were reviewed on site on 5/20/2013. This boring is located on the northern end of Transect B, and is one of the thicker alluvial sections encountered. See Table 7.1 for a complete soil description of the continuously sampled boring, table 7.2 for the SDI index value calculations and relative age estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect B at boring B-1 is a weakly developed Entisol that is characterized by severely truncated juvenile argillic horizon development and has a estimated relative age of 1 - 4 ka. The uppermost buried soils that can be correlated across the entire length of Transect B are buried soil numbers 1 and 2 in boring B-1. These soils are well developed and severely truncated buried argillic soil profiles. Combined with the surface soil, buried soil 1 comprises a Early Holocene to Latest Pleistocene alluvial package that ranges in relative age from 9 - 30 ka. Buried soil 2 in boring B-1 for Transect B is a Late Pleistocene truncated alluvial argillic soil that ranges in relative age from 39 - 89 ka. The entire alluvial stratigraphic section in Transect B, boring B-1 has an estimated age that ranges from 165 - 371 ka, and is at least 95 feet thick.

Boring 3

The core samples from GEOCON Transect B, Boring B-3 were reviewed on site on 6/6/2013. This boring is located in the southern portion of Transect B, and is a thin or truncated alluvial section. See Table 8.1 for a complete soil description of the continuously sampled boring, table 8.2 for the SDI index value calculations and relative age estimates, and the GEOCON Inc.'s cross section and geologic map for both the borehole and transect's location.

The surface soil in Transect B at boring B-3 is a weakly developed Alfisol that is characterized by a severely truncated and moderately well developed argillic horizon and has a estimated relative age of 8 - 15 ka. The uppermost buried soils that can be correlated across the entire length of Transect B are buried soil numbers 1 and 2 in boring B-3. These soils are well developed and severely truncated buried argillic soil profiles. Combined with the surface soil, buried soil 1 comprises a Early Holocene to Latest Pleistocene alluvial package that ranges in relative age from 16 - 30 ka. Buried soil 2 in boring B-3 for Transect B is a Late Pleistocene truncated alluvial argillic soil that ranges in relative age from 31 - 60 ka. The entire alluvial stratigraphic section in Transect B, boring B-1 has an estimated age that ranges from 92 - 191 ka, and is 50.2 feet thick.

GEOCON BORING SUMMARY DESCRIPTIONS

Soil summary descriptions were generated for most of the other GEOCON borings that were not described in detail for this study. For Transect B the additional soil summary descriptions for the GEOCON borings are listed in Tables 9.1 through 9.4. Relative age estimates were not generated for any of these listed soil summary descriptions. These summary descriptions were generated to assist with establishing stratigraphic correlations across the site. The observations for the soil summary descriptions of borings B-2 and B-4 through B-6 for Transect B were made on 5/20/2013. All of the GEOCON borings along Transect B appear to contain a stacked sequence of Early Holocene-aged to Late a Pleistocene-aged soils.

AMEC BORING SUMMARY DESCRIPTIONS

The core samples from AMEC borings B-5, B-6, and B-7 along transect B were briefly reviewed for soil properties on 6/12/2012. These soil summary descriptions for the AMEC borings are listed in Tables 10.1 through 10.3. The AMEC borings along Transect B all appear to contain a truncated and thin Early Holocene-aged to Latest Pleistocene-aged soil at the ground surface.

CONCLUSIONS

The soils observed across the study area are mainly alfisols that have developed in alluvial environments. All six of the soil profiles across Transects A and B consist of a series of stacked, truncated, and buried argillic soil horizons. The truncated and buried soils with argillic sub surface soil horizons are moderately well to strongly developed. The buried alfisol soils typically have 10 YR colors with a moderate amount of secondary (pedogenic) clay in a series of argillic (Bt) diagnostic subsurface horizons.

The near surface buried soil profiles across the project site area are laterally continuous, and dip gently to the north. Lateral variability in the soils across the site is due to localized scouring, infilling, and stacking of these materials in an alluvial environment. In this sedimentological environment surfaces that have been stable long enough to form a robust soil, can suddenly be buried by a new deposit, or scoured out (truncated) and possibly infilled with younger material. The amount of erosion that has occurred with each truncated soil under study is unknown. Thus the relative age estimates given in this study are minimum ages.

These soil relative age determinations are consistent with the general geologic and pedogenic observations of soils in southern California. Strongly developed, well horizonated, thick, and oxidized alfisols can be as much as 200 ka in age. Erosion tends to act as a rejuvenating aspect in soil development, by decreasing the strength of the soil development properties consequent age estimates are younger. In that past magnitudes and rates of erosion is difficult to assess the soil relative age estimates are utilized as minimum ages.

The soils observed along Transect A are Holocene to Pleistocene in age. The buried and stacked soils display soil horizons that have strong argillic horizon development. Age estimates range from 58 to 135 ka for the young and thin alluvial stratigraphic section studied along the southern portion of transect A. An older and thick alluvial section along the northern

portion of Transect A has relative age estimates that range from 137 - 322 ka in age. The uppermost buried soil that can be correlated across the entire length of Transect A is a well developed and truncated buried argillic soil profile that ranges in relative age from 19 - 57 ka.

The soils observed along Transect B are Pleistocene in age. The buried and stacked soils display soil horizons that also have strong argillic horizon development. Age estimates range from 92 to 191 ka for the young and thin alluvial stratigraphic section studied along the southern portion of transect B. An older and thick alluvial section along the northern portion of Transect B has relative age estimates that range from 165 - 371 ka in age. The uppermost soil that can be correlated across the entire length of Transect B is a near surface, moderately well developed, and truncated buried argillic soil profile that ranges in relative age from 8 - 19 ka. The underlying truncated soil can also be correlated across the entire length of Transect B, which is a well developed, truncated buried argillic soil profile that ranges in relative age in relative age from 36 - 60 ka.

LIMITATIONS

The conclusions and recommendations presented herein are the results of an inherently limited scope. Specifically, the scope of services consisted of an assessment of relative age from core samples and did not participate in any drilling activities at the site. The conclusions and recommendations contained in this report are professional opinions derived in accordance with current standards of professional practice. No warranty is expressed or implied.

This report has been prepared for the exclusive use of GEOCON, Inc. and applies only to the Fault Rupture Hazard Study located at The Westfield Century City Mall. In the event that significant changes in the interpretations of this study to be made, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by John Helms, CEG, and the conclusions and recommendations of this report are verified in writing.

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Table 1.1Soil Description - Transect A; Boring 1

| Depth (Ft) | Horizon | Transect A; B-1 Description |
|-------------|-----------------|--|
| 0 - 16.0 | Af | Artificial Fill - not described |
| 16 - 20 | NR | No Recovery - no sample |
| 20 - 20.7 | AB | Very dark grayish brown (10YR 3/2m mixed), loam, organic rich, slightly hard, friable, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, common fine and few moderately thick humus films on ped faces, clear lower boundary to; |
| 20.7 - 22 | Bw / Btj | Dark yellowish brown (10YR 3/4m, mixed), sandy loam, slightly well oxidized, soft to slightly hard, friable, slightly sticky, non- to slightly plastic, medium-grained moderately well sorted sand, few very fine clay films (or stains) on ped faces, gradational lower boundary to; |
| 22 - 25.9 | C1 scour | Dark yellowish brown (10YR 4/4m, mixed), loamy sand, crudely stratified, moderately well oxidized, soft, very friable, non- to slightly sticky, non-plastic, coarse-grained poorly sorted sand, common fine gravel, gradational lower boundary to; |
| 25.9 - 27.7 | C2 scour | Dark yellowish brown (10YR 4/3m, mixed), loamy sand to sandy loam, massive, slightly oxidized, soft to slightly hard, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, clear lower boundary to; |
| 27.7 - 31.3 | 2Btb | Dark yellowish brown (10YR 3/4m, mixed), loam to clay loam, massive, moderately well oxidized, hard, friable to firm, moderately sticky, moderately to very plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, clear lower boundary to; |
| 31.3 - 32.8 | 2BCb | Dark yellowish brown (10YR 4/3m, mixed), loam, massive, slightly hard, friable, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, faintly mottled and gleyed, clear lower boundary to; |
| 32.8 - 35.5 | 3Bt1b | Dark grayish brown (10YR 4/2m, mixed), clay loam, massive, hard to very hard, firm, moderately to very sticky, very plastic, fine-grained well sorted sand, slightly well oxidized, many fine and common moderately thick clay films on ped faces, abrupt lower boundary to; |
| 35.5 - 36.3 | 3BCb lam | Brown (10YR 4/3m, mixed), sandy loam to loam, faintly laminated, soft to slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, slightly mottled and gleyed, abrupt lower boundary to; |
| 36.3 - 38.4 | 4Btb | Dark grayish brown (10YR 4/2m, mixed), clay loam, massive, hard, firm, moderately to very sticky, very plastic, fine-grained well sorted sand, moderately well oxidized, many fine and common moderately thick clay films on ped faces, partially mottled and mostly gleyed, abrupt lower boundary to; |
| 38.4 - 40 | 4Cb1 scour | Dark gray (10YR 4/1m, mixed), sandy loam, stratified, slightly hard, very friable, non- to slightly sticky, non-plastic, medium-grained moderately well sorted sand, strongly gleyed, gradational lower boundary to; |
| 40 - 42.4 | 4Cb2 scour | Gray (10YR 5/1m, mixed), loamy sand, massive, soft, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, strongly gleyed, clear lower boundary to; |
| 42.4 - 45.3 | 5Btb trun | Dark Grayish brown (10YR 4/2m, mixed), silt loam, massive, slightly hard, friable, moderately sticky, moderately plastic, coarse-grained poorly sorted sand, few to common fine and medium gravel, few to common fine clay films on ped faces, moderately gleyed, clear lower boundary to; |
| 45.3 - 46.2 | 5Coxb scour | Brown (7.5YR 4/4m, mixed), loamy sand, crudely stratified, well oxidized, soft, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, common to many fine gravel, abrupt lower boundary to; |
| 46.2 - 47.5 | 6BCb ox trun | Dark yellowish brown (10YR 4/4m, mixed), sandy loam, faintly laminated, moderately well oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, gradational lower boundary to; |

Table 1.1

| Depth (Ft) | Horizon | Transect A; B-1 Description (Continued) |
|-------------|-----------------|--|
| 47.5 - 48.3 | 6Coxb scour | Dark yellowish brown (10YR 4/4m, mixed), loamy sand, massive, moderately well oxidized, soft to slightly hard, friable, non- to slightly sticky, non-plastic, coarse-grained poorly sorted sand, abrupt lower boundary to; |
| 48.3 - 50.9 | 7Btb1 trun | Dark yellowish brown (10YR 4/4m, mixed), loam, massive, moderately well oxidized, slightly hard to hard, friable, slightly to moderately sticky, slightly plastic, medium-grained moderately well sorted sand, many fine and common moderately thick clay films on ped faces, clear lower boundary to; |
| 50.9 - 52.3 | 7Btb2 | Dark yellowish brown (10YR 4/4m, mixed), silty clay loam, finely laminated, moderately well oxidized, hard, firm, moderately sticky, moderately to very plastic, very fine-grained very well sorted sand, common fine and few moderately thick clay films on ped faces, gradational lower boundary to; |
| 52.3 - 54.5 | 7Btkb3 | Brown (7.5YR 4/4m, mixed), clay loam, massive, well oxidized, very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, many fine and common moderately thick clay films on ped faces, calcium carbonate stage 1+, well disseminated in matrix and common fine nodules, clear lower boundary to; |
| 54.5 - 55 | 7BC scour | Yellowish brown (10YR 5/4m mixed), loam, massive, moderately well oxidized, hard, friable, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, common fine clay films on ped faces, partially gleyed clear lower boundary to; |
| 55 - 58.7 | 8ABb / 8Btb1 | Dark brown (10YR 3/3 m, mixed), silty clay loam, massive, organic rich, slightly oxidized, very hard, firm, moderately to very sticky, very plastic, very fine-grained very well sorted sand, many fine and common moderately thick and thick clay films on ped faces, many fine MnO nodules in matrix, gradational lower boundary to; |
| 58.7 - 65.9 | 8Btb2 | Dark yellowish brown (10YR 4/4m, mixed), loam to clay loam, massive, moderately well oxidized, very hard, firm, moderately to very sticky, moderately to very plastic, fine-grained well sorted sand, few to common fine and medium gravel, many fine and common moderately thick and thick clay films on ped faces and coating clasts, partially gleyed, gradational lower boundary to; |
| 65.9 - 69.3 | 8BCb / 8Btb3 | Brown (10YR 4/3m mixed), loam, massive, slightly oxidized, hard, friable, moderately sticky, moderately plastic, fine- to medium-grained moderately well sorted sand, few fine gravel, many fine, common moderately thick and few thick clay films on ped faces and coating clasts, partially gleyed, gradational lower boundary to; |
| 69.3 - 71.5 | 9ABb / 9Btb1 | Dark brown (10YR 3/3 m, mixed), loam to clay loam, massive, slightly oxidized, slight organics, very hard, firm, moderately to very sticky, very plastic, fine-grained well sorted sand, few to common fine and few moderately thick clay films on ped faces, partially gleyed, gradational lower boundary to; |
| 71.5 - 75 | 9Btb2 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, moderately well oxidized, very hard, firm, moderately to very sticky, very plastic, very fine-grained very well sorted sand, common to many fine and moderately thick clay films on ped faces, partially gleyed, clear lower boundary to; |
| 75 - 75.5 | 9BCb scour | Brown (10YR 4/3 m, mixed), loamy sand to sandy loam, massive, slightly oxidized, slightly hard, friable, non- to slightly sticky, non-plastic, medium- to coarse-grained poorly sorted sand, common fine gravel, undetermined (No recovery) lower boundary to; |
| 75.5 - 80 | NR | No Recovery |
| 80 - 82.7 | 10Btb trun | Dark yellowish brown (10YR 3/4m, mixed), clay loam, massive, moderately well oxidized, very hard, firm, moderately sticky, moderately to very plastic, fine-grained well sorted sand, common to many moderately thick and few thick clay films on ped faces, clear lower boundary to; |

| Table | 1 | .1 | ۱ |
|-------|---|----|---|
|-------|---|----|---|

| Depth (Ft) | Horizon | Transect A; B-1 Description (Continued) |
|-------------|------------------------|--|
| 82.7 - 83.9 | 10BCoxb scour | Dark yellowish brown (10YR 4/4 m, mixed), loamy sand to sandy loam, crudely stratified, moderately well oxidized, hard, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, few fine gravel, clear lower boundary to; |
| 83.9 - 86 | 11Btb trun | Dark grayish brown (2.5Y 4/2 m, mixed), silt loam, massive, very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, common to many thin and moderately thick clay films on ped faces, partially mottled and strongly gleyed, gradational lower boundary to; |
| 86 - 90 | 11BCb lam | Brown (10YR 4/3 m, mixed), loam, laminated (lams 2 to 3" thick, randomly spaced) slightly oxidized, hard, friable to firm, moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, few fine MnO nodules, partially gleyed, gradational lower boundary to; |
| 90 - 92.2 | 11Cb scour | Dark grayish brown (10YR 4/2m mixed), sandy loam, massive, slightly oxidized, soft to slightly hard, friable, non- to slightly sticky, non-plastic, medium-grained moderately well sorted sand, well oxidized along base, abrupt lower boundary to; |
| 92.2 - 92.7 | 12ABb / 12Btb1 trun | Very dark grayish brown (10YR 3/2 m, mixed), loam to silt loam, massive, slight organics, slightly hard to hard, friable to firm, moderately sticky, moderately plastic, fine-grained well sorted sand, many fine and common moderately thick clay films on ped faces, few fine MnO veinlets, clear lower boundary to; |
| 92.7 - 94.5 | 12Btb2 | Dark grayish brown (10YR 4/2 m, mixed), clay loam, faintly laminated, hard, firm, very sticky, very plastic, fine-grained well sorted sand, common thin and few moderately thick clay films on ped faces, strongly mottled and gleyed, gradational lower boundary to; |
| 94.5 - 95.5 | 12BCb scour | ^r Dark Gray (2.5Y 4/1 m, mixed), loamy sand to sandy loam, massive, slightly hard, friable, non- to slightly sticky, non-plastic, medium-grained poorly sorted sand, few fine gravel, strongly gleyed, abrupt lower boundary to; |
| 95.5 + | Lakewood Fm. | Bedrock. Highly weathered and poorly lithified. |

Table 1.2 Soil Development Index Calculation Sheet Transect A, Boring 1

| Unit | Thickness | Color | | | Те | xture | Consistence | | | | Clay Film | s | Horizon | Mean Hor. | |
|----------------|-----------|----------|------|-----------|------|-------|-------------|---------|------|------------|-----------|-----------------|---------|-----------|--------|
| | (Feet) | Dry | | Moist | | | | Dry | | W | et | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | s | X/6 | lo | X/5 | SO | X/6 | 0 | X/15 | | - |
| Boring 1 | | | | | | | | | | | | | | | |
| AB | 0.7 | n.d. | 0 | 10YR 3/2 | 0 | 1 | 0.5 | sh | 0.40 | ss-s, ps | 0.42 | 2fpf, 1mkpf | 0.5 | 0.36 | 0.25 |
| Bw / Btj | 1.3 | n.d. | 0 | 10YR 3/4 | 0.1 | sl | 0.33 | so-sh | 0.3 | ss, po-ps | 0.25 | v1vfpf | 0.2 | 0.24 | 0.31 |
| C1 scour | 3.9 | n.d. | 0 | 10YR 4/4 | 0.1 | ls | 0.16 | SO | 0.2 | so-ss, po | 0.08 | | 0 | 0.11 | 0.42 |
| C2 scour | 1.8 | n.d. | 0 | 10YR 4/3 | 0 | ls-sl | 0.25 | so-sh | 0.3 | ss, po-ps | 0.25 | | 0 | 0.16 | 0.29 |
| 2Btb | 3.6 | n.d. | 0 | 10YR 3/4 | 0.1 | I-cl | 0.58 | h | 0.6 | s, p-vp | 0.75 | 2fpf, 1mkpf | 0.5 | 0.51 | 1.82 |
| 2BCb | 1.5 | n.d. | 0 | 10YR 4/3 | 0 | 1 | 0.5 | sh | 0.4 | ss-s, ps | 0.42 | | 0 | 0.26 | 0.40 |
| 3Bt1b | 2.7 | n.d. | 0 | 10YR 4/2 | 0 | cl | 0.67 | h - vh | 0.7 | s-vs, vp | 0.92 | 3fpf, 2mkpf | 0.6 | 0.58 | 1.56 |
| 3BCb lam | 0.7 | n.d. | 0 | 10YR 4/3 | 0 | sl-l | 0.42 | sh | 0.4 | ss, po-ps | 0.25 | | 0 | 0.21 | 0.15 |
| 4Btb | 2.1 | n.d. | 0 | 10YR 4/2 | 0 | cl | 0.67 | h | 0.6 | s-vs, vp | 0.92 | 3fpf, 2mkpf | 0.6 | 0.56 | 1.17 |
| 4Cb1 scour | 1.6 | n.d. | 0 | 10YR 4/1 | 0 | sl | 0.33 | sh | 0.40 | so-ss, po | 0.08 | | 0 | 0.16 | 0.26 |
| 4Cb2 scour | 2.4 | n.d. | 0 | 10YR 5/1 | 0 | ls | 0.16 | SO | 0.20 | so, po | 0.00 | | 0 | 0.07 | 0.17 |
| 5Btb trun | 2.9 | n.d. | 0 | 10YR 4/2 | 0 | sil | 0.67 | sh | 0.40 | s, p | 0.67 | 1-2fpf | 0.3 | 0.41 | 1.18 |
| 5Coxb scour | 0.9 | n.d. | 0 | 7.5YR 4/4 | 0.2 | ls | 0.16 | SO | 0.20 | so, po | 0.00 | | 0 | 0.11 | 0.10 |
| 6BCb ox trun | 1.3 | n.d. | 0 | 10YR 4/4 | 0.1 | sl | 0.33 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.22 | 0.28 |
| 6Coxb scour | 0.8 | n.d. | 0 | 10YR 4/4 | 0.1 | ls | 0.16 | so - sh | 0.30 | so-ss, po | 0.08 | | 0 | 0.13 | 0.10 |
| 7Btb1 trun | 2.6 | n.d. | 0 | 10YR 4/4 | 0.1 | I | 0.5 | sh - h | 0.50 | ss-s, ps | 0.42 | 3fpf, 2mkpf | 0.6 | 0.42 | 1.10 |
| 7Btb2 | 1.4 | n.d. | 0 | 10YR 4/4 | 0.1 | sicl | 0.67 | h | 0.60 | s, p-vp | 0.75 | 2fpf, 1mkpf | 0.5 | 0.52 | 0.73 |
| 7Btkb3 | 2.2 | n.d. | 0 | 7.5YR 4/4 | 0.2 | I-cl | 0.58 | vh | 0.80 | vs, vp | 1.00 | 3fpf, 2mkpf | 0.6 | 0.64 | 1.40 |
| 7BC scour | 0.5 | n.d. | 0 | 10YR 5/4 | 0.1 | 1 | 0.5 | h | 0.60 | ss-s, ps | 0.42 | 2fpf | 0.33 | 0.39 | 0.20 |
| 8ABb / 8Btb1 | 3.7 | n.d. | 0 | 10YR 3/3 | 0 | I-cl | 0.58 | vh | 0.80 | s-vs, vp | 0.92 | 2kpf | 0.83 | 0.63 | 2.32 |
| 8Btb2 | 7.2 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | vh | 0.80 | s-vs, p-vp | 0.83 | 2kpf | 0.83 | 0.65 | 4.65 |
| 8BCb / 8Btb3 | 3.4 | n.d. | 0 | 10YR 4/3 | 0 | 1 | 0.5 | h | 0.60 | s, p | 0.67 | 1kpf | 0.8 | 0.51 | 1.75 |
| 9ABb / 9Btb1 | 2.2 | n.d. | 0 | 10YR 3/3 | 0 | l-cl | 0.58 | vh | 0.80 | s-vs, vp | 0.92 | 1-2fpf, 1mkpf | 0.52 | 0.56 | 1.24 |
| 9Btb2 | 3.5 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | vh | 0.8 | s-vs, vp | 0.92 | 2fpf, 2mkpf | 0.57 | 0.61 | 2.14 |
| 9BCb scour | 0.5 | n.d. | 0 | 10YR 4/3 | 0 | ls-sl | 0.25 | sh | 0.4 | so-ss, po | 0.08 | | 0 | 0.15 | 0.07 |
| 10Btb trun | 2.7 | n.d. | 0 | 10YR 3/4 | 0.1 | cl | 0.67 | vh | 0.8 | s, p-vp | 0.92 | 2-3mkpf, 1kpf | 0.63 | 0.62 | 1.68 |
| 10BCoxb scour | 1.2 | n.d. | 0 | 10YR 4/4 | 0.1 | ls-sl | 0.25 | h | 0.6 | ss, po-ps | 0.25 | | 0 | 0.24 | 0.29 |
| 11Btb trun | 2.1 | n.d. | 0 | 2.5Y 4/2 | 0 | sil | 0.67 | vh | 0.8 | vs, vp | 1 | 2-3fpf, 2-3mkpf | 0.38 | 0.57 | 1.20 |
| 11BCb lam | 4.0 | n.d. | 0 | 10YR 4/3 | 0 | I | 0.5 | h | 0.6 | s, ps-p | 0.58 | | 0 | 0.34 | 1.34 |
| 11Cb scour | 2.2 | n.d. | 0 | 10YR 4/2 | 0 | sl | 0.33 | so - sh | 0.3 | so-ss, po | 0.08 | | 0 | 0.14 | 0.31 |
| 12ABb / 12Btb1 | | | | | | | | - | | | | | | | |
| trun | 0.5 | n.d. | 0 | 10YR 3/2 | 0 | I-sil | 0.58 | sh - h | 0.5 | s, p | 0.67 | 3fpf, 2mkpf | 0.6 | 0.47 | 0.24 |
| 12Btb2 | 1.8 | n.d. | 0 | 10YR 4/2 | 0 | cl | 0.67 | h | 0.6 | vs, vp | 1 | 2fpf, 1mkpf | 0.5 | 0.55 | 1.00 |
| 12BCb scour | 1.0 | n.d. | õ | 2.5Y 4/1 | Ő | ls-sl | 0.25 | sh | 0.4 | so-ss, po | 0.08 | 2.p., 1110p1 | 0.0 | 0.15 | 0.15 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | MHI | Mean Soil | SDI | Color Index | Clay Film | Soil Age | Section Age |
|----------------|------|-----------|----------|-------------|-----------|-------------|-------------|
| | | Index | @ 7 feet | | Index | Estimate ka | Estimate ka |
| Surface Soil | 0.36 | 1.27 | 1.16 | 0.2 | 0.70 | 4 - 8 | 4 - 8 |
| Buried Soil 1 | 0.51 | 2.22 | 3.04 | 0.1 | 0.50 | 15 - 30 | 19 - 38 |
| Buried Soil 2 | 0.58 | 1.71 | 3.52 | 0 | 0.60 | 15 - 30 | 34 - 68 |
| Buried Soil 3 | 0.56 | 1.60 | 1.84 | 0 | 0.60 | 8 - 15 | 42 - 83 |
| Buried Soil 4 | 0.41 | 1.28 | 2.36 | 0.2 | 0.30 | 8 - 15 | 50 - 98 |
| Buried Soil 5 | 0.22 | 0.38 | 1.28 | 0.2 | 0.00 | 1 - 4 | 51 - 102 |
| Buried Soil 6 | 0.64 | 3.43 | 3.58 | 0.5 | 2.03 | 15 - 30 | 66 - 132 |
| Buried Soil 7 | 0.65 | 8.72 | 4.27 | 0.1 | 2.46 | 30 - 70 | 96 - 202 |
| Buried Soil 8 | 0.61 | 3.46 | 3.90 | 0.1 | 1.09 | 15 - 30 | 111 - 232 |
| Buried Soil 9 | 0.62 | 1.97 | 3.54 | 0.2 | 0.63 | 15 - 30 | 126 - 262 |
| Buried Soil 10 | 0.57 | 2.85 | 2.41 | 0 | 0.38 | 15 - 30 | 141 - 292 |
| Buried Soil 11 | 0.55 | 1.38 | 2.92 | 0 | 1.10 | 15 - 30 | 156 - 322 |

Table 2.1Soil Description - Transect A; Boring 4

| Depth (Ft) | Horizon | Transect A; B-4 Description |
|---------------|------------|--|
| 0 - 9.5 | Af | Artificial Fill |
| 9.5 -15 | AB/Bt | Dark brown, to very dark grayish brown (10-7.5YR 3/2d, 2/1m mixed), loam to clay loam, organic rich, very hard, firm, moderately to very sticky, very plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, gradational lower boundary to; |
| 15 - 15.5 | BC ox | Dark yellowish brown (10YR 4/4d, 3/3m mixed), loam, slightly oxidized, hard, friable, moderately sticky, slightly to moderately plastic, fine- grained well sorted sand, few fine clay films on ped faces, clear lower boundary to; |
| 15.5 - 16.1 | C scour | Yellowish brown (10YR 5/4d, 4/3m mixed), sandy loam, soft, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, common fine slate gravel, abrupt lower boundary to; |
| 16.1 - 21 | 2Bwb/2Btjb | Yellowish brown (10YR 4/4d, 4/3m mixed), loam, slightly hard to hard, friable, slightly sticky, slightly plastic, fine-grained well sorted sand, few fine clay films on ped faces, gradational lower boundary to; |
| 21 - 22.1 | 2BCb | Brown (10YR 5/3d, 3/3m mixed), loamy sand, soft, very friable, non- to slightly sticky, non- plastic, fine-grained well sorted sand, clear lower boundary to; |
| 22.1 - 25.75 | 2Cb scour | Grayish brown (10YR 5/2d, 3/1m mixed), gravelly sandy loam, loose to soft, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, common to many slate gravel, abrupt lower boundary to; |
| 25.75 - 26.25 | 3Bwb | Dark yellowish brown (10YR 4/4d, 3/2m mixed), sandy loam, slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, common fine slate gravel, very few fine clay films on ped faces and coating gravel, abrupt lower boundary to; |
| 26.25 - 28 | 3C scour | Brown (10YR 5/3d, 3/2m mixed), loamy sand, loose to soft, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, common to many fine slate gravel, clear lower boundary to; |
| 28 - 30.2 | 4ABb/4Btb | Yellowish brown (10YR 5/4d, 3/3m mixed), loam, slightly oxidized, slight organics, slightly hard, friable, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, few fine clay films on ped faces and coating clasts, clear lower boundary to; |
| 30.2 - 33.5 | 5Btb1 trun | Brown (7.5YR 4/4d, 3/2m mixed), sandy clay loam to clay loam, moderately well oxidized, slight organics, hard to very hard, friable to firm, very sticky, moderately to very plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces and coating clasts, gradational lower boundary to; |

Table 2.1

| Depth (Ft) | Horizon | Transect A; B-4 Description (Continued) |
|--------------|------------|--|
| 33.5 - 36.25 | 5Btb2 | Brown (7.5YR 5/4d, 3/3m mixed), sandy clay loam to loam, moderately well oxidized, hard, friable, moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, gradational lower boundary to; |
| 36.25 - 44.5 | 5BCb lam | Yellowish brown (10YR 5/4d, 3/3m mixed), loamy sand to sandy loam with localized clay loam zones, slightly oxidized, soft to slightly hard, friable, slightly sticky, non- to slightly plastic, fine to medium-grained moderately well sorted sand, varve like stratification, clear lower boundary to; |
| 44.5 - 45 | 6Btb trun | Brown (7.5YR 5/4d, 3/2m mixed), gravelly loam, moderately well oxidized, common MnO coatings, hard, friable, slightly to moderately sticky, slightly plastic, coarse-grained poorly sorted sand, common well rounded gravel, many fine, common moderately thick, and few thick clay films on ped faces and common moderately thick coating gravel, clear lower boundary to; |
| 45 - 46.5 | 6BCb ox | Yellowish brown to brown (10-7.5YR 5/4d, 3/3m mixed), sandy loam, slightly to moderately well oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, common fine clay films on ped faces, gradational lower boundary to; |
| 46.5 - 54.5 | 7Btb1 trun | Strong brown (7.5YR 4/6d, 3/3m mixed), clay loam, well oxidized, very hard, firm, very sticky, very plastic, fine-grained well sorted sand, many moderately thick and common thick clay films on ped faces, gradational lower boundary to; |
| 54.5 - 60.5 | 7Btb2 | Yellowish brown (10YR 5/4d, 3/2m mixed), loam to clay loam, slightly oxidized, faint primary stratigraphy preserved, hard to very hard, firm, very sticky, moderately to very plastic, coarse-grained poorly sorted sand, common gravel, many fine and common moderately thick clay films on ped faces, abrupt lower boundary to; |
| 60.5 - 62 | 7Cb scour | Light yellowish brown (10YR 6/4d, 4/2m mixed), loamy sand, soft, very friable, non- to slightly sticky, non- plastic, coarse-grained poorly sorted sand, common fine slate gravel, abrupt lower boundary to; |
| 62 - 65.5 | 8Btb trun | Yellowish brown (10YR 5/4d, 3/3m mixed), loam to clay loam, slightly oxidized, faint varve like stratigraphy preserved, hard to very hard, firm, very sticky, moderately to very plastic, fine-grained well sorted sand, many fine and common moderately thick clay films on ped faces, clear lower boundary to; |
| 65.5 - 66 | 8Cb scour | Brown (10YR 5/3d, 4/2m mixed), sandy loam, soft, very friable, slightly sticky, non-plastic, fine-grained well sorted sand, massive, abrupt lower boundary to; |

Table 2.1

| Depth (Ft) | Horizon | Transect A; B-4 Description (Continued) |
|--------------|------------------|--|
| 66 - 72.5 | 9BCb lam /9Cb | Stacked sequence of Dark grayish brown (10YR 5/2d, 4/1m mixed), loam - clay loams, strongly mottled with varve like stratigraphy preserved, hard, firm, very sticky, moderately to very plastic, fine- grained well sorted sand, common thin and moderately thick clay films on ped faces, with abrupt lower boundaries to - Interbedded scours, Brown to yellowish brown (10YR 5/3-4d, 4/2m), sandy loam to loamy sand, soft to loose, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, massive, clear lower boundary to; |
| 72.5 - 78.25 | 10Btb lam | Brown (7.5YR 5/4d, 3/3m mixed), loam - clay loams, strongly mottled with varve like stratigraphy preserved, moderately well oxidized, hard, firm, very sticky, moderately to very plastic, fine-grained well sorted sand, common thin and moderately thick clay films on ped faces, abrupt lower boundary to; |
| 78.25 - 85 | 10Cb scour | Light yellowish brown (10YR 6/4d, 4/2m mixed), loamy sand, soft to loose, very friable, non- to slightly sticky, non-plastic, medium-grained moderately well sorted sand, massive to crudely bedded, abrupt lower boundary to; |
| 85+ | Lakewood Fm. | Bedrock. Highly weathered bedrock. |

Table 2.2

Soil Development Index Calculation Sheet Transect A; Boring 4

| Unit | Thickness | s Color | | | | Tex | cture | Consistence | | | | Clay Films | | Horizon | Mean Hor. |
|------------------|-----------|--------------|------|--------------|------|--------|-------|-------------|------|-----------|------|-----------------------------|------|---------|-----------|
| | (Feet) | Dry | | Moist | | | | Dry | Dry | | Wet | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | s | X/6 | lo | X/5 | <i>S0</i> | Х/6 | 0 | X/15 | | |
| Boring 4 | | | | | | | | | | | | | | | |
| AB/Bt | 5.5 | 10-7.5YR 3/2 | 0.15 | 10-7.5YR 2/1 | 0.05 | l - cl | 0.58 | vh | 0.80 | s-vs, vp | 0.92 | 2fpf, 1mkpf | 0.5 | 0.50 | 2.75 |
| BC ox | 0.5 | 10YR 4/4 | 0.3 | 10YR 3/3 | 0 | 1 | 0.5 | h | 0.6 | s, ps-p | 0.58 | 1fpf | 0.27 | 0.38 | 0.19 |
| C scour | 0.4 | 10YR 5/4 | 0.3 | 10YR 4/3 | 0 | sl | 0.33 | SO | 0.2 | ss, po-ps | 0.25 | | 0 | 0.18 | 0.07 |
| 2Bwb/2Btjb | 4.9 | 10YR 4/4 | 0.3 | 10YR 4/3 | 0 | I | 0.5 | sh-h | 0.5 | ss, ps | 0.33 | 1fpf | 0.27 | 0.32 | 1.55 |
| 2BCb | 1.1 | 10YR 5/3 | 0.2 | 10YR 3/3 | 0 | sl | 0.33 | SO | 0.2 | so, po-ps | 0.08 | | 0 | 0.14 | 0.15 |
| 2Cb scour | 3.65 | 10YR 5/2 | 0.1 | 10YR 2/1 | 0 | ls | 0.16 | lo-so | 0.1 | so, po | 0.00 | | 0 | 0.06 | 0.22 |
| 3Bwb | 0.5 | 10YR 4/4 | 0.3 | 10YR 3/2 | 0 | sl | 0.33 | sh | 0.4 | ss, po-ps | 0.25 | v1fpf, v1fcl | 0.3 | 0.26 | 0.13 |
| 3C scour | 1.75 | 10YR 5/3 | 0.2 | 10YR 3/2 | 0 | ls | 0.16 | lo-so | 0.1 | so, po | 0 | | 0 | 0.08 | 0.13 |
| 4ABb/4Btb | 2.2 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | 1 | 0.5 | sh | 0.4 | ss-s, ps | 0.42 | 1fpf, 1fcl | 0.38 | 0.33 | 0.73 |
| 5Btb1 trun | 3.3 | 7.5YR 4/4 | 0.4 | 7.5YR 3/2 | 0.1 | scl-cl | 0.67 | h-vh | 0.70 | vs, p-vp | 0.92 | 2fpf, 1mkpf, 2mkcl | 0.67 | 0.58 | 1.90 |
| 5Btb2 | 2.75 | 7.5YR 5/4 | 0.4 | 7.5YR 3/3 | 0 | scl-l | 0.58 | h | 0.60 | s, ps-p | 0.58 | 2fpf, 1mkpf | 0.5 | 0.44 | 1.22 |
| 5BCb lam | 8.25 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | ls-sl | 0.25 | so-sh | 0.30 | ss-s, ps | 0.42 | | 0 | 0.21 | 1.75 |
| 6Btb trun | 0.5 | 7.5YR 5/4 | 0.4 | 7.5YR 3/2 | 0.1 | I | 0.5 | h | 0.60 | ss-s, ps | 0.42 | 3fpf, 2mkpf, 1kpf, 2mkcl | 0.88 | 0.48 | 0.24 |
| 6BCb ox | 1.5 | 10-7.5YR 5/4 | 0.35 | 10-7.5YR 3/3 | 0.05 | sl | 0.33 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.23 | 0.35 |
| 7Btb1 trun | 8 | 7.5YR 4/6 | 0.6 | 7.5YR 3/3 | 0.1 | cl | 0.67 | vh | 0.80 | vs, vp | 1.00 | 3mkpf, 2kpf | 0.6 | 0.63 | 5.03 |
| 7Btb2 | 6 | 10YR 5/4 | 0.3 | 10YR 3/2 | 0 | I-cl | 0.58 | h-vh | 0.70 | vs, p-vp | 0.92 | 3fpf, 2mkpf | 0.6 | 0.52 | 3.10 |
| 7Cb scour | 1.5 | 10YR 6/4 | 0.3 | 10YR 4/2 | 0 | ls | 0.16 | so | 0.20 | so-ss, po | 0.08 | | 0 | 0.12 | 0.19 |
| 8Btb trun | 3.5 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | I-cl | 0.58 | h-vh | 0.70 | vs, p-vp | 0.92 | 3fpf, 2mkpf | 0.6 | 0.52 | 1.81 |
| 8Cb scour | 0.5 | 10YR 5/3 | 0.2 | 10YR 4/2 | 0 | sl | 0.33 | SO | 0.20 | ss, po | 0.17 | | 0 | 0.15 | 0.08 |
| 9BCb lam /9Cb | 6.5 | 10YR 5/3 | 0.2 | 10YR 4/2 | 0 | sl-l | 0.42 | sh | 0.40 | s, p | 0.67 | 2fpf, 1mkpf | 0.5 | 0.37 | 2.37 |
| 10Btb lam | 5.75 | 7.5YR 5/4 | 0.4 | 7.5YR 3/3 | 0.1 | I-cl | 0.58 | h | 0.60 | vs, p-vp | 0.92 | 2fpf, 1mkpf | 0.5 | 0.52 | 2.97 |
| 10Cb scour | 6.75 | 10YR 6/4 | 0.3 | 10YR 4/2 | 0 | ls | 0.16 | lo-so | 0.10 | so-ss, po | 0.08 | | 0 | 0.11 | 0.72 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | МНІ | Mean Soil Index | SDI @ 7 feet | Color Index | Clay Film Index | Soil Age Estimate ka | Section Age Estimate ka |
|---------------|------|--------------------|-----------------|-------------|--------------------|-------------------------|----------------------------|
| Surface Soil | 0.50 | 3.01 | 3.29 | 0.75 | 0.77 | 8 - 15 | 8 - 15 |
| Buried Soil 1 | 0.32 | 1.92 | 1.39 | 0.6 | 0.27 | 4 - 8 | 12 - 23 |
| Buried Soil 2 | 0.26 | 0.27 | 0.83 | 0.5 | 0.30 | 1 - 4 | 13 - 27 |
| Buried Soil 3 | 0.33 | 0.73 | 2.33 | 0.3 | 0.38 | 15 - 30 | 28 - 57 |
| Buried Soil 4 | 0.58 | 4.87 | 2.38 | 1.1 | 0.72 | 30 - 70 | 58 - 127 |
| Buried Soil 5 | 0.48 | 0.59 | 2.05 | 0.75 | 0.88 | 15 - 30 | 73 - 157 |
| Buried Soil 6 | 0.63 | 8.31 | 3.75 | 1.2 | 1.20 | 30 - 70 | 103 - 227 |
| Buried Soil 7 | 0.52 | 1.88 | 3.30 | 0.5 | 0.60 | 15 - 30 | 118 - 257 |
| Buried Soil 8 | 0.37 | 2.37 | 2.56 | 0.2 | 0.50 | 4 - 8 | 122 - 265 |
| Buried Soil 9 | 0.52 | 3.69 | 2.07 | 0.7 | 0.50 | 15 - 30 | 137 - 295 |

Table 3.1Soil Description - Transect A; Boring 5

| Depth (Ft) | Horizon | Transect A; B-5 Description |
|--------------|------------|--|
| 0 - 9.45 | Af | Artificial Fill |
| 9.45 - 11.4 | AB/Bt | Dark brown (7.5YR 3/4d, 2/3m mixed), clay loam, moderately well oxidized, organic rich, hard to very hard, firm, very sticky, very plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces and coating clasts, few fine gravel, undetermined (no recovery) lower boundary to; |
| 20 - 21.8 | BC ox | Yellowish brown (10YR 5/4d, 3/3m mixed), loam to sandy loam, slightly oxidized, slightly hard to hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, few fine clay films on ped faces, abrupt lower boundary to; |
| 21.8 - 25.6 | C scour | Brown (10YR 5/3d, 4/2m mixed), loamy sand with gravel, loose to soft, very friable, non- to slightly sticky, non-plastic, coarse-grained poorly sorted sand, common fine slate gravel, clay stains on gravel, abrupt lower boundary to; |
| 25.6 - 26.3 | 2Bwb | Yellowish brown (10YR 5/4d, 4/3m mixed), sandy loam, slightly oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, abrupt lower boundary to; |
| 26.3 - 28.3 | 2Cb scour | Pale brown (10YR 6/3d, 4/2m mixed), loamy sand, loose - soft, very friable, non- to slightly sticky, non-plastic, coarse-grained poorly sorted sand, common fine slate gravel, clear lower boundary to; |
| 28.3 - 31.1 | 3ABb/Btb | Yellowish brown (10YR 5/4d, 4/3m mixed), loam, slight organics, slightly oxidized, slightly hard, friable, moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, few to common fine clay films on ped faces, clear lower boundary to; |
| 31.1 - 33.4 | 4Btb1 trun | Brown (7.5YR 4/4d, 3/3m mixed), clay loam, slightly oxidized, hard to very hard, firm, very sticky, very plastic, fine-grained well sorted sand, many fine and common moderately thick clay films on ped faces and coating clasts, few fine gravel, clear lower boundary to; |
| 33.4 - 36.1 | 4Btb2 | Brown (7.5YR 4/4d, 3/3m mixed), clay loam, slightly to moderately well oxidized, hard, firm, very sticky, very plastic, medium-grained moderately well sorted sand, common thin and moderately thick clay films on ped faces and coating clasts, few fine gravel, abrupt lower boundary to; |
| 36.1 - 36.95 | 4Cb scour | Brown (10YR 4/3d, 3/2m mixed), gravelly loam, hard, friable to firm, moderately sticky, slightly to moderately plastic, coarse-grained poorly sorted sand, common fine gravel, common MnO staining on gravel, abrupt lower boundary to; |

Table 3.1

| Depth (Ft) | Horizon | Transect A; B-5 Description (Continued) |
|---------------|-----------------|---|
| 36.95 - 37.85 | 5Bwb/BCb lam | Brownish yellow (10YR 6/6d, 4/4m mixed), loam, moderately well to well oxidized, slightly hard to hard, friable, moderately sticky, slightly to moderately plastic, medium-grained moderately well sorted sand, strongly mottled, clear lower boundary to; |
| 37.85 - 50 | 5Cb scour | Light yellowish brown (2.5Y 6/3d, 5/2m mixed), sandy loam to loam, slightly hard, friable, slightly sticky, slightly plastic, fine-grained well sorted sand, massive to crudely bedded, mottled and strongly gleyed, abrupt lower boundary to; |
| 50+ | Lakewood Fm. | Bedrock. Highly weathered and poorly lithified sandstone. |

Table 3.2

Soil Development Index Calculation Sheet Transect A; Boring 5

| Unit | Thickness | | Co | lor | | Те | xture | | Cons | sistence | | Clay Film | ıs | Horizon | Mean Hor. |
|-----------------|-----------|-----------|------|-----------|------|--------|-------|---------|------|-----------|------|-----------------------|------|---------|-----------|
| | (Feet) | Dry | | Moist | | | | Dry | / | W | /et | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | S | X/6 | lo | X/5 | SO | X/6 | 0 | X/15 | | |
| Boring 5 | | | | | | | | | | | | | | | |
| AB/Bt | 1.95 | 7.5YR 3/4 | 0.4 | 7.5YR 2/3 | 0.1 | cl | 0.67 | h - vh | 0.70 | vs, vp | 1.00 | 2fpf, 1mkpf | 0.5 | 0.56 | 1.10 |
| BC ox | 1.8 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | I-sl | 0.42 | sh - h | 0.5 | ss, po-ps | 0.25 | 1fpf | 0.27 | 0.29 | 0.52 |
| C scour | 3.8 | 10YR 5/3 | 0.2 | 10YR 4/2 | 0 | ls | 0.16 | lo - so | 0.1 | so-ss, po | 0.08 | v1vncl | 0.2 | 0.12 | 0.47 |
| 2Bwb | 0.7 | 10YR 5/4 | 0.3 | 10YR 4/3 | 0 | sl | 0.33 | sh | 0.4 | ss, po-ps | 0.25 | | 0 | 0.21 | 0.15 |
| 2Cb scour | 2 | 10YR 6/3 | 0.2 | 10YR 4/2 | 0 | ls | 0.16 | lo - so | 0.1 | so-ss, po | 0.08 | | 0 | 0.09 | 0.18 |
| 3ABb/Btb | 2.8 | 10YR 5/4 | 0.3 | 10YR 4/3 | 0 | I | 0.5 | sh | 0.4 | s, ps-p | 0.58 | 1-2fpf | 0.3 | 0.35 | 0.97 |
| 4Btb1 trun | 2.3 | 7.5YR 4/4 | 0.4 | 7.5YR 4/3 | 0.1 | cl | 0.67 | h - vh | 0.70 | vs, vp | 1.00 | 3fpf, 2mkpf, 2mkcl | 0.77 | 0.61 | 1.40 |
| 4Btb2 | 2.7 | 7.5YR 4/4 | 0.4 | 7.5YR 3/3 | 0.1 | cl | 0.67 | h | 0.6 | vs, vp | 1.00 | 2fpf, 2mkpf, 2mkcl | 0.67 | 0.57 | 1.55 |
| 4Cb scour | 0.85 | 10YR 4/3 | 0.2 | 10YR 3/2 | 0 | I | 0.5 | h | 0.6 | s, ps-p | 0.58 | | 0 | 0.31 | 0.27 |
| 5Bwb/BCb lam | 0.9 | 10YR 6/6 | 0.5 | 10YR 4/4 | 0.1 | I | 0.5 | sh - h | 0.5 | s, ps-p | 0.58 | | 0 | 0.36 | 0.33 |
| 5Cb scour | 12.2 | 2.5Y 6/3 | 0.1 | 2.5Y 5/2 | 0 | sl - I | 0.42 | sh | 0.4 | ss, ps | 0.33 | | 0 | 0.21 | 2.54 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | мні | Mean Soil Index | SDI @ 7 feet | Color Index | Clay Film Index | Soil Age Estimate ka | Section Age Estimate ka |
|---------------|------|--------------------|-----------------|-------------|--------------------|-------------------------|----------------------------|
| Surface Soil | 0.56 | 2.09 | 1.93 | 0.9 | 0.97 | 8 - 15 | 8 - 15 |
| Buried Soil 1 | 0.21 | 0.33 | 0.85 | 0.5 | 0.00 | 1 - 4 | 9 - 19 |
| Buried Soil 2 | 0.35 | 0.97 | 2.43 | 0.3 | 0.30 | 15 - 30 | 24 - 49 |
| Buried Soil 3 | 0.61 | 3.21 | 3.84 | 1 | 1.44 | 30 - 70 | 54 - 119 |
| Buried Soil 4 | 0.36 | 2.87 | 1.53 | 0.6 | 0.00 | 4 - 8 | 58 - 127 |

Table 4.1Soil Description - Transect A; Boring 7

| | Depth (Ft) | Horizon | Transect A; B-7 Description |
|---|--------------|------------|---|
| | 0 - 15 | Af | Artificial Fill |
| | 15 - 17.5 | AB/Bt | Dark brown(7.5YR 3/4d, 3/2m mixed), loam, organic rich, hard to very hard, friable, moderately sticky, slightly plastic, fine-grained well sorted sand, few fine clay films on ped faces, gradational lower boundary to; |
| | 17.5 - 21 | BC ox | Yellowish brown (10YR 5/4d, 3/3m mixed), loam to sandy loam, slightly oxidized, hard, friable, slightly sticky, non- to slightly plastic, fine- grained well sorted sand, few very fine clay films on ped faces, gradational lower boundary to; |
| | 21 - 21.5 | C scour | Yellowish brown (10YR 5/4d, 3/3m mixed), loamy sand, slightly oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, common fine slate gravel, clay stains on gravel, abrupt lower boundary to; |
| _ | 21.5 - 22.5 | 2Bwb | Yellowish brown (10YR 5/4d, 4/3m mixed), sandy loam, slightly oxidized, soft to slightly hard, very friable, non- to slightly sticky, non- plastic, medium-grained moderately well sorted sand, abrupt lower boundary to; |
| | 22.5 - 22.75 | 2Cb scour | Pale brown (10YR 6/3d, 4/2m mixed), loamy sand, loose - single grained, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand, abrupt lower boundary to; |
| _ | 22.75 - 29.5 | | Yellowish brown (10YR 5/4d, 4/3m mixed), loam, slightly oxidized, slightly hard, friable, slightly to moderately sticky, slightly plastic, fine- grained well sorted sand, few very fine and fine clay films on ped faces, undetermined lower boundary (no recovery) to; |
| _ | 30 - 32.5 | 4ABb/Btb | Dark yellowish brown (10YR 4/4d, 3/3m mixed), loam, slightly oxidized, slight organics, slightly hard, friable, moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, few to common fine clay films on ped faces, clear lower boundary to; |
| _ | 32.5 - 35.5 | 5Btb1 trun | Brown (7.5YR 4/4d, 2.5/2m mixed), loam to clay loam, slightly to moderately well oxidized, hard to very hard, friable to firm, very sticky, moderately to very plastic, fine-grained well sorted sand, many thin and common moderately thick clay films on ped faces and coating clasts, few fine gravel, gradational lower boundary to; |
| | 35.5 - 46 | | Stacked sequence of Brown (10YR 5/3d, 4/2m mixed), loams, strongly mottled with varve like stratigraphy preserved, slightly hard, friable to firm, moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, abrupt lower boundaries to - Interbedded scours, Yellowish brown (10YR 5/4d, 4/3m mixed), sandy loam to loamy sand, soft to slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, massive, abrupt lower boundary to; |

| Depth (Ft) | Horizon | Transect A; B-7 Description (Continued) |
|------------|-----------------|---|
| 46 - 47.25 | 6Cb scour | Brown (10YR 5/3d, 4/2m mixed), sandy loam, soft to loose, very friable, slightly sticky, non-plastic, coarse-grained poorly sorted sand, massive to crudely bedded, abrupt lower boundary to; |
| 47.25+ | Lakewood Fm. | Bedrock. Highly weathered and poorly lithified sandstone. |

Table 4.1

Table 4.2

Soil Development Index Calculation Sheet Transect A; Boring 7

| Unit | Thickness | Color | | | Te | xture | | Cons | sistence | | Clay Film | s | Horizon Mean Hor. | Mean Hor. | |
|---------------------------|-----------|-----------|------|-------------|------|--------|------|---------|----------|-----------|-----------|--------------------|-------------------|-----------|--------|
| | (Feet) | Dry | | Moist | | | | Dry | / | W | /et | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | s | X/6 | ю | X/5 | so | X/6 | 0 | X/15 | | |
| Boring 7 | | | | | | | | | | | | | | | |
| AB/Bt | 2.5 | 7.5YR 3/4 | 0.4 | 7.5YR 3/2 | 0.1 | Ι | 0.5 | vh | 0.80 | s, ps | 0.50 | 1fpf | 0.27 | 0.43 | 1.07 |
| BC ox | 3.5 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | I-sl | 0.42 | h | 0.6 | ss, po-ps | 0.25 | v1fpf | 0.23 | 0.30 | 1.05 |
| C scour | 0.5 | 10YR 5/4 | 0.3 | 10YR 3/3 | 0 | ls | 0.16 | sh | 0.4 | ss, po-ps | 0.25 | v1vncl | 0.2 | 0.22 | 0.11 |
| 2Bwb | 1 | 10YR 5/4 | 0.3 | 10YR 4/3 | 0 | sl | 0.33 | so - sh | 0.3 | so-ss, po | 0.08 | | 0 | 0.17 | 0.17 |
| 2Cb scour | 0.25 | 10YR 6/3 | 0.2 | 10YR 4/2 | 0 | ls | 0.16 | lo | 0 | so, po | 0.00 | | 0 | 0.06 | 0.02 |
| 3Btjb/3BCb lam stacked | 6.75 | 10YR 5/4 | 0.3 | 10YR 4/3 | 0 | Ι | 0.5 | sh | 0.4 | ss-s, ps | 0.42 | 1vfpf, 1fpf | 0.38 | 0.33 | 2.25 |
| 4ABb/Btb | 2.5 | 10YR 4/4 | 0.3 | 10YR 3/3 | 0 | Ι | 0.5 | sh | 0.4 | s, ps-p | 0.58 | 1-2fpf | 0.3 | 0.35 | 0.87 |
| 5Btb1 trun | 3 | 7.5YR 4/4 | 0.4 | 7.5YR 2.5/2 | 0.1 | l - cl | 0.58 | h-vh | 0.7 | vs, p-vp | 0.91 | 3fpf, 2mkpf, 2mkcl | 0.62 | 0.55 | 1.66 |
| 6Bwb/6BCb lam stacked | 10.5 | 10YR 5/3 | 0.2 | 10YR 4/2 | 0 | - s | 0.42 | so - sh | 0.3 | ss-s, ps | 0.42 | | 0 | 0.22 | 2.35 |
| 6Cb scour | 1.25 | 10YR 5/3 | 0.2 | 10YR 4/2 | 0 | sl | 0.33 | lo - sl | 0.10 | ss, po | 0.17 | | 0 | 0.13 | 0.17 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | МНІ | Mean Soil Index | SDI @ 7 feet | Color Index | Clay Film Index | Soil Age Estimate ka | Section Age Estimate ka |
|---------------|------|--------------------|-----------------|-------------|--------------------|-------------------------|----------------------------|
| Surface Soil | 0.43 | 2.23 | 2.40 | 1 | 0.70 | 8 - 15 | 8 - 15 |
| Buried Soil 1 | 0.17 | 0.18 | 1.03 | 0.5 | 0.00 | 1 - 4 | 9 - 19 |
| Buried Soil 2 | 0.33 | 2.25 | 2.33 | 0.3 | 0.38 | 4 - 8 | 13 - 27 |
| Buried Soil 3 | 0.35 | 0.87 | 2.43 | 0.3 | 0.30 | 15 - 30 | 28 - 57 |
| Buried Soil 4 | 0.55 | 1.66 | 3.86 | 0.4 | 0.62 | 30 - 70 | 58 - 127 |
| Buried Soil 5 | 0.22 | 2.51 | 1.50 | 0.4 | 0.00 | 4 - 8 | 62 - 135 |

Table 5.1 Transect A - Boring 2

| Depth (Ft) | Horizon | Summary Description of Transect A; Boring 2 |
|--------------|--------------------|---|
| 0 - 16.6 | Af | Artificial Fill |
| 16.6 - 20.5 | Bw / Btj | weak argillic, truncated |
| 20.5 - 23.5 | BC | massive, weak |
| 23.5 - 24 | С | massive scour |
| 24 - 25 | | No Recovery |
| 25 - 26.3 | 2ABb/ 2Btb1 | moderate argillic, moderately oxidized |
| 26.3 - 30 | | No Recovery |
| 30 - 34.5 | 3Btb1 | strong argillic, plugged with clay, truncated |
| 34.5 - 37 | 3Btb2 | strong argillic, plugged with clay |
| 37 - 47.5 | 3BCb | crudely stratified (stacked), mottled |
| 47.5 - 56.75 | 4Btb1 | strong argillic with gravel, plugged with clay, well oxidized |
| 56.75 - 58 | 4Btb2 | moderate argillic, sandy, moderately oxidized |
| 58 - 59 | 4Btb3 | moderate argillic, crudely stratified (stacked), mottled |
| 59 - 61 | 4BCb | massive, sandy, slightly oxidized |
| 61 - 63.5 | 5Btb1 | strong argillic, plugged with clay, slightly oxidized, trun. |
| 63.5 - 65 | 5Btb2 | strong argillic with gravel, slightly oxidized |
| 65 - 69 | 5Btb3 | strong argillic, mottled |
| 69 - 71.8 | 5Btb4 | strong argillic with gravel, mottled |
| 71.8 - 77 | 5BCb / 5Cb scour | massive scour |
| 77 - 79.25 | 6Btb | strong argillic, slightly oxidized |
| 79.25 - 80.5 | 6BCb1 | massive, sandy, gleyed |
| 80.5 - 94 | 6BCb2 / 6Cb1 | crudely stratified (stacked) |
| 94 - 105 | 6Cb2 scour | massive scour |
| 105+ | Lakewood Formation | n Poorly lithified bedrock. |

Table 5.1 Transect A - Boring 2

| Depth (Ft) | Horizon | Summary Description of Transect A; Boring 2 |
|--------------|--------------------|---|
| 0 - 16.6 | Af | Artificial Fill |
| 16.6 - 20.5 | Bw / Btj | weak argillic, truncated |
| 20.5 - 23.5 | BC | massive, weak |
| 23.5 - 24 | С | massive scour |
| 24 - 25 | | No Recovery |
| 25 - 26.3 | 2ABb/ 2Btb1 | moderate argillic, moderately oxidized |
| 26.3 - 30 | | No Recovery |
| 30 - 34.5 | 3Btb1 | strong argillic, plugged with clay, truncated |
| 34.5 - 37 | 3Btb2 | strong argillic, plugged with clay |
| 37 - 47.5 | 3BCb | crudely stratified (stacked), mottled |
| 47.5 - 56.75 | 4Btb1 | strong argillic with gravel, plugged with clay, well oxidized |
| 56.75 - 58 | 4Btb2 | moderate argillic, sandy, moderately oxidized |
| 58 - 59 | 4Btb3 | moderate argillic, crudely stratified (stacked), mottled |
| 59 - 61 | 4BCb | massive, sandy, slightly oxidized |
| 61 - 63.5 | 5Btb1 | strong argillic, plugged with clay, slightly oxidized, trun. |
| 63.5 - 65 | 5Btb2 | strong argillic with gravel, slightly oxidized |
| 65 - 69 | 5Btb3 | strong argillic, mottled |
| 69 - 71.8 | 5Btb4 | strong argillic with gravel, mottled |
| 71.8 - 77 | 5BCb / 5Cb scour | massive scour |
| 77 - 79.25 | 6Btb | strong argillic, slightly oxidized |
| 79.25 - 80.5 | 6BCb1 | massive, sandy, gleyed |
| 80.5 - 94 | 6BCb2 / 6Cb1 | crudely stratified (stacked) |
| 94 - 105 | 6Cb2 scour | massive scour |
| 105+ | Lakewood Formation | n Poorly lithified bedrock. |

Table 5.2 Transect A - Boring 3

| Depth (Ft) | Horizon | Summary Description of Transect A; Boring 3 |
|---------------|--------------|---|
| 0 - 12.3 | Af | Artificial Fill |
| 12.3 - 15.2 | AB / Bt | moderate argillic, organic rich, truncated |
| 15.2 - 15.75 | C scour | massive scour |
| 15.75 - 19.25 | 2Btjb / 2BCb | massive, weak |
| 19.25 - 20 | | No Recovery |
| 20 - 21 | 2Cb scour | massive scour |
| 21 - 26.5 | 3Bwb / 3Btjb | massive, weak |
| 26.5 - 27 | 3Cb scour | massive scour |
| 27 - 30.5 | 4ABb / 4Btb1 | strong argillic, plugged with clay, organic rich, truncated |
| 30.5 - 33.75 | 4Btb2 | strong argillic, plugged with clay |
| 33.75 - 36.5 | 4Btb3 | strong argillic, plugged with clay |
| 36.5 - 42.75 | 4BCb | crudely stratified (stacked), laminated sands |
| 42.75 - 48.5 | 4Cb | massive scour |
| 48.5 - 50.25 | 5Btb1 | strong argillic, plugged with clay, truncated |
| 50.25 - 52.25 | 5Btb2 | strong argillic, plugged with clay |
| 52.25 - 59 | 5Btb3 | strong argillic, plugged with clay |
| 59 - 65 | 5Btb4 | strong argillic, plugged with clay |
| 65 - 66 | 5Cb scour | massive weak scour |
| 66 - 70 + | 6Btb | strong argillic, plugged with clay |
| | | |

Table 5.3 Transect A - Boring 9

| Depth (Ft) | Horizon | Summary Description of Transect A; Boring 9 |
|-------------|----------------|--|
| 0 - 15.0 | Af | Artificial Fill |
| 15 - 17.3 | AB / Bt1 | strong argillic, plugged with clay, organic rich, truncated |
| 17.3 - 18 | Bt2 | strong argillic, plugged with clay |
| 18 - 20 | | No Recovery |
| 20 - 20.7 | BC | massive, weak |
| 20.7 - 21.9 | C1 | crudely stratified, gravelly |
| 21.9 - 29.2 | C2 | massive scour, sandy |
| 29.2 - 35.5 | 2Btb1 | strong argillic, plugged with clay, truncated |
| 35.5 - 36.8 | 2Btb2 / 2BCb | stratified, silty, weak |
| 36.8 - 37.2 | 2Cb scour | massive scour, gravelly |
| 37.2 - 38.5 | 3Btb | strong argillic, sandy, well oxidized, truncated |
| 38.5 - 39 | 3BCb | massive, weak, gravelly scour |
| 39 - 39.5 | 4Btb | strong argillic, sandy, well oxidized, truncated |
| 39.5 - 41.8 | 4BCb | massive, weak, sandy scour |
| 41.8 - 43.8 | 5Btb | strong argillic, sandy, well oxidized, truncated |
| 43.8 - 45 | | No Recovery |
| 45 - 46.6 | 5Cb scour | massive scour |
| 46.6 - 47.9 | 6BCb | massive, weak |
| 47.9 - 48.9 | 6Cb scour | massive scour |
| 48.9 - 50 | | No Recovery |
| 50 - 54.3 | 7Btb1 | strong argillic, plugged with clay, well oxidized, truncated |
| 54.3 - 57 | 7Btb2 | strong argillic, plugged with clay, well oxidized |
| 57 - 62 | 7Btb3 | strong argillic, plugged with clay, gravelly |
| 62 - 66.9 | 7BCb lam1 | crudely stratified (stacked), gravelly with MnO |
| 66.9 - 70 | | No Recovery |
| 70 - 70.9 | 7BCb2 | massive scour |
| 70.9 - 73.9 | 8Btb1 | strong argillic, plugged with clay, well oxidized, truncated |
| 73.9 - 75.4 | 8Btb2 / 9BCb | weak argillic, gravelly, well oxidized |
| 75.4 - 76.3 | 9ABb / 9Btb1 | strong argillic, plugged with clay, organic rich, truncated |
| 76.3 - 80.7 | 9Btb2 | strong argillic, plugged with clay, well oxidized |
| 80.7 - 85.5 | 9Btb3 / 9BCb | weak argillic, gravelly, well oxidized |
| 85.5 - 88.5 | 10Btb1 | strong argillic, plugged with clay, gravelly, well oxidized |
| 88.5 - 89.7 | 10Btb2 / 10BCb | weak argillic, gravelly |

Table 5.3

| Depth (Ft) | Horizon | Summary Description of Transect A; Boring 9 (Cont.) |
|--------------------------|---------------------|---|
| 89.7 - 92.4 92.4 - 95 | 11Btb1 11BCb lam | strong argillic, plugged with clay, well oxidized crudely stratified (stacked), sandy with gravel |
| 95 - 98.8 98.8 - 100 | 12Btb1 12BCb lam | strong argillic, plugged with clay, strong mottles, truncated stratified, sandy |
| 100 - 100.9 | 13Btb | strong argillic, strong mottles, truncated |
| 100.9 - 101.7 | 13BCb | massive, weak, well oxidized |
| 101.7 - 103.5 | 14Btb | strong argillic, truncated |
| 103.5 - 105 | 14BCb lam | stratified, sandy, well oxidized |
| 105 - 107.5 + | 14Cb scour | massive scour |

Table 6.1 Transect A - AMEC Boring 3

| Depth (Ft) | Horizon | Summary Description of Transect A; AMEC Boring 3 |
|--------------|-------------------|---|
| 0 - 14.5 | Af | Artificial Fill |
| 14.5 - 20.5 | Btj | silty, moderate oxidation, clay stains |
| 20.5 - 24.25 | Cox | nested scour, gravel and silt lenses |
| 24.25 - 25 | 2Btj | silty, moderate oxidation, clay stains |
| 25 - 27.5 | 2Cox | scour, gravel rich, coarse-grained |
| 27.5 - 29 | 3Btj | silty, moderate oxidation, clay stains |
| 29 - 33.8 | 4ABt/4Bt | organic and clay rich, coarser-grained, moderate oxidation |
| 33.8 - 40.5 | 4BCredox1 | silty, fine-grained w/ sparse gravel, moderately strong redox |
| 40.5 - 46 | 4BC/4Credox2 | coarser-grained, CaCO3 fine nodules, moderate redox |
| 46 - 56 | 4Cgl | coarse-grained, gravelly with oxidized rip up clasts? |
| 56.5 - 61 | 5BCredox1 | silty, fine-grained w/ sparse gravel, strong redox |
| 61 - 68.5 | 5BCredox2 | fine-grained w/ fine CaCO3 concretions, strong redox |
| 68.5 - 77 | 5BCox | clayey, common fine CaCO3 concretions, moderate redox |
| 77 - 91.8 | 6Cox1 | silty, fine-grained w/ clay laminations, moderate oxidation |
| 91.8 - 100 | 6Cox2 | coarse-grained scour, moderate oxidation |
| 100 - 101.5 | 6C3 | coarse-grained scour, gravel rich |
| 101.5 + | Lakewood Formatio | n Poorly lithified bedrock. |

Table 6.2 Transect A - AMEC Boring 2

| Depth (Ft) | Horizon | Summary Description of Transect A; AMEC Boring 2 |
|------------|-----------------|--|
| | | |
| 0 - 19 | Af | Artificial Fill |
| 19 - 29.5 | Btj | silty, moderate oxidation, clay stains |
| 29.5 - 35 | 2ABt/2Bt | silty, organic rich, moderate oxidation |
| 35 - 37 | 2BC/Bt gl | silty, fine-grained, slight redox |
| 37 - 42 | 2BCredox | silty, fine-grained, moderate redox |
| 42 - 42.5 | 2Cox | sandy scour, gravel rich |
| 42.5 - 47 | 3BC redox | sandy, coarse-grained. Fines upwards, moderate redox |
| 47 - 55.5 | 3Cox | sandy, coarse-grained, well oxidized, fines upwards |
| 55.5 - 62 | Lakewood Format | tion Poorly lithified bedrock. |

Table 6.3 Transect A - AMEC Boring 8

| Depth (Ft) | Horizon | Summary Description of Transect A; AMEC Boring 8 |
|-------------|------------------|--|
| | A.4 | |
| 0 - 18 | Af | Artificial Fill |
| 18 - 20 | Btj | silty, moderate oxidation, clay stains |
| 20 - 26.6 | Cox | nested scour, gravel and silt lenses |
| 26.6 - 27.5 | 2Btj | silty, moderate oxidation, clay stains |
| 27.5 - 28.3 | 2Cox | scour, gravel rich, coarse-grained |
| 28.3 - 31.8 | 3Btj | silty, moderate oxidation, clay stains |
| 31.8 - 34.8 | 4ABt/4Bt | silty, organic rich, moderate oxidation |
| 34.8 - 50 | 4BC 4C ox | sandy scour, coarse-grained, silt and gravel rich lenses |
| 50 + | Lakewood Formati | on Poorly lithified bedrock. |
| | | |

Table 7.1Soil Description - Transect B; Boring 1

| Depth (Ft) | Horizon | Transect B; B-1 Description |
|-------------|------------|--|
| 0 - 5.0 | NR | No Recovery - no sample |
| 5.0 - 5.2 | Btj / BC | Dark yellowish brown (10YR 3/4m, mixed), loam, massive, slightly oxidized, slightly hard to hard, friable, slightly sticky, slightly to moderately plastic, coarse-grained poorly sorted sand, few to common fine slate gravel, few fine clay films on ped faces and coating gravel, clear lower boundary to; |
| 5.2 - 6.0 | 2ABb | Very dark grayish brown (10YR 3/2m mixed), silt loam, massive, organic rich, hard to ver hard, friable to firm, moderately sticky, moderately to very plastic, fine-grained well sorted sand, common moderately thick humus films on ped faces, gradational lower boundary to; |
| 6.0 - 9.0 | 2Btb | Dark brown (10YR 3/3m, mixed), loam, massive, slightly oxidized, very hard, friable, slightly to moderately sticky, slightly to moderately plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, clear lower boundary to; |
| 9.0 - 10.0 | 3ABb/3Btb1 | Very dark grayish brown (10YR 3/2m mixed), loam, massive, organic rich, very hard, friable, slightly to moderately sticky, moderately plastic, fine-grained well sorted sand, common fine and very few moderately thick clay films on ped faces, gradational lower boundary to; |
| 10.0 - 15.2 | 3Btb2 | Dark yellowish brown (10YR 3/4m, mixed), silt loam, massive, moderately well oxidized, hard to very hard, friable to firm, moderately sticky, moderately to very plastic, fine- grained well sorted sand, common to many fine and common moderately thick clay films on ped faces, few fine MnO nodules in matrix and fine webbing common on ped faces, gradational lower boundary to; |
| 15.2 - 18.4 | 3Btb3 | Dark grayish brown (10YR 4/2m, mixed), silt loam, massive, strongly gleyed, weakly oxidized, slightly hard to hard, firm, very sticky, moderately to very plastic, very fine- grained very well sorted sand, common fine and few moderately thick clay films on ped faces, few fine MnO nodules in soil matrix, gradational lower boundary to; |
| 18.4 - 20.0 | 3Btb4 | Dark yellowish brown (10YR 3/4m, mixed), loam to clay loam, faintly laminated, moderately well oxidized, partially gleyed, hard to very hard, firm, very sticky, moderately to very plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, few fine MnO nodules in matrix and fine webbing common on ped faces, no recovery to; |
| 20.0 - 24.1 | 3BCb ox | Dark yellowish brown (10YR 3-4/4m, mixed), sandy loam, massive, hard, friable, slightly sticky, slightly plastic, fine-grained well sorted sand, very few fine and few very fine thick clay films on ped faces, slightly mottled and well gleyed, fine MnO webbing common on ped faces, basal (gravel-rich) scour, abrupt lower boundary to; |
| 24.1 - 29.2 | 4Btb | Dark yellowish brown (10YR 4/4m, mixed), loam to clay loam, faintly laminated, moderately well oxidized, hard to very hard, friable to firm, moderately sticky, moderately to very plastic, fine- to medium-grained moderately well sorted sand, many fine and common moderately thick clay films on ped faces, clear lower boundary to; |
| 29.2 - 34.1 | 4BCb lam | Yellowish brown (10YR 5/4m, mixed), loamy sand and sandy loam, laminated (4" to 6" thick), moderately well oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, fine- to medium-grained moderately well sorted sand, alternates between sandy and clayey lams, abrupt lower boundary to; |
| 34.1 - 36.2 | 4Cb scour | Brown (10YR 5/3m, mixed), loamy sand, massive, loose to soft, very friable, non-sticky, non-plastic, medium-grained moderately well sorted sand, abrupt lower boundary to; |
| 36.2 - 37.9 | 5BCb lam | Yellowish brown (10YR 5/4m, mixed), sandy loam and loam, faintly laminated (0.5" to 3" thick), moderately well oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, fine-grained well sorted sand, abrupt lower boundary to; |

Table 7.1

| Depth (Ft) | Horizon | Transect B; B-1 Description (Cont.) |
|--------------|-----------------------|--|
| 37.9 - 50.25 | 6BCb lam | Dark Grayish brown (10YR 4/2m, mixed), silt loam, finely laminated (varve like), locally well oxidized (in lams), hard, firm, moderately sticky, moderately to very plastic, very fine- grained very well sorted sand, localized MnO-rich zones (in lams), abrupt lower boundary to; |
| 50.25 - 50.7 | 6Cb scour | Brown (10YR 4/3m, mixed), loamy sand to sandy loam, massive, slightly oxidized, loose, very friable, non-sticky, non-plastic, medium-grained moderately well sorted sand, abrupt lower boundary to; |
| 50.7 - 59.2 | 7Btb | Dark grayish brown (10YR 4/2m, mixed), loam, finely laminated, moderately well oxidized and partially reduced, hard to very hard, firm, moderately sticky, moderately plastic, very fine-grained very well sorted sand, common fine and few moderately thick clay films on ped faces, abrupt lower boundary to; |
| 59.2 - 60.3 | 7BCb / 7C ox scour | Dark brown (10YR 3/3m, mixed), sandy loam, massive, slightly oxidized, slightly hard, friable, slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, abrupt lower boundary to; |
| 60.3 - 63.8 | 8ABb / 8Btb1 | Very dark grey (10YR 3/1m, mixed), clay loam, massive, organic rich, very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, few to common fine and few moderately thick clay or humus films on ped faces, gradational lower boundary to; |
| 63.8 - 67.5 | 8Btb2 | Dark grayish brown (10YR 4/2m, mixed), clay loam, faintly bedded to massive, strongly gleyed (reduced), hard to very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, few fine and moderately thick clay films on ped faces, clear lower boundary to; |
| 67.5 - 71.4 | 8Btb3 | Dark yellowish brown (10YR 4/4m, mixed) and Dark grayish brown (10YR 4/2m, mixed), loam, crudely laminated, well oxidized and strongly reduced (gleyed), hard to very hard, firm, very sticky, very plastic, fine-grained well sorted sand, many fine, common moderately thick and few thick clay films on ped faces, carbonate stage 1+ to 2, common fine and medium nodules in matrix and basal calcium carbonate layer (0.25' thick), abrupt lower boundary to; |
| 71.4 - 75.5 | 9Btb1 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, moderately well oxidized and strongly reduced (gleyed) along fractures, hard to very hard, friable, very sticky, very plastic, medium- to coarse-grained poorly sorted sand, common fine gravel, many fine, common moderately thick, and few thick clay films on ped faces, calcium carbonate stage 1, common fine nodules in matrix and common coatings along fractures, gradational lower boundary to; |
| 75.5 - 79.5 | 9BCb lam / 9Btb2 | Brown (10YR 4/3 m, mixed), silty clay loam and silt loam, massive to faintly laminated, slightly oxidized, very hard, firm, moderately to very sticky, very plastic, very fine-grained very well sorted sand, common fine and moderately thick clay films on ped faces, calcium carbonate stage 1-, few fine nodules in matrix, clear lower boundary to; |
| 79.5 - 91 | 10Btb1 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, thick, moderately well oxidized and strongly reduced (gleyed) along fractures, very hard, friable to firm, very sticky, very plastic, fine-grained well sorted sand, many fine and common moderately thick and few thick clay films on ped faces, calcium carbonate stage 1-, few fine nodules in matrix and faint coatings along fractures, gradational lower boundary to; |
| 91 - 93.5 | 10Btb2 / 10BCb | Brown (10YR 4/3m mixed), loam, massive, slightly oxidized and partially reduced (gleyed), hard, friable, moderately sticky, very plastic, fine-grained well sorted sand, few to common fine and few moderately thick clay films on ped faces, calcium carbonate stage 1+, common fine and medium nodules in matrix, clear lower boundary to; |

| Table 7. | 1 |
|----------|---|
|----------|---|

| Depth (Ft) | Horizon | Transect B; B-1 Description (Cont.) |
|--------------|---------|---|
| 93.5 - 95.0+ | 11Btb1 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, moderately well oxidized, slightly hard to hard, firm, moderately to very sticky, very plastic, very fine-grained very well sorted sand, few to common fine and moderately thick and very few thick clay films on ped faces, calcium carbonate stage 1+ to 2, many fine nodules in matrix and common fine veinlets, undetermined lower boundary. |

Table 7.2Soil Development Index Calculation SheetTransect B; Boring 1

| Unit | Thickness | hickness Color | | | Те | Texture Consistence | | | | Clay Films | | Horizon | Mean Hor. | | |
|---------------------|-----------|----------------|------|------------|------|---------------------|------|--------|------|------------|------|----------------------|-----------|--------|--------|
| | (Feet) | Dry | | Moist | | | | Dry | | W | et | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | s | X/6 | lo | X/5 | so | X/6 | 0 | X/15 | | |
| Tran B; Boring | 1 | | | | | | | | | | | | | | |
| Btj / BC | 0.2 | n.d. | 0 | 10YR 3/4 | 0.1 | I | 0.5 | sh-h | 0.50 | ss, ps-p | 0.42 | 1fpf, 1fcl | 0.37 | 0.38 | 0.08 |
| 2ABb | 0.8 | n.d. | 0 | 10YR 3/2 | 0 | sil | 0.67 | h-vh | 0.7 | s, p-vp | 0.75 | 2mkpf | 0.4 | 0.50 | 0.40 |
| 2Btb | 3.0 | n.d. | 0 | 10YR 3/3 | 0 | I | 0.5 | vh | 0.8 | ss-s, ps-p | 0.50 | 2fpf, 1mkpf | 0.5 | 0.46 | 1.38 |
| 3ABb/3Btb1 | 1.0 | n.d. | 0 | 10YR 3/2 | 0 | I. | 0.5 | vh | 0.8 | ss-s, p | 0.58 | 2fpf, v1mkpf | 0.45 | 0.47 | 0.47 |
| 3Btb2 | 5.2 | n.d. | 0 | 10YR 3/4 | 0.1 | sil | 0.67 | h-vh | 0.7 | s, p-vp | 0.75 | 2-3fpf, 2mkpf | 0.58 | 0.56 | 2.91 |
| 3Btb3 | 3.2 | n.d. | 0 | 10YR 4/2 | 0 | I-cl | 0.58 | sh-h | 0.5 | vs, p-vp | 0.92 | 2fpf, 1mkpf | 0.5 | 0.50 | 1.60 |
| 3Btb4 | 1.6 | n.d. | 0 | 10YR 3/4 | 0.1 | sl | 0.33 | h-vh | 0.7 | vs, p-vp | 0.92 | 2fpf, 1mkpf | 0.5 | 0.51 | 0.82 |
| 3BCb ox | 4.1 | n.d. | 0 | 10YR 3-4/4 | 0.1 | I-cl | 0.58 | h | 0.6 | ss, ps | 0.33 | v1vfpf | 0.2 | 0.36 | 1.48 |
| 4Btb | 5.1 | n.d. | 0 | 10YR 4/4 | 0.1 | sl-sl | 0.25 | h-vh | 0.7 | s, p-vp | 0.75 | 3fpf, 2mkpf | 0.6 | 0.48 | 2.45 |
| 4BCb lam | 4.9 | n.d. | 0 | 10YR 5/4 | 0.1 | ls | 0.17 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.18 | 0.90 |
| 4Cb scour | 2.1 | n.d. | 0 | 10YR 5/3 | 0 | sl-l | 0.42 | lo-so | 0.10 | so, po | 0.00 | | 0 | 0.10 | 0.22 |
| 5BCb lam | 1.7 | n.d. | 0 | 10YR 5/4 | 0.1 | sil | 0.67 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.28 | 0.48 |
| 6BCb lam | 12.4 | n.d. | 0 | 10YR 4/2 | 0 | sil | 0.67 | h | 0.60 | s, p-vp | 0.75 | | | 0.40 | 4.99 |
| 6Cb scour | 0.5 | n.d. | 0 | 10YR 4/3 | 0 | ls-sl | 0.25 | lo | 0.20 | so, po | 0.00 | | 0 | 0.09 | 0.04 |
| 7Btb | 8.5 | n.d. | 0 | 10YR 4/2 | 0 | Ι | 0.5 | h-vh | 0.70 | s, p | 0.67 | 3fpf, 2mkpf | 0.6 | 0.49 | 4.20 |
| 7BCb / 7C ox | | | | | | | | | | | | | | | |
| scour | 1.1 | n.d. | 0 | 10YR 3/3 | 0 | sl | 0.33 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.20 | 0.22 |
| 8ABb / 8Btb1 | 3.5 | n.d. | 0 | 10YR 3/1 | 0 | cl | 0.67 | vh | 0.80 | vs, vp | 1.00 | 1-2fpf, 1mkpf | 0.48 | 0.59 | 2.07 |
| 8Btb2 | 3.7 | n.d. | 0 | 10YR 4/2 | 0 | cl | 0.67 | h-vh | 0.70 | vs, vp | 1.00 | 1fpf, 1mkpf | 0.47 | 0.57 | 2.10 |
| | | | | | | | | | | | | 3fpf, 2mkpf, | | | |
| 8Btb3 | 3.9 | n.d. | 0 | 10YR 4/4 | 0.1 | | 0.5 | h-vh | 0.70 | vs, vp | 1.00 | 1kpf | 0.8 | 0.62 | 2.42 |
| 9Btb1 | 4.1 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | h-vh | 0.70 | vs, vp | 1.00 | 3fpf, 2mkpf, 1kpf | 0.8 | 0.65 | 2.68 |
| | 4.1 | n.u. | 0 | 10111 4/4 | 0.1 | CI | 0.07 | 11-011 | 0.70 | v3, vp | 1.00 | ткрі | 0.0 | 0.05 | 2.00 |
| 9BCb lam / 9Btb2 | 4.0 | n.d. | 0 | 10YR 4/3 | 0 | sicl | 0.83 | vh | 0.80 | s-vs, vp | 0.92 | 2fpf, 2mkpf | 0.65 | 0.64 | 2.56 |
| OBIDE | | | Ū | 10111 1/0 | Ū | 0.01 | 0.00 | • | 0.00 | 0 10, Ip | 0.02 | 3fpf, 2mkpf, | 0.00 | 0.01 | 2.00 |
| 10Btb1 | 11.5 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | vh | 0.80 | vs, vp | 1.00 | 1kpf | 0.8 | 0.67 | 7.75 |
| 10Btb2 / | | | | | | | | | | | | | | | |
| 10BCb | 2.5 | n.d. | 0 | 10YR 4/3 | 0 | I | 0.5 | h | 0.60 | s, vp | 0.83 | 1-2fpf, 1mkpf | 0.52 | 0.49 | 1.23 |
| | | | | | | | | | | | | 1-2fpf, 1-2mkpf, | | | |
| 11Btb1 | 1.5 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | sh-h | 0.5 | s-vs, vp | 0.92 | v1kpf | 0.7 | 0.58 | 0.87 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | MHI | Mean Soil | SDI | Color Index | Clay Film | Soil Age | Section Age |
|----------------|------|-----------|----------|-------------|-----------|-------------|-------------|
| | | Index | @ 7 feet | | Index | Estimate ka | Estimate ka |
| Surface Soil | 0.38 | 0.08 | 2.65 | 0.1 | 0.37 | 1 - 4 | 1 - 4 |
| Buried Soil 1 | 0.50 | 1.78 | 3.28 | 0 | 0.90 | 8 - 15 | 9 - 19 |
| Buried Soil 2 | 0.56 | 7.28 | 3.37 | 0.3 | 2.22 | 30 - 70 | 39 - 89 |
| Buried Soil 3 | 0.48 | 3.57 | 2.06 | 0.2 | 0.60 | 8 - 15 | 47 - 104 |
| Buried Soil 4 | 0.28 | 0.48 | 1.99 | 0.1 | 0.00 | 1 - 4 | 48 - 108 |
| Buried Soil 5 | 0.40 | 5.03 | 2.75 | 0 | 0.00 | 4 - 8 | 52 - 116 |
| Buried Soil 6 | 0.49 | 4.41 | 3.22 | 0 | 0.60 | 8 - 15 | 60 - 131 |
| Buried Soil 7 | 0.62 | 6.58 | 4.15 | 0.1 | 1.75 | 30 - 70 | 90 - 201 |
| Buried Soil 8 | 0.65 | 5.24 | 4.53 | 0.1 | 1.45 | 30 - 70 | 120 - 271 |
| Buried Soil 9 | 0.67 | 8.98 | 4.49 | 0.1 | 1.32 | 30 - 70 | 150 - 341 |
| Buried Soil 10 | 0.58 | 0.87 | 4.05 | 0.1 | 0.58 | 15 - 30 | 165 - 371 |

Table 8.1

Soil Description - Transect B; Boring 3

| | Depth (Ft) | Horizon | Transect B; B-3 Description | | | | | |
|---|-------------|-------------|---|--|--|--|--|--|
| | 0 - 5 | NR | No Recovery - no sample | | | | | |
| _ | 5.0 - 6.1 | Bt1 | Dark grayish brown (10YR 4/2m mixed), loam to clay loam, slightly oxidized, slightly hard, friable, moderately sticky, moderately plastic, coarse-grained poorly sorted sand, few to common fine slate gravel, few to common fine clay films on ped faces, gradational lower boundary to; | | | | | |
| | 6.1 - 7.0 | BC ox / Bt2 | Dark yellowish brown (10YR 3/4m, mixed), clay loam, moderately well oxidized, soft to slightly hard, friable, moderately sticky, very plastic, coarse- grained poorly sorted sand, few very fine clay films (or stains) and sylans on ped faces, clear lower boundary to; | | | | | |
| - | 7.0 - 8.0 | 2Btb1 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, moderately well oxidized, slightly hard to hard, friable, moderately to very sticky, very plastic, coarse-grained poorly sorted sand, few fine clay films on ped faces, calcium carbonate stage 1- few fine nodules, clear lower boundary to; | | | | | |
| | 8.0 - 9.0 | 2BCb1 | Dark yellowish brown (10YR 4/4m, mixed), sandy loam to loam, massive, moderately well oxidized, soft to slightly hard, friable, slightly sticky, slightly plastic, coarse-grained poorly sorted sand, few very fine clay films (or stains) on ped faces, calcium carbonate stage 1- to 1 few to common fine nodules, clear lower boundary to; | | | | | |
| _ | 9.0 - 11.5 | 3Btb1 | Brown (10YR 4/3m, mixed), clay loam, massive, moderately well oxidized, hard to very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, common to many fine, common moderately thick, and few thick clay films on ped faces, gradational lower boundary to; | | | | | |
| | 11.5 - 11.9 | 3Btb2 | Dark brown (10YR 3/3m, mixed), loam to clay loam, massive, slightly oxidized, hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, few to common fine and few moderately thick clay films on ped faces, clear lower boundary to; | | | | | |
| - | 11.9 - 15.3 | 4Btb1 | Dark yellowish brown (10YR 4/4m, mixed), clay loam, massive, moderately well oxidized, hard to very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, many fine, common moderately thick, and few thick clay films on ped faces, few to common fine MnO nodules in soil matrix, gradational lower boundary to; | | | | | |
| | 15.3 - 20.2 | 4BCkb1 | Brown (10YR 4/3m, mixed), loam, massive, slightly oxidized, slightly hard to hard, friable, moderately sticky, slightly plastic, fine-grained well sorted sand, few fine gravel, calcium carbonate stage 1- to 1 few to common very fine and fine nodules in soil matrix; abrupt lower boundary to; | | | | | |
| | 20.2 - 23.5 | 4BCb2 lam | Brown (10YR 4/3m, mixed), loam, crudely bedded or thickly laminated, slightly oxidized, soft to slightly hard, friable to very friable, non- to slightly sticky, non- to slightly plastic, coarse-grained poorly sorted sand, basal scour bed contains common fine slate gravel, common fine MnO nodules in coarser beds; abrupt lower boundary to; | | | | | |

| Depth (Ft) | Horizon | Transect B; B-3 Description (Cont.) |
|-------------|-----------|--|
| 23.5 - 25.6 | 5Btb | Dark yellowish brown (10YR 3/4m, mixed), silty clay loam, finely bedded or laminated (varve like), well oxidized and gleyed in varves, hard to very hard, firm, very sticky, very plastic, very fine-grained very well sorted sand, many fine and common moderately thick clay films on ped faces, clear lower boundary to; |
| 25.6 - 27.3 | 5BCb1 lam | Brown and Dark brown (10YR 4/3 and 3/3m, mixed), loam, crudely bedded or laminated (lams are 3"-5" thick), slightly oxidized, soft to slightly hard, friable to firm, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, localized common fine MnO nodules in lams; clear lower boundary to; |
| 27.3 - 28.5 | 5BCb2 lam | Dark yellowish brown (10YR 4/4m, mixed), loam, crudely stratified or laminated (lams are 3"-5" thick), slightly oxidized, slightly hard, friable, slightly sticky, slightly plastic, fine-grained well sorted sand, clear lower boundary to; |
| 28.5 - 30.0 | 6Btb | Dark yellowish brown (10YR 3/4m, mixed), loam to clay loam, finely bedded or laminated (varve like), slightly oxidized and partially gleyed in varves, hard, firm, slightly to moderately sticky, moderately plastic, fine-grained well sorted sand, common fine and few moderately thick clay films on ped faces, common MnO veinlets on ped faces, no recovery to; |
| 30.0 - 30.5 | 6Cb scour | Dark brown (10YR 3/3m, mixed), sandy loam, massive, slightly oxidized and gleyed, slightly hard, friable, slightly sticky, non- to slightly plastic, medium- grained moderately well sorted sand, few fine MnO nodules in soil matrix, gradational lower boundary to; |
| 30.5 - 33.6 | 7Btb trun | Dark yellowish brown (10YR 4/4m, mixed), loam, faintly laminated (irregular spacing), moderately well oxidized, very hard, firm, slightly to moderately sticky, slightly plastic, fine-grained well sorted sand, common fine and moderately thick clay films on ped faces, common MnO webbing on ped faces, gradational lower boundary to; |
| 33.6 - 43.1 | 7BCb lam | Yellowish brown (10YR 5/4m, mixed), loam, faintly laminated (irregular spacing), well oxidized, slightly hard to hard, friable, slightly sticky, slightly plastic, fine-grained well sorted sand, common MnO webbing on ped faces, clear lower boundary to; |
| 43.1 - 50.2 | 8BCb lam | Dark yellowish brown (10YR 4/4m, mixed), silty clay loam, finely laminated, moderately well oxidized, hard, firm, moderately sticky, moderately to very plastic, very fine-grained very well sorted sand, common MnO webbing on ped faces, abrupt lower boundary to; |
| 50.2+ | Lakewood | Bedrock |

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Table 8.2

Soil Development Index Calculation Sheet Transect B; Boring 3

| Unit | Thickness | | С | olor | | Те | xture | | Cons | sistence | | Clay Film | Clay Films | | Mean Hor. |
|----------------|-----------|----------|------|----------|------|------|-------|-------|------|------------------------------|------|------------------------|------------|--------|-----------|
| | (Feet) | Dry | | Moist | | | | Dry | / | W | et | | | Values | Values |
| Raw Alluvium | 3 | 2.5Y 7/2 | X/10 | 10YR 6/3 | X/10 | s | Х/6 | lo | X/5 | SO | Х/6 | 0 | X/15 | | |
| Transect B; Bo | ring 3 | | | | | | | | | | | | | | |
| Bt1 | 1.1 | n.d. | 0 | 10YR 4/2 | 0 | l-cl | 0.58 | sh | 0.40 | s, p | 0.67 | 1-2fpf | 0.3 | 0.39 | 0.43 |
| BC ox / Bt2 | 0.9 | n.d. | 0 | 10YR 3/4 | 0.1 | cl | 0.67 | so-sh | 0.3 | s, vp | 0.83 | v1fpf | 0.23 | 0.43 | 0.38 |
| 2Btb1 | 1 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | sh-h | 0.5 | s-vs, vp | 0.92 | 1fpf | 0.27 | 0.49 | 0.49 |
| 2BCb1 | 1 | n.d. | 0 | 10YR 4/4 | 0.1 | sl-l | 0.42 | so-sh | 0.3 | ss, ps | 0.33 | v1fpf | 0.23 | 0.28 | 0.28 |
| 3Btb1 | 2.5 | n.d. | 0 | 10YR 4/3 | 0 | cl | 0.67 | h-vh | 0.7 | vs, vp | 1.00 | 2-3fpf, 2mkpf, 1kpf | 0.78 | 0.63 | 1.58 |
| 3Btb2 | 0.4 | n.d. | 0 | 10YR 3/3 | 0 | I-cl | 0.58 | h | 0.6 | vs, vp | 1.00 | 1-2fpf, 1mkpf | 0.48 | 0.53 | 0.21 |
| 4Btb1 | 3.4 | n.d. | 0 | 10YR 4/4 | 0.1 | cl | 0.67 | h-vh | 0.7 | vs, vp | 1.00 | 3fpf, 2mkpf, 1kpf | 0.8 | 0.65 | 2.22 |
| 4BCkb1 | 4.9 | n.d. | 0 | 10YR 4/3 | 0 | Ι | 0.5 | sh-h | 0.5 | s, ps | 0.5 | | 0 | 0.30 | 1.47 |
| 4BCb2 lam | 3.3 | n.d. | 0 | 10YR 4/3 | 0 | Ι | 0.5 | so-sh | 0.3 | so-ss, po [.] ps | 0.17 | | 0 | 0.19 | 0.64 |
| 5Btb | 2.1 | n.d. | 0 | 10YR 3/4 | 0.1 | sicl | 0.83 | h-vh | 0.70 | vs, vp | 1.00 | 3fpf, 2mkpf, 1kpf | 0.8 | 0.69 | 1.44 |
| 5BCb1 lam | 1.7 | n.d. | 0 | 10YR 4/3 | 0 | I | 0.5 | so-sh | 0.30 | ss-s, ps | 0.42 | | | 0.24 | 0.41 |
| 5BCb2 lam | 1.2 | n.d. | 0 | 10YR 4/4 | 0.1 | I | 0.5 | sh | 0.40 | ss, ps | 0.33 | | 0 | 0.27 | 0.32 |
| 6Btb | 1.5 | n.d. | 0 | 10YR 3/4 | 0.1 | l-cl | 0.58 | h | 0.60 | ss-s, p | 0.58 | 2fpf, 1mkpf | 0.5 | 0.47 | 0.71 |
| 6Cb scour | 0.5 | n.d. | 0 | 10YR 3/3 | 0 | sl | 0.33 | sh | 0.40 | ss, po-ps | 0.25 | | 0 | 0.20 | 0.10 |
| 7Btb trun | 3.1 | n.d. | 0 | 10YR 4/4 | 0.1 | | 0.5 | vh | 0.80 | s, ps | 0.50 | 2fpf, 2mkpf | 0.54 | 0.49 | 1.51 |
| 7BCb lam | 9.5 | n.d. | 0 | 10YR 5/4 | 0.1 | I | 0.5 | sh-h | 0.50 | ss, ps | 0.33 | | 0 | 0.29 | 2.72 |
| 8BCb lam | 7.1 | n.d. | 0 | 10YR 4/4 | 0.1 | sicl | 0.83 | h | 0.60 | s, p-vp | 0.75 | | 0 | 0.46 | 3.24 |

INDEX VALUES AND DETERMINED AGES (ka)

| Soil Member | MHI | Mean Soil | SDI | Color Index | Clay Film | Soil Age | Section Age |
|---------------|------|-----------|----------|-------------|-----------|-------------|-------------|
| | | Index | @ 7 feet | | Index | Estimate ka | Estimate ka |
| Surface Soil | 0.43 | 0.81 | 2.84 | 0.1 | 0.43 | 8 - 15 | 8 - 15 |
| Buried Soil 1 | 0.49 | 0.77 | 2.69 | 0.2 | 0.77 | 8 - 15 | 16 - 30 |
| Buried Soil 2 | 0.63 | 1.79 | 4.32 | 0 | 1.16 | 15 - 30 | 31 - 60 |
| Buried Soil 3 | 0.65 | 4.33 | 6.07 | 0.1 | 0.80 | 30 - 70 | 61 - 130 |
| Buried Soil 4 | 0.69 | 2.17 | 3.04 | 0.2 | 0.80 | 15 - 30 | 76 - 160 |
| Buried Soil 5 | 0.47 | 0.81 | 2.82 | 0.1 | 0.50 | 8 - 15 | 84 - 175 |
| Buried Soil 6 | 0.49 | 4.23 | 2.35 | 0.2 | 0.54 | 4 - 8 | 88 - 183 |
| Buried Soil 7 | 0.46 | 3.24 | 3.19 | 0.1 | 0.00 | 4 - 8 | 92 - 191 |

Table 9.1 Transect B - Boring 2

| Depth (Ft) | Horizon | Summary Description of Transect B; Boring 2 |
|-------------|-----------------|--|
| 0 - 5.0 | | No Recovery |
| 5.0 - 6.8 | Btj / BC | weak argillic, truncated |
| 6.8 - 9.5 | 2Btb | strong argillic, plugged with clay, truncated |
| 9.5 - 10.2 | | |
| | 3ABb/3Btb1 | strong argillic, plugged with clay, organic rich |
| 10.2 - 16.0 | 3Btb2 | strong argillic, plugged with clay, well oxidized |
| 16.0 - 17.1 | 3Cb scour | gravel rich scour |
| 17.1 - 20 | 4BCb lam | crudely laminated with gravel |
| 20 - 20.5 | 4Cb scour | gravel rich scour, slightly oxidized |
| 20.5 - 21.1 | 5Btb | thin argillic, plugged with clay, truncated |
| 21.1 - 25.2 | 5BCb lam | crudely laminated with clay and gravel |
| 25.2 - 26.6 | 6BCb lam1 | thickly laminated, sandy, moderate redox |
| 26.6 - 30.6 | 6BCb lam2 | thickly laminated, sandy, moderately reduced |
| 30.6 - 36 | 7BCb lam / 7Btb | thinly laminated (varve like), clayey, moderate redox |
| 36 - 42.8 | 8BCb lam | thickly laminated, sandy |
| 42.8 - 43.3 | 8Cb scour | massive scour |
| 43.3 - 44.7 | 9Btb / BCb lam | thinly laminated (varve like), silty |
| 44.7 - 46 | 9Cb scour | massive sandy scour |
| 46 - 59 | 10Btb | strong argillic, plugged with clay, organic rich, truncated |
| 59 - 60 | 10Cb scour | massive scour |
| 60 - 70.5 | 11Btb | strong argillic, plugged with clay, well oxidized, truncated |
| 70.5 - 75.5 | 12Btb | strong argillic, gravel rich, truncated |
| 75.5 - 80.5 | 13BCb lam1 | thinly laminated (varve like), clayey, with MnO, truncated |
| 80.5 - 85+ | 13BCb lam2 | thinly laminated (varve like), clayey, well oxidized |
| | | |

Table 9.2 Transect B - Boring 4

| Depth (Ft) | Horizon | Summary Description of Transect B; Boring 4 |
|-------------|-------------------|---|
| 0 - 5.0 | | No Recovery |
| 5 - 5.7 | Bt | strong argillic, plugged with clay, truncated |
| 5.7 - 6.3 | BC | massive, silty, slightly oxidized |
| 6.3 - 8.4 | 2Btb | strong argillic with gravel, plugged with clay, well oxidized |
| 8.4 - 10 | 2BCb | massive, sandy with gravel, moderately oxidized |
| 10 - 10.9 | 2Cb | gravel rich scour |
| 10.9 - 15.9 | 3ABb / 3Btb | strong argillic, plugged with clay, organic rich, truncated |
| 15.9 - 17.4 | 3BCb | massive, silty, slightly oxidized |
| 17.4 - 20.3 | 4Btb1 | strong argillic, plugged with clay, well oxidized, truncated |
| 20.3 - 24 | 4Btb2 / 4BCb1 | weak argillic, silty, well oxidized |
| 24 - 26.6 | 4BCb2 | massive, sandy, slightly oxidized |
| 26.6 - 29.5 | 5Btb | moderate argillic, silty, moderately oxidized |
| 29.5 - 31.8 | 5BCb | massive, silty, slightly oxidized |
| 31.8 - 34.5 | 6BCb lam | thinly laminated (varve like), silty |
| 34.5 - 38.9 | 7BCb lam | thinly laminated (varve like), clayey |
| 38.9 + | Lakewood Formatic | on Poorly lithified bedrock. |

Table 9.3 Transect B - Boring 5

| Depth (Ft) | Horizon | Summary Description of Transect B; Boring 5 |
|-------------|-------------------|---|
| 0 - 5.0 | | No Recovery |
| 5.0 - 8.2 | Bt / Btj | weak argillic, truncated |
| 8.2 - 10.3 | BC | massive with gravel |
| 10.3 - 11 | C scour | massive scour |
| 11 - 12.8 | 2ABb / 2Btb1 | strong argillic, plugged with clay, organic rich, truncated |
| 12.8 - 15 | 2Btb2 | strong argillic, plugged with clay, well oxidized |
| 15 - 16.3 | 2BCb | massive, silty, slightly oxidized |
| 16.3 - 20 | 3Btb1 | moderate argillic, silty |
| 20 - 21.8 | 3Btb2 / 3BCb1 | weak argillic, sandy, moderately oxidized |
| 21.8 - 23.9 | 3BCb2 | massive, silty, slightly oxidized |
| 23.9 - 25.4 | 4Btb | weak argillic, silty |
| 25.4 - 25.9 | 4BCb | massive, sandy, slightly oxidized |
| 25.9 - 26.8 | 5Btb1 | strong argillic, plugged with clay, organic rich, truncated |
| 26.8 - 27.3 | 5Btb2 / 5BCb | weak argillic, silty, moderately oxidized |
| 27.3 - 28.8 | 6ABb / 6Btb | strong argillic, plugged with clay, organic rich, truncated |
| 28.8 + | Lakewood Formatic | on Poorly lithified bedrock. |

Table 9.4 Transect B - Boring 6

| Depth (Ft) | Horizon | Summary Description of Transect B; Boring 5 |
|-------------|--------------------|---|
| 0 - 5.0 | | No Recovery |
| 5.0 - 5.7 | Btj / BC | weak argillic, silty, truncated |
| 5.7 - 8.9 | 2Btb1 | moderate argillic, hard |
| 8.9 - 11.1 | 2Btb2 / 2BCb | moderate argillic, silty, moderately oxidized |
| 11.1 - 22.5 | 3Btb | moderate argillic, silty, thick |
| 22.5 - 26.2 | 3BCb lam | faintly laminated (varve like), clayey, well oxidized |
| 26.2 - 28.9 | 4ABb / 4Btb | strong argillic, plugged with clay, reduced |
| 28.9 + | Lakewood Formation | Poorly lithified bedrock. |

| Depth (Ft) | Horizon | Summary Description of Transect B; AMEC Boring 5 |
|-------------|-------------|---|
| 0 - 6 | Af | Artificial Fill |
| 6 - 6.5 | AB t | Dark brown, organic rich, clayey |
| 6.5 - 9 | Bt1 | oxidized, fine-grained |
| 9 - 13 | Bt2 | less oxidized, fine-grained |
| 13.5 - 21.2 | Bt3/BC1 | coarse-grained, partial redox |
| 21.2 - 25.5 | Bt4/BC2 | finer-grained, moderate redox |
| 25.5 - 27 | 2AB/Bt trun | clayey, organic rich, strong redox |
| 27.5 - 33 | 2BCox1 | silty, loose, strong redox |
| 33 - 37.5 | 2BCox2 | coarser-grained, strong redox |
| 37.5 - 43.5 | 3C beach1 | beach sand?, well sorted, rounded clasts |
| 43.5 - 49 | 3C beach2 | beach sand and colluvium?, well sorted, rounded clasts |
| 49 - 52 + | 3Cox beach3 | beach sand?, well sorted, rounded clasts, well oxidized |

Table 10.1 Transect B - AMEC Boring 5

Table 10.2 Transect B - AMEC Boring 6

| Depth (Ft) | Horizon | Summary Description of Transect B; AMEC Boring 6 |
|--------------|-------------------|--|
| 0 - 6 | Af | Artificial Fill |
| 6 - 14 | Bt1 | well oxidized, plugged with clay |
| 14 - 19 | Bt2 | well oxidized, plugged with clay. Coarser-grained |
| 19 - 21.5 | 2Bt1 | moderate oxidation, fine-grained |
| 21.5 - 24.25 | 2Bt2 | moderate oxidation, coarser-grained |
| 24.25 - 28.5 | 2Bt3/BC1 | silty, slight redox |
| 28.5 - 30.5 | 3AB | organic and clay rich, coarser-grained |
| 30.5 - 39 | 3Bt1 redox | clayey, coarse-grained, strong redox |
| 39 - 44 | 3Bt2 redox | silty, fine-grained, strong redox |
| 44 - 47 | 3BC redox | silty, fine-grained, moderate redox |
| 49 - 54 | 4Bt1 redox | fine-grained, mixed organics and MnO strong redox |
| 54 - 64.25 | 4Bt2/BC redox | fine-grained, MnO, moderate to strong redox |
| 64.25 - 66.5 | 5AB/5Bt1 | clayey, fine-grained, mixed organics and MnO, slight redox |
| 66.5 - 74 | 5Bt2 redox | clayey, fine-grained, MnO, moderate redox |
| 74 - 100 + | Lakewood Formatic | on Poorly lithified bedrock. |

Table 10.3 Transect B - AMEC Boring 7

| Depth (Ft) | Horizon | Summary Description of Transect B; AMEC Boring 7 |
|--------------|-----------|---|
| 0 - 7.5 | Af | Artificial Fill |
| 7.5 - 9.2 | Btj | silty, moderately oxidized, coarse-grained |
| 9.2 - 16 | 2 Bt gl | clayey, fine-grained, reduced |
| 16 - 25 | 3Bt 1&2 | silty, fine-grained, slight redox |
| 25 - 38.5 | 3BC ox | silty, coarser-grained, slight redox, locally laminated |
| 38.5 - 41 | 4AB/4Bt1 | clayey, fine-grained, well oxidized, organic rich |
| 41 - 58.5 | 4Bt2 | clayey, fine-grained, moderately oxidized |
| 58.5 - 69.75 | 4BC redox | silty, coarse-grained, moderate redox |
| 69.75 - 72 | 5AB/5Bt1 | clayey, fine-grained, well oxidized, organic rich |
| 72 - 74 + | 5Bt2/BC | clayey, fine-grained, strong redox |

Table 11. Soil Surface Relative-Age EstimatesSummary Table

| Profile Number | Soil Member | MHI Value | SDI Value | Clay Film | Relative Age (ka) |
|-------------------|----------------|-----------|-----------|-----------|----------------------|
| | | | | Oldy Till | (100) |
| 1 | Surface Soil | 0.36 | 1.16 | 0.7 | 4 - 8 |
| Transect A | Buried Soil 1 | 0.51 | 3.04 | 0.5 | 19 - 38 |
| Boring 1 | Buried Soil 2 | 0.58 | 3.52 | 0.6 | 34 - 68 |
| - | Buried Soil 3 | 0.56 | 1.84 | 0.6 | 42 - 83 |
| | Buried Soil 4 | 0.41 | 2.36 | 0.3 | 50 - 98 |
| | Buried Soil 5 | 0.22 | 1.28 | 0.0 | 51 - 102 |
| | Buried Soil 6 | 0.64 | 3.58 | 2.0 | 66 - 132 |
| | Buried Soil 7 | 0.65 | 4.27 | 2.5 | 96 - 202 |
| | Buried Soil 8 | 0.61 | 3.90 | 1.1 | 111 - 232 |
| | Buried Soil 9 | 0.62 | 3.54 | 0.6 | 126 - 262 |
| | Buried Soil 10 | 0.57 | 2.41 | 0.4 | 141 - 292 |
| | Buried Soil 11 | 0.55 | 2.92 | 1.1 | 156 - 322 |
| | | | | | |
| 2 | Surface Soil | 0.5 | 3.29 | 0.77 | 8 - 15 |
| Transect A | Buried Soil 1 | 0.32 | 1.39 | 0.27 | 12 - 23 |
| Boring 4 | Buried Soil 2 | 0.26 | 0.83 | 0.30 | 13 - 27 |
| | Buried Soil 3 | 0.33 | 2.33 | 0.38 | 28 - 57 |
| | Buried Soil 4 | 0.58 | 2.38 | 0.72 | 58 - 127 |
| | Buried Soil 5 | 0.48 | 2.05 | 0.88 | 73 - 157 |
| | Buried Soil 6 | 0.63 | 3.75 | 1.20 | 103 - 227 |
| | Buried Soil 7 | 0.52 | 3.30 | 0.60 | 118 - 257 |
| | Buried Soil 8 | 0.37 | 2.56 | 0.50 | 122 - 265 |
| | Buried Soil 9 | 0.52 | 2.07 | 0.50 | 137 - 295 |
| 0 | | 0.50 | 1.00 | 0.07 | 0.45 |
| 3 | Surface Soil | 0.56 | 1.93 | 0.97 | 8 - 15 |
| Transect A | Buried Soil 1 | 0.21 | 0.85 | 0.00 | 9 - 19 |
| Boring 5 | Buried Soil 2 | 0.35 | 2.43 | 0.30 | 24 - 49 |
| | Buried Soil 3 | 0.61 | 3.84 | 1.44 | 54 - 119 |
| | Buried Soil 4 | 0.36 | 1.53 | 0.00 | 58 - 127 |
| 4 | Surface Soil | 0.43 | 2.40 | 0.70 | 8 - 15 |
| Transect A | Buried Soil 1 | 0.17 | 1.03 | 0.00 | 9 - 19 |
| Boring 7 | Buried Soil 2 | 0.33 | 2.33 | 0.38 | 13 - 27 |
| Doning / | Buried Soil 3 | 0.35 | 2.43 | 0.30 | 28 - 57 |
| | Buried Soil 4 | 0.55 | 3.86 | 0.62 | 58 - 127 |
| | Buried Soil 5 | 0.22 | 1.50 | 0.00 | 62 - 135 |

| Profile Number | Soil Member | MHI Value | SDI Value | Clay Film | Relative Age (ka) |
|-------------------|----------------|-----------|-----------|-----------|----------------------|
| | | | | | |
| 5 | Surface Soil | 0.38 | 2.65 | 0.37 | 1 - 4 |
| Transect B | Buried Soil 1 | 0.50 | 3.28 | 0.90 | 9 - 19 |
| Boring 1 | Buried Soil 2 | 0.56 | 3.37 | 2.22 | 39 - 89 |
| C C | Buried Soil 3 | 0.48 | 2.06 | 0.60 | 47 - 104 |
| | Buried Soil 4 | 0.28 | 1.99 | 0.00 | 48 - 108 |
| | Buried Soil 5 | 0.4 | 2.75 | 0.00 | 52 - 116 |
| | Buried Soil 6 | 0.49 | 3.22 | 0.60 | 60 - 131 |
| | Buried Soil 7 | 0.62 | 4.15 | 1.75 | 90 - 201 |
| | Buried Soil 8 | 0.65 | 4.53 | 1.45 | 120 - 271 |
| | Buried Soil 9 | 0.67 | 4.49 | 1.32 | 150 - 341 |
| | Buried Soil 10 | 0.58 | 4.05 | 0.58 | 165 - 371 |
| | | | | | |
| 6 | Surface Soil | 0.43 | 2.84 | 0.43 | 8 - 15 |
| Transect B | Buried Soil 1 | 0.49 | 2.69 | 0.77 | 16 - 30 |
| Boring 3 | Buried Soil 2 | 0.63 | 4.32 | 1.16 | 31 - 60 |
| | Buried Soil 3 | 0.65 | 6.07 | 0.80 | 61 - 130 |
| | Buried Soil 4 | 0.69 | 3.04 | 0.80 | 76 - 160 |
| | Buried Soil 5 | 0.47 | 2.82 | 0.50 | 84 - 175 |
| | Buried Soil 6 | 0.49 | 2.35 | 0.54 | 88 - 183 |
| | Buried Soil 7 | 0.46 | 3.19 | 0.00 | 92 - 191 |
| | | | | | |

Table 11 (Cont.). Summary Table

Table 12. Comparison Soil Data Indices Value Summary

| (McFadden) Mission | | | Reddening | | |
|--------------------------------------|-----------|------|--------------------|-----------------|--|
| Creek Soils | SDI At 7' | MHI | Index | Clay Film Index | |
| S7 0-1000 yrbp | 5.9 | 0.12 | 0 | 0 | |
| S5 4-13 ka | 10.2 | 0.3 | 0.1 | 0 | |
| S4 13-70 ka | 31.4 | 0.37 | 3.94 | 7.37 | |
| S2 70-250 ka | 56.10 | 0.61 | 4.80 | 6.24 | |
| S2 250-700 ka | 25.70 | 0.39 | 6.20 | 10.31 | |
| | | | | | |
| (Rockwell) Ventura River | | | Reddening | | |
| Basin Soils | SDI At 7' | MHI | Index | Clay Film Index | |
| | 47 | 0.17 | 0.5 | <u>^</u> | |
| Qt3 4 - 8 ka | 17 | 0.17 | 0.5 | 0 | |
| Qt4 10 -15 ka | 27 | 0.43 | 2 | 4 | |
| Qt5a 15 – 20 ka | 28 | 0.37 | 3.5 | 4.2 | |
| Qt5b 30 ka | 32 | 0.46 | 5 | 7 | |
| | | | | | |
| (WLA) West Hollywood Buried Soils | SDI At 7' | МНІ | Reddening Index | Clay Film Index | |
| | 01.4 | 0.40 | 4.05 | 1.00 | |
| Qol1 100 ka | 21.4 | 0.42 | 1.05 | 1.99 | |
| Qol2 100-300 ka | 73.5 | 0.8 | 8.2 | 13.2 | |

| TAB | TABLE 13. Soil Field Description Abbreviation Key | | | | | | | | | | | | |
|---------|---|-----|--------------------|-------------|------------------|-----------|---------------------------|------------|---------------------|-------------------|-----------------------|--------|---|
| | | | - | | - | | | | | | | | |
| | Texture Structure | | | Consistence | | | | Clay Films | | Calcium Carbonate | | | |
| | | | | | Dry | | Moist | | Wet | | | | (Pedogenic CaCO3) |
| | | | · · · · · | <u> </u> | | | (11) | | | | | | |
| S LS | - sand | m | - massive | | - loose -soft | vfr fr | -very friable -friable | | non stickey | V1 | veryfew | sl dis | |
| LS | - laomy sand | sg | - single grained | SO | -son | Ir | -maple | SS | slightly stickey | - 1 | few | I | slight coatings common on clast bottoms |
| | | | | | | | | | | | | | bottoms; few medium common fine |
| SL | - sandy loam | | OR | sh | -slightly hard | fi | -firm | s | moderately siteckey | 2 | common | 11 | nooduses |
| | | | | | | | | | | | | | thick coatings common on clast bottoms, |
| | | | | | | | | | | | | | common medium nodules, common fine |
| L | - Ioam | 1 | - weak | h | -hard | vfi | -very firm | VS | very stickey | 3 | continuous | | pendants, many fine nodules |
| | | | | | | | | | | | | | many thick coatings on clasts bottoms |
| | | | | . | | | | | | | | | common coarse pendants few clasts |
| CL | - clay loam | 2 | - moderate | vh | -very hard | | | | AND | | AND | VI | completely enveloped |
| | | | | | | | | | | | | | many thick coatings on clasts bottoms, |
| | a a sa ali sa la sula a sa a | | | | | | | | www.wlastat | | | v | many coarse pendants common clasts |
| SCL | sandy clay loam | 3 | - strong | eh | -extremely hard | | | ро | non plastci | vn | stains | V | completely enveloped- petrocalcic many thick coatings on clasts bottoms, |
| | | | | | | | | | | | | | many coarse pendants many clasts |
| | | | | | | | | | | | | | completely enveloped, completely |
| С | - clav | | AND | | | | | ne | slightly plastic | n | thin | V+ | disseminated in matrix - petrocalcic |
| Si | - silt | vf | - very fine | | | | | ps | moderately plastic | | moderately thick | VT | |
| SiL | - silt loam | f | - fine | | | | | | very plastic | | thick | | |
| SiCL | - silt clay loam | m | - medium | | | | | 10 | very plaotio | | AND | | |
| SiC | - silty clay | c | - coarse | | | | | - | | cl | coating clasts | | |
| | ,, | VC | - very coarse | | | | | | | | ped faces | | |
| | | - | AND | | | | | | | br | brodgeing sand grains | | |
| | | gr | - granular | | | | | | | ро | lining pores | | |
| | | pl | - platty | | | | | | | | 2. | | |
| | | pr | -prismatic | | | | | | | | | | |
| | | abk | -angular blockey | | | | | | | | | | |
| | | sbk | - sub angular bloc | key | | | | | | | | | |

| Boring Transect | Boring Described | Soil Horizon | Profile Relative Age (ka) | Unit Relative Age (ka) |
|--------------------|---------------------|--|------------------------------|---------------------------|
| A | 1 4 | Buried soil 1 and 2 Buried soil 3 and 4 | 34 - 68 58 - 127 | 34 - 127 |
| | 5 7 | Buried soil 2 and 3 Buried soil 3 and 4 | 54 - 119 58 - 127 | 04 127 |
| В | 1 3 | Buried soil 1 Buried soil 1 | 9 - 30 16 - 30 | 9 - 30 |
| В | 1 3 | Buried soil 2 Buried soil 2 | 39 - 89 31 - 60 | 31 - 89 |
| | | | | |

 Table 14. Cross Sectional Unit Relative Ages

APPENDIX E

GEOMORPHIC ANALYSIS



Lettis Consultants International, Inc. 27441 Tourney Road, Suite 220 Valencia, CA 91355 (661) 287-9900; fax (661) 287-9990

July 30, 2013

Susan Kirkgard, CEG Senior Geologist Geocon West, Inc. 3303 N. San Fernando Blvd., Suite 100 Burbank, CA 91504

Subject: Geomorphic Observations of Brown Canyon drainage in the Cheviot Hills Westfield Century City Mall Project

Dear Susan:

This set of geomorphic observations is intended to assist Geocon West, Inc. with their fault investigation for the Westfield Century City Mall project located in Century City, California. The purpose of providing these geomorphic observations is to help understand the context of the landforms, site geology, and the soil age estimates of fluvial deposits in boring Transect A along Avenue of the Stars.

This assessment of the site geomorphology was initially completed as a draft on February 4, 2013. We understand that Geocon West, Inc. has continued to perform studies (drilling and soil age dating) at the project site , and therefore, it should be noted that the observations and information contained in this letter only reflect the subsurface data that was collected at that time (February 2013), which may have been revised or superseded by more recent data. This assessment of the local geomorphology is focused on Brown Canyon (adjacent to the site), and is not intended to represent a thorough assessment of faulting at the site, nor a synthesis of stratigraphic, structural, and geomorphic data of the Cheviot Hills.

To perform this geomorphic interpretation, contours from 1926 Hollywood and 1934 Sawtelle 5minute U.S. Geological Survey topographic maps (surveyed in 1923-1924) were digitized. Contours depicted on these maps represent the landscape prior to mechanized grading and significant development that escalated in the 1930s. The digitized contours were used to create a 5-m-resolution digital elevation model (DEM) and derivative hillshade, color shaded relief, and slope images. In addition to interpretation of these images, topographic profiles were extracted from the DEM and aided in the identification and correlation of surfaces.



This geomorphic assessment provides observations grouped into the following areas: (1) Fault zones expressed in the landscape of Cheviot Hills, (2) mapping of terrace deposits along Brown Canyon, (3) possible capture of Benedict Canyon Wash by Brown Canyon, and (4) geomorphic context for origin and age of fluvial deposits encountered in Transect A borings.

Fault Zones in the Cheviot Hills

Previous mapping and interpretation has identified 3 main fault zones within the Cheviot Hills that are expressed in the landscape surrounding the project site. These include the West Beverly Hills Lineament (WBHL) to the east, and two zones associated with the Santa Monica fault zone (Figure 1). The northern, northeast-striking zone generally follows Santa Monica Boulevard and has been mapped by most as the Santa Monica fault zone (e.g., Dolan et al., 2000). The southern zone was recently interpreted by Kinney Geoscience (2012) as a reverse or thrust flap of the Santa Monica fault zone that merges with the northern strand to the west. For the purposes of this discussion, we will refer to the northern strand as the Santa Monica Boulevard Fault Zone (SMBFZ) and the southern strand as the Santa Monica Fault Zone (SMFZ).

- The northerly striking WBHL is expressed in the landscape as the eastern margin of the uplifted and dissected Cheviot Hills (Figure 1). The WBHL, which represents the northern extension of the right-lateral, strike-slip Newport-Inglewood fault zone, separates the uplifted Cheviot Hills on the west from the lower active fan surfaces (associated Benedict Canyon wash and other drainages) to the east.
- The northeast-striking Santa Monica Boulevard Fault Zone (SMBFZ) is expressed both as a shallow, narrow trough or swale in the topography which was exploited and modified by construction of the railroad and Santa Monica Boulevard (Figure 1). Several fault studies (including this Westfield project) have encountered steeply north-dipping normal- or oblique-slip faults associated with this zone. This fault is also expressed locally as a prominent north-side-up scarp at its eastern end where it diverges northward from Santa Monica Boulevard. Farther west near Overland Avenue (where the SMBFZ and SMFZ merge), the zone exhibits a prominent north-side-up fault scarp that continues westward to the prominent scarp in the lawn of the Mormon temple and farther west.
- The easterly striking Santa Monica Fault Zone (SMFZ) is expressed as a diffuse, easterly striking, north-side-up scarp in the Cheviot Hills (Figure 1). This scarp generally separates higher terrain on the north from lower terrain on the south, and likely exhibits a strong reverse component of slip. In addition, this fault appears to influence fluvial deposition and incision where it crosses Browns Canyon. The Qt1 terrace of Brown Canyon is only present upstream of this fault and not downstream. The canyon bottom widens downstream of the SMFZ and the broad Qt3 surface appears to emanate from Brown Canyon and widen downstream of the fault (Figures 1 and 2). A gradient change in the modern Brown Canyon drainage also occurs near the SMFZ in Profile A (Figure 3). These characteristics are all consistent with uplift along the fault zone. This newly



recognized reverse fault strand is also consistent with, and helps explain the zone of normal faulting along the SMBFZ to the north. Perhaps the SMBFZ is a hanging wall structure that accommodates both lateral slip and extension as the thrust flap (SMFZ) moves southward away from the SMBFZ.

Terrace Deposits Along Brown Canyon

Terrace surface mapping along Brown Canyon is shown on Figure 2. These surfaces were mapped using hillshade and slope images, 5-ft-interval contours, and topographic profiles. We recognize three fluvial surfaces that appear to be associated with the Browns Canyon drainage. These are sequentially numbered with increasing relative age starting with Qt1 (lowermost and youngest) to Qt3 (highest and oldest) (Figure 2). A few vertical meters above the modern Qal surface, a series of unpaired terrace surfaces are observed at various distance intervals on either side of the modern channel. Geocon's Boring Transect A along Avenue of the Stars is located on a mid-Holocene to late-Pleistocene Qt1 surface. A single Qt2 surface is located just upstream of the mouth of Brown Canyon. Two relatively large Qt3 surfaces are identified, one slightly NE of the Westfield site (between Brown Canyon and Benedict Canyon Wash, and another near the mouth of lower Brown Canyon. This downstream Qt3 surface more closely resembles an abandoned fan surface as opposed to a stream-cut terrace. Nevertheless, it is possible that the two Qt3 surfaces were associated with the posited capture of Benedict Canyon wash into Brown Canyon.

- Profile A (Figure 3; location on Figure 2) combines a profile constructed along Qt1 surfaces and a longitudinal profile following the thalweg of modern Brown Canyon. Two changes in gradient are observed along the profile at points A and B:
 - Point A approximately marks a relatively abrupt transition from a steeper gradient upstream to a lower downstream gradient (grey lines in Figure 3). This relationship may be related to: (1) normal concavity of the stream captured in less-than-optimal elevation data; (2) gradient change induced by hanging wall uplift north of the SMBFZ; or, (3) a marked increase in contributing drainage area, such as if Benedict Canyon wash had been captured by Brown Canyon. Although the data to construct this profile are coarse, the general trend of streams seems to be accurately captured and we favor a combination of the first two interpretations, for which there are more corroborative data than the third interpretation.
 - o Point B marks another relatively abrupt transition from a steeper upstream gradient, to shallower downstream gradient (Figure 3). This transition is almost certainly related to the transition from a channelized, incising stream, to a distributary wash developed on a fan surface. Note, however, that this relationship may be exaggerated by hanging wall uplift north of the SMFZ, which lies just upstream of the change in gradient. The profile constructed along Qt1 surfaces appears to diverge above the stream profile (i.e., gradient shallows) around 2,250 m, just upstream from the SMFZ. This relationship may be related to hanging wall uplift north of the fault, which would abandon and aid in preservation of these terrace surfaces, and bury terraces on the foot wall.



Without greater confidence in terrace surface correlations, however, this interpretation remains speculative.

- Topographic Profile B (Figure 4; location on Figure 2) is coincident with Transects 1, 8, and A, which primarily follow Avenue of the Stars. This profile depicts the top of the Lakewood Fm, above which lie the fluvial deposits (Brown Canyon fill terrace or older fan deposits?) the distinct soil is developed on. The upper Lakewood Fm may have served as a base level during cut and fill sequences in the Brown Canyon paleo-wash. Alternatively, the fluvial deposits directly overlying the Lakewood Fm may be older fan deposits that predate incision of Brown Canyon. The mid-Holocene to late Pleistocene (?) Qt1 surface extends along the middle approximately 150 m of the profile (dotted section).
- Topographic Profile C (Figure 5; location on Figure 2) crosses lower Brown Canyon and boring transects 1, 8, and A. The base of the modern Brown Canyon alluvial fill sequence (which post-dates the 17 to 20 ka low sea level stand), likely lies above the elevation of the distinct Pleistocene buried soil developed on an older alluvial fill sequence.

Could Benedict Canyon Wash have been captured by the modern Brown Canyon?

It has been postulated by Kinney GeoScience (2012) that Pleistocene alluvial and fluvial deposits within the Cheviot Hills were sourced from Benedict Canyon Wash. If this is correct, then the age of the deposits would necessarily predate the present uplifted and dissected landscape of the Cheviot Hills. Given that there is not much vertical relief separating the active piedmont surface associated with Benedict Canyon Wash and Brown Canyon, we attempt to assess if more recent capture of Benedict Canyon Wash is possible in the current landscape. If so, then the confluence of these two drainages would be located east-northeast of the Westfield project site (Figure 2) and perhaps explain the Qt3 surface interpreted between these two drainages in the saddle along Santa Monica Boulevard.

The cross-valley topographic profiles in Figure 6 show valley widths of lower Brown Canyon. These profiles compare widths upstream and downstream of the intersection of Brown Canyon with the SMBFZ fault and postulated paleo-confluence with Benedict Canyon wash (Figure 2). Brown Canyon valley width is generally consistent, ranging from roughly 130 to 160 m. The narrowest section lies just upstream from the SMFZ and is about 130-m-wide (Profile 5). The widest section lies well upstream of the SMBFZ and is about 160 m wide (Profile 1). Despite the posited confluence with Benedict Canyon wash, which would more than double the contributing drainage area, there is very little variability in channel width. This relationship argues against the possible Brown-Benedict Canyon wash confluence, although it is certainly not definitive. The lack of channel width change associated with a posited drastic increase in drainage area reduces the likelihood that the gradient change described above is related to the possible drainage capture.



 A relatively sharp and high scarp on the north side of the posited confluence could be interpreted to represent scour from a Benedict Canyon wash flow that cut into the hills and was captured by Brown Canyon wash (before most recent uplift of Cheviot Hills). The location of the scarp, however, lies on the opposite side expected for a cutbank and suggests the scarp is more likely tectonically related to the SMBFZ.

Age Estimates of Buried Soils and Faulting in Transect A

- The geomorphic mapping suggests that Geocon boring Transect A along Avenue of the Stars is located on a Qt1 terrace surface. Based on the elevation and position of this Qt1 surface with respect to the incised Brown Canyon, the age is likely mid-Holocene to late-Pleistocene. This age interpretation is also supported by the estimates of soil ages (mid-Holocene to late Pleistocene) provided by John Helms for the strata recovered in borings above a distinct buried Pleistocene soil encountered at depths of approximately 30 ft.
- The borings and draft cross section developed by the Geocon West, Inc. team indicate that the distinct buried soil found in each of the borings along Transect A at a depth of about 30 ft does not appear faulted. The estimated exposure age of this soil is 30 to 70 ka as estimated by John Helms. The estimated age of the soil (when considering overlying deposition and soil development) is approximately 58 to 127 ka. This age estimate suggests that the stable surface and soil development formed sometime between the MIS 5e sea level high stand (~120 ka), or as young as the MIS 5a sea level high stand (~80 ka). Both of these high stands were followed by regressions that would have driven incision in Brown Canyon, and led to the development of stable surfaces and soils on prior fluvial deposits.
- The buried soil is developed into a package of fluvial deposits cut on top of the Pleistocene Lakewood Fm. The soil represents a period of landscape stability and may have been associated with a sea level low stand.
- The fluvial deposits in which the soil is developed could represent (1) a Brown Canyon channel fill sequence or (2) older alluvial fan deposition that pre-dates the incision of the modern Brown Canyon and present landscape of the Cheviot Hills.
- No discernible fault displacement is observed in the 58 to 127 ka buried soil. However, since this observation is based on closely spaced borings and not a continuous exposure, minor vertical separation, on the order of inches, cannot be precluded.

<u>References</u>

Dolan, J.F., Sieh, K., and Rockwell, T.K., 2000, Late Quaternary activity and seismic potential of the Santa Monica fault system, Los Angeles, California, Geological Society of America Bulletin, v. 112, no. 10, p. 1559-1581.



Kenney GeoScience, 2012, Geomorphic, structural, and stratigraphic evaluation of the eastern Santa Monica Fault Zone, and West Beverly Hills Lineament, Century City/Cheviot Hills, California, consulting report to Beverly Hills Unified High School, July 18, 2012.

Should you have any questions, please do not hesitate to contact us. We appreciate the opportunity to assist Geocon West, Inc. on this project.

Sincerely, Lettis Consultants International, Inc.

Settelulul !!

Scott C. Lindvall Sr. Principal Geologist

hat DKg

Christopher Kemp Project Geologist

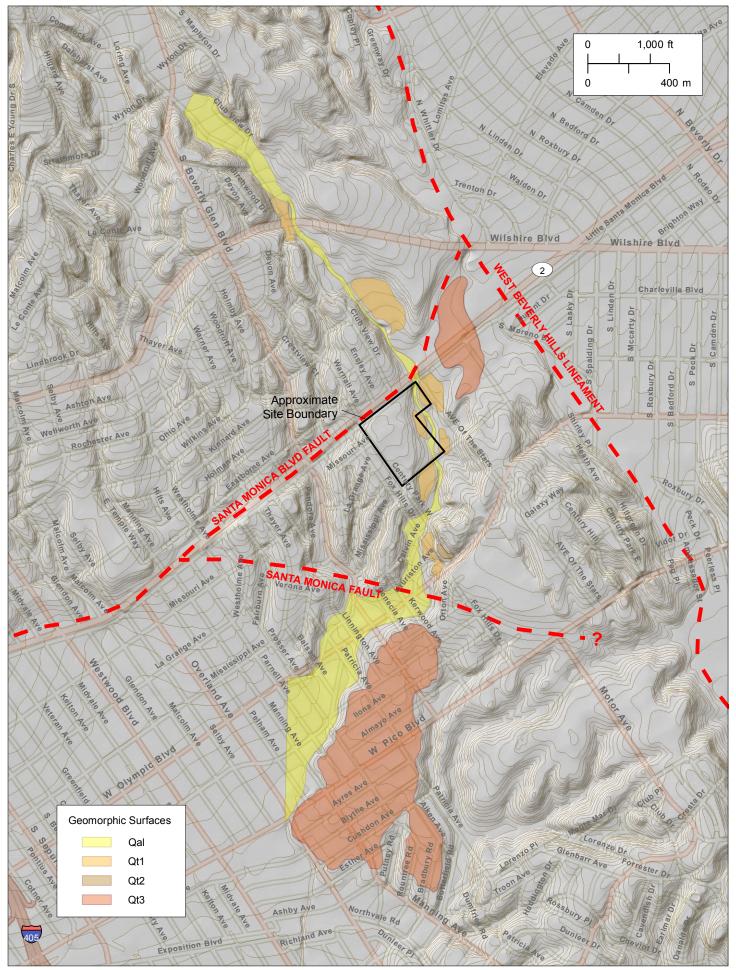


Figure 1. Map showing geomorphic surfaces with street base

1,000 ft

400 m

Possible confluence of Brown and Benedict Canyon washes (?)

Benedict Canyon

Possible scour from Benedict Canyon drainage (?) or scarp of Santa Monica Boulevard fault (?)

0

0

Surface possibly related to capture of Benedict Canyon wash (?)

Profile B (follows Transects 1, 8, & A)

Brown Canyon

Approximate Site Boundary

otofile

Red represents Transect A of Geocon (Ave. of the Stars)

Profile C

Only recognized Qt2 surface

Surface and deposits possibly related to outlet of captured Benedict Canyon wash

Geomorphic Surfaces Qal Qt1 Qt2 Qt3

Figure 2. Map showing geomorphic surfaces and terrace profile locations

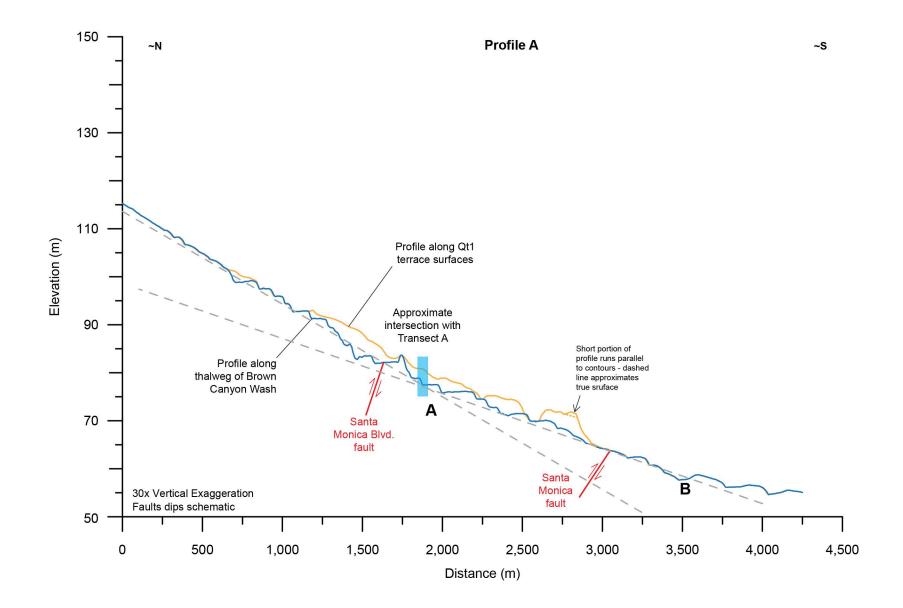


Figure 3. Longitudinal profile of Brown Canyon thalweg and Qt1 terrace surfaces

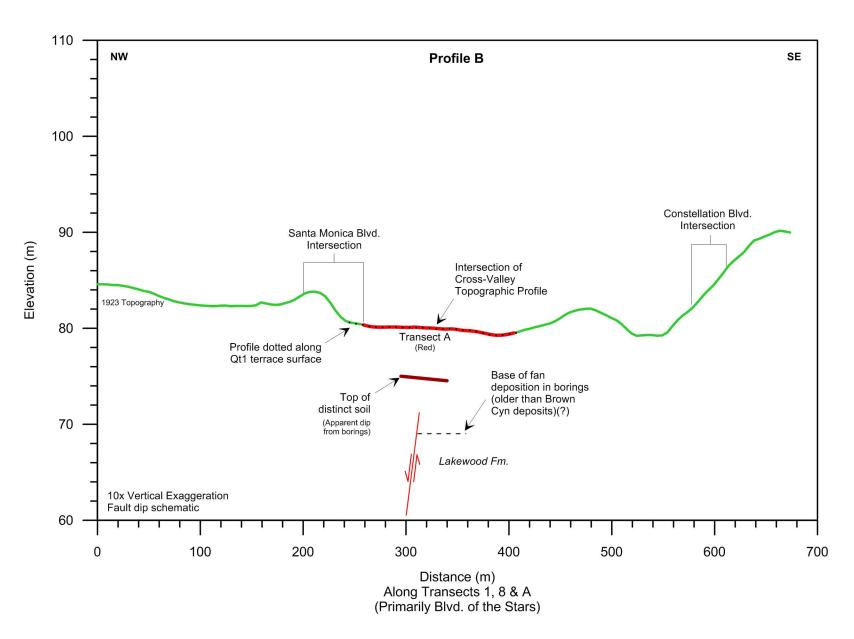
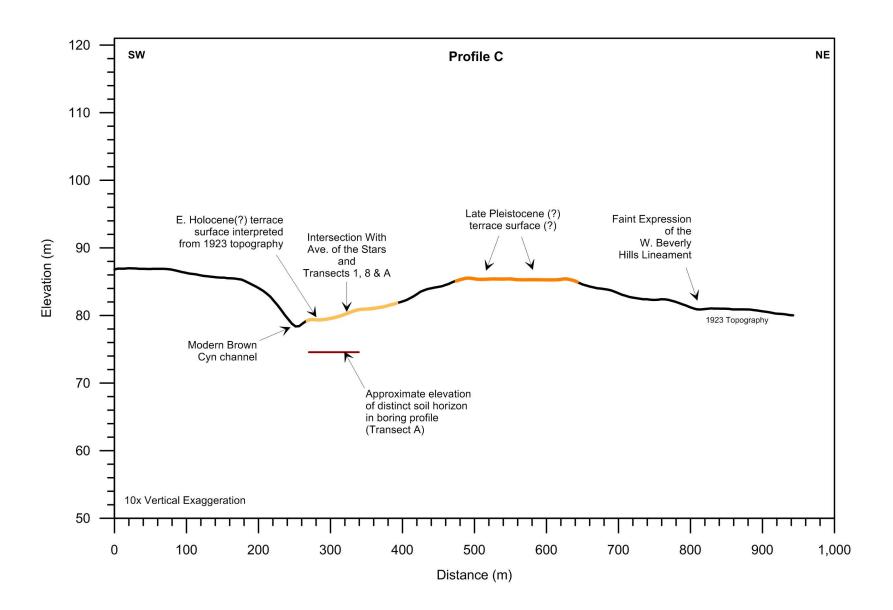


Figure 4. Topographic profile along Transects 1, 8, and A



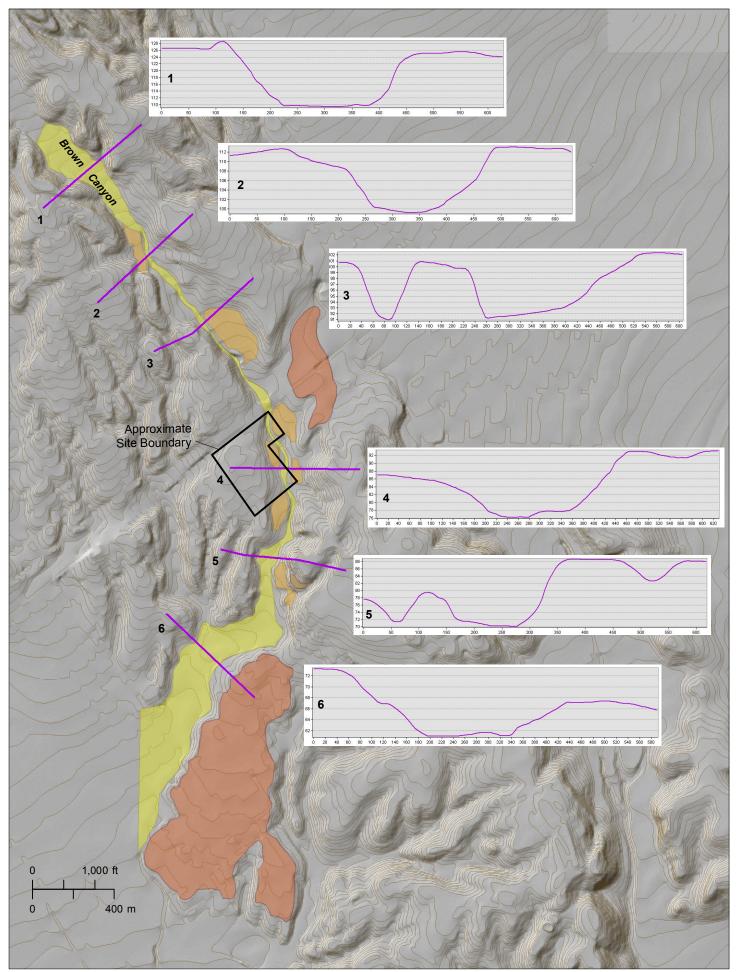


Figure 6. Cross-valley profiles along Brown Canyon