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Subject: **Preliminary literature and geomorphic evaluation of the eastern Santa Monica Fault Zone and potential impacts associated with fault surface rupture relative to proposed LA Metro stations in Century City, California.**

Mr. Rochefort,

Kenney GeoScience (KGS) is pleased to provide you this report providing preliminary findings regarding potential fault surface rupture hazards associated with two proposed LA Metro Stations in the Century City area. Specifically, to evaluate potential fault surface rupture hazard associated with the Santa Monica Fault Zone relative to the Base and Constellation Boulevard proposed LA Metro Stations. The Base Station is proposed along Santa Monica Boulevard near the intersection of Avenue of the Stars, and the Constellation Station is proposed along Constellation Boulevard and the intersection of Avenue of the Stars. This report also provides a preliminary evaluation of fault parameters such as reasonable anticipated moment magnitude and displacement per event for future major earthquakes on the Santa Monica Fault Zone. The results of this study are based on evaluation of previously published and unpublished geologic studies, and a regional and site geomorphic analysis of the Santa Monica Fault Zone.

EXECUTIVE SUMMARY

- Only one strong geomorphic lineament was identified referred herein as the Santa Monica Fault Lineament (SMFL) and it clearly does not exhibit significant vertical displacement.

- A couple of very weak geomorphic lineaments are observed in the Cheviot Hills south of the SMFL that may be associated with faulting but could easily have resulted from erosion of the hills. The likelihood of a well defined north dipping reverse fault reaching the surface during repeated major earthquakes in the Cheviot Hills is considered very low.

- No geomorphic scarp displaying significant vertical displacements was observed in the Century City area of the proposed Base and Constellation Stations. Thus, no scarp was identified in the study area that would have accommodated approximately 1 meter of offset across a discrete reverse fault over the course of thousands of years and presumably numerous major earthquakes. Therefore, it is the conclusion of this report that a north dipping reverse fault reaching the surface and accommodating even 1 meter of vertical displacement per event does not exist in the study area.

- The relatively strong geomorphic SMFL was likely produced by a near surface steeply dipping secondary strike-slip fault to the SMFZ or by erosion along a fold (kink) in the older alluvial fan sediments and surfaces produced by motion across a blind reverse fault strand to the SMFZ.

- A lack of any strong geomorphic scarp lineaments and evidence of vertical uplift and warping during the late Quaternary within the Cheviot Hills suggests that reverse faults exhibiting vertical displacements reside at depth beneath the Cheviot Hills. It is possible due to the distribution of deformation through the hills that the total magnitude of displacement of the SMFZ during a major earthquake would likely be distributed to a number of faults and many of these faults would not reach the surface (blind). In addition, relative uplift appears to have occurred parallel to and west of the poorly understood West Beverly Hills Lineament (WBHL). The combination of these two mechanisms of deformation may provide the best explanation of local tectonics.

- The total displacement during a major earthquake in the Century City area would likely be much less than the average displacement observed along the entire fault length. It was determined via a source parameter evaluation of the Santa Monica Fault Zone (SMFZ) that reasonable source parameters would include a moment magnitude Mw=7.1, with an average vertical displacement of ~2 meters (see next section for summary of source parameter evaluation). Thus, in the area of the proposed LA Metro Century City stations at the presumed eastern end of the SMFZ, the total displacement during a major earthquake would be much less than 2 meters. For discussion, we could reasonably indicate that the total vertical displacement may be on the order of 1 meter or less.

- The estimated1 meter or less of proposed total vertical displacement entering the Cheviot Hills during a major earthquake on the SMFZ may be partitioned to a series of bifurcated blind faults at depth causing local uplift and relatively small scale offsets across numerous strands.

- Although a subsurface investigation would need to be conducted to better understand near surface faulting in the Century City area, based on the results of this study, no geomorphic structures were observed in the region that have accommodated repeated displacements from many paleoearthquakes on the SMFZ. This observation suggests that if surface displacements occur in the area during a major earthquake on the SMFZ that the magnitude of slip is small (on the order of centimeters) across any one structure.

- Regardless of the mechanism that produced the SMFL it appears based on evaluation of the data that the active surface expression of the Santa Monica Fault Zone is weakening and possibly terminating within the Cheviot Hills near the Western Beverly Hills Lineament (WBHL).

- For design purposes, the proposed Base Station along Santa Monica Boulevard is located within the SMFL. Various fault models are provided in this report that provide geomorphic evidence that it is unlikely that a north dipping reverse fault produced the SMFL, that there is a relatively low to moderate probability that a strike-slip fault resides within the SMFL, and that there is a reasonable probability that no fault resides in the area of the Base Station as the SMFL may have been produced by erosion along a fold axis associated with blind faulting. In addition, if a strike-slip fault exists along the SMFL near the Base Station, geomorphic evidence indicates that the amount of slip across the fault per event is likely very small (centimeters).

- In the case of the proposed Constellation station, no moderately strong or strong geomorphic lineaments were identified in the area of the station. A very weak geomorphic lineament associated with a series of weak changes in slope across designated terraces transects the proposed station location.

- For design purposes and at a minimum, the Base and Constellation stations should anticipate near surface fracturing, minor uplift, warping/tilting and possible small scale offsets during a major earthquake on the Santa Monica and possibly Newport Inglewood fault zones.

- A future subsurface fault investigation utilizing one or a combination of fault trenching, seismic lines, continuous cores, large diameter bucket auger and CPT, would be required to better understand the style, location and magnitude of faulting in the area of the proposed Base and Constellation Stations.

- On a side note, based on my cross section analysis, it appears that the proposed Constellation station may reside in man made artificial fill placed within a local drainage (see Section A-A' on Plate E).

Site Description

The project site involves two proposed LA Metro underground mass transit stations in Century City referred to herein as the Base Station and Constellation Station (Plate B). The Century City stations are components of Option 4 of the Westside Subway Extension (Metro, 2010). The Base Station would be along Santa Monica Boulevard as the primary location with the alternative option of placing the station along Constellation Boulevard. The Base Station runs beneath the center line of Santa Monica Boulevard at the intersection of the Avenue of the Stars. Constellation Station is proposed beneath the center line of Constellation Boulevard with a center point at the intersection of the Avenue of the Stars. Plate G provides a design map of the Base Station along Santa Monica Boulevard.

Methodology and Data Sources

The findings in this report were achieved by the evaluation of pertinent existing published reports regarding the geologic history of the northern Los Angeles Basin with an emphasis on the eastern end of the Santa Monica Fault within the Cheviot Hills. Some important studies for this report include Hoots and Kew (1931); Wright (1991), Pipkin and Proctor (1992), Doland and Sieh (1992), Dolan and Pratt (1997), Pratt et al. (1998), Dolan Sieh and Rockwell (2000), Catchings et al. (2008 and 2010) and Metro (2010).

A geomorphic analysis of 1923 to 1925 USGS 5-foot contour topographic maps provided the primary data base for the evaluation of late Quaternary fault locations and characteristics of deformation. The 5-contour maps utilized were from a geologic map by Hoots and Kew (1931) that provides the base maps in Plates B and C.

Field mapping was conducted on April 5, 2011 along Club View Drive and Santa Monica Boulevard to evaluate existing topography along roadways and the Los Angeles Country Club.

Evaluation of faulting in the region of the proposed stations was limited due to the development of the area in the early 1900's (i.e. limits usefulness of aerial photographs), and lack of near site subsurface studies (paleoseismic trench studies, boring, CPT, etc).

Local Geology Near Century City

The local geology of the area near Century City exhibits elevated and dissected Quaternary (Late to latest Pleistocene) older alluvial fan deposits north of a relatively strong north-east-east trending geomorphic lineament mapped as the surface trace of the Santa Monica Fault by Dolan and Sieh (1992) and the east extension of the Petrero fault by Wright (1991). This lineament will be referred to herin as SMFL and is located essentially along the northern side of Santa Monica Boulevard in the Cheviot Hills that appears to have been constructed along an old railroad line (see Plate B).

The Cheviot Hills are generally considered as a group of eroding low lying hills south of the SMFL that extend eastward across the West Beverly Hills Lineament (WBHL; Plates B and C). These hills expose Quaternary Older alluvium (Qpt by Hoots and Kew, 1931; Qoa) that overly late Quaternary interbedded marine and terrestrial fan deposits (unit Qm of Hoots and Kew, 1931; Dibblee, 1991).

Although the Cheviot Hills are generally shown on geologic and topographic maps south of the SMFL, the area geomorphically connects with the previously described elevated and dissected series of Quaternary fan deposits (unit Qpt) north of Santa Monica Boulevard (Plate B). In addition, the Cheviot Hills and Beverly Hills Oil fields continue north across Santa Monica Boulevard. Within the Cheviot Hills numerous stream and marine terraces (likely fill and cut types) exist suggesting that latest Quaternary erosion and deposition occurred in the area during local uplift. No Quaternary marine deposits (unit Qm) are identified on the surface north of Santa Monica Boulevard however these sediments likely exist at fairly shallow depths beneath the alluvial fan deposits as shown on cross sections by Wright (1991) and Tsutsumi et al. (2001). Thus, geomorphic features change across the SMFL suggesting that this lineament is likely associated with a Quaternary deformational structure such as a fault. This will be discussed in more detail in the Findings section of this report.

At depth, Wright (1991) indicates that the Cheviot Hills exhibits a doubling plunging, west-northwest trending anticline and that the steep south flank of the fold is broken by the Rancho Thrust Fault over a kilometer deep (Figures 1 and 2). Wright (1991) also shows this antiform north of the SMFL associated with the Sawtelle Oil Field (see Plate B, inset cross section). These folds are shown on cross sections through the area by Tsutsumi et al. (2001) as well.

Wright (1991) and Tsutsumi et al. (2001) indicate that the SMFZ in the Cheviot and Beverly Hills has had a complex geologic history since the Miocene that involved numerous strands with varying levels of activity and sense of movement (normal vs reverse) throughout the late Cenozoic. Many of these faults no longer reach the surface within the Cheviot Hills (Figure 2). Many faults in the Santa Monica Fault Zone exhibited normal (extensional) displacement during the Miocene and subsequently experienced a tectonic inversion to exhibit a reverse sense of movement since the Pliocene (Wright, 1991; Tsutsumi et al., 2001).

Figure 1: Modified structural map from Wright (1991, Figure 14) showing the mapped surface trace of the active Potrero Canyon fault and the inactive Santa Monica Fault (structural contours) as it trends eastward into the Cheviot-Beverly Hills area. A literal interpretation of the Wright (1991) cross sections I-I' to H-H' indicate that with the Cheviot-Beverly Hills area, at least one strand of the Santa Monica Fault reaches the surface but that all other strands do not.

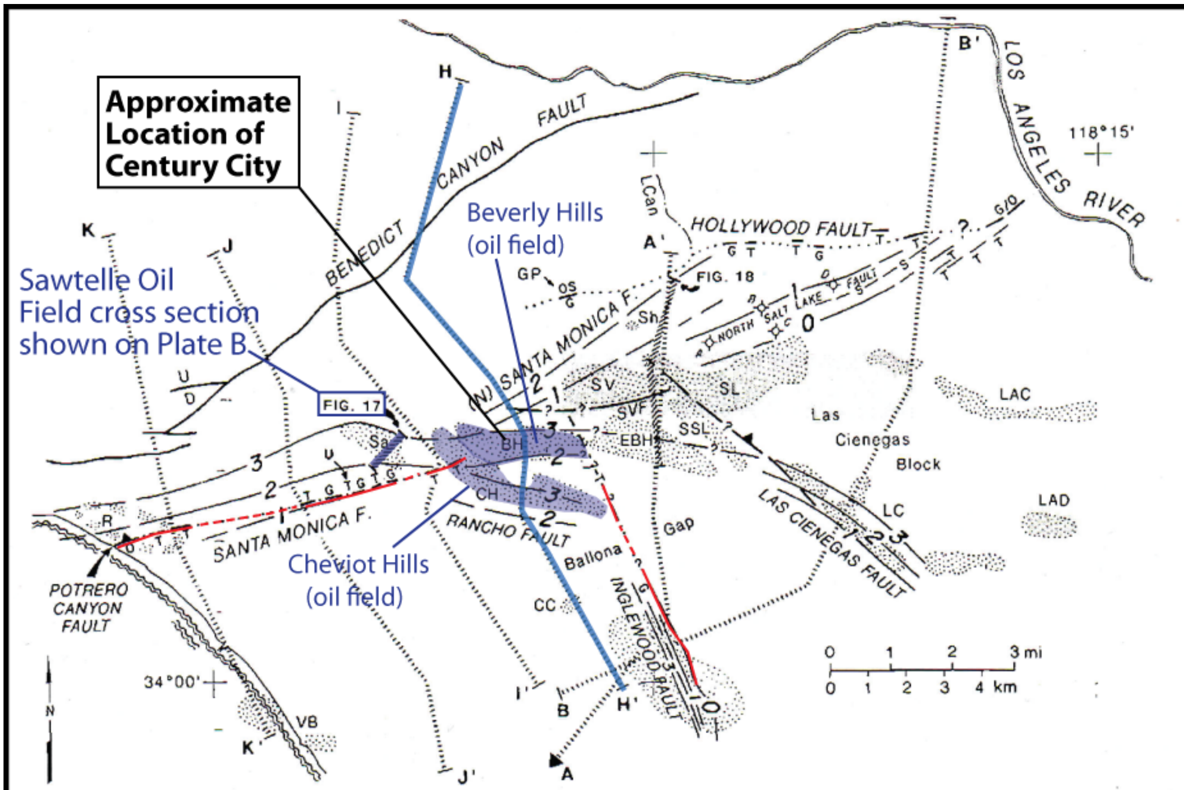
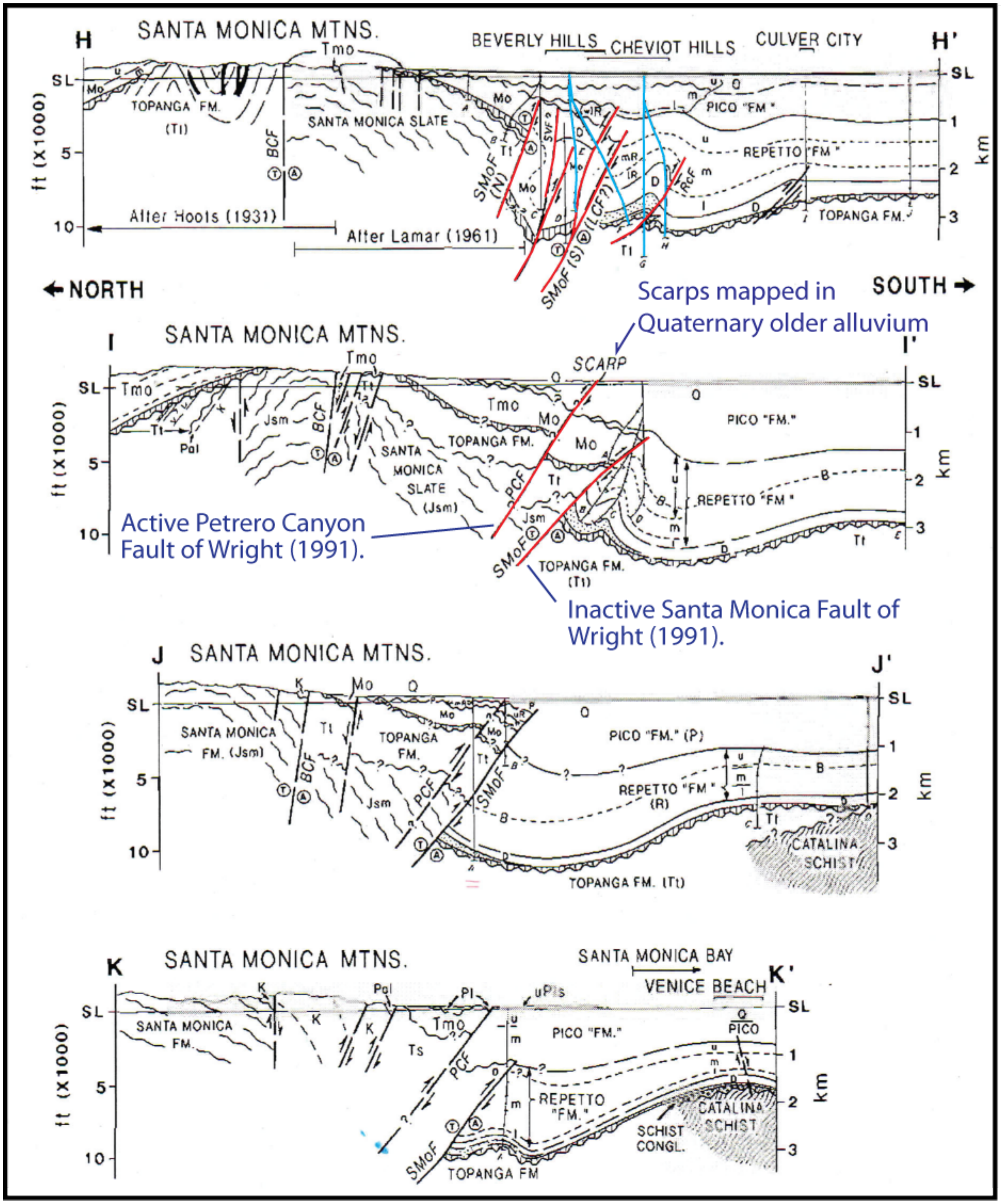


Figure 14. Map showing major faults in the northwestern Los Angeles basin. Fault-plane contours on the Inglewood, Las Cienegas, North Salt Lake, Rancho, and Santa Monica faults are based on subsurface well data. Contour interval: 1 km. Evidence of the surface traces of the Hollywood and Potrero Canyon faults and the northern extension of the Inglewood fault includes outcrop data (O), topography (T), and geotechnical data (G) from trenches and borings, plus soil contacts (S) and oil seepages (OS) (see text for sources). For other symbols, etc., see Figure 9.

Cross sections AA' and BB' are in Figure 8; cross sections HH' to KK' are in Figure 15. Also shown are locations of four core holes (listed in Appendix 2) that define the North Salt Lake fault and cross sections through the Sawtelle oil field (Figure 17), the East Beverly Hills, and San Vicente oil fields (Figure 18). Oil fields (stippled) are Beverly Hills (BH), Cheviot Hills (CH), Culver City (CC), East Beverly Hills (EBH), Inglewood (I), Las Cienegas (LC), Los Angeles City (LAC), Los Angeles Downtown (LAD), Salt Lake (SL), San Vicente (SV), Sawtelle (Sa), Sherman (Sh), South Salt Lake (SSL), Venice Beach (VB), and the undeveloped Riviera (R) discovery. GP is Greystone Park, LCan is Laurel Canyon, U is University High School.

Figure 2: Modified cross sections from Figure 15 of Wright (1991). Cross section H-H' transects the region of the Cheviot Hills near the proposed Base Station indicating that the Santa Monica Fault Zone locally consists of numerous essentially blind reverse faults that terminate within subsurface sediments with the Cheviot Hills.



Based on the literature reviewed for this report, no absolute ages of the local alluvial and marine deposits currently exist. A prominent preserved but dissected fan terrace surface exists in the study area (Cheviot Hills and north of Santa Monica Boulevard) that may loosely correlate with a 50,000 year old fan surface (terrace) identified by Dolan, et al. (2000) located approximately two miles west of Century City near the intersection of Sawtelle Boulevard and Ohio Avenue (Plate B - Veterans Administration Building site). This preserved terrace surface is designated 315T immediately north of Santa Monica Boulevard and 300T within the Cheviot Hills to the south on Plate C.

<u>General Fault Setting</u>

Southern California is a seismically active region exhibiting many active and potentially active faults (Plate A; Jennings, 1994; Bryant and Hart, 2007). The focus area of this study is in Century City located in the northern Los Angeles Basin just south of the Santa Monica Mountains (Plate A). Three active fault systems trend toward and likely terminate in the region of the site including the eastern end of the Santa Monica Fault Zone (SMFZ; Dolan et al. 2000a), northern end of the Newport Inglewood Fault Zone (NIFZ) and the western extension of the Hollywood Fault Zone (HFZ, Dolan et al., 2000b).

The SMFZ and HFZ both generally strike east west south of the Santa Monica Mountains (Plates A and B). The NIFZ trends nearly north-south and its northern end is currently mapped south of the Cheviot Hills (Plate A). Along the general strike of the NIFZ, a currently not well understood structure referred to as the West Beverly Hills Lineament (WBHL) transects the Cheviot Hills and continues north of Santa Monica Boulevard along the eastern flank of the elevated older alluvial deposits (Plate B).

Although the SMFZ and HFZ are considered active based on paleoseismic studies (Dolan et al., 1997; Dolan et al., 2000a, Dolan et al., 2000b), the State of California has not designated a Fault-Rupture Hazard Zone under the guidelines of the Alquist-Priolo act of 1972 for either fault zone to date (Bryant and Hart, 1997).

The SMFZ, HFZ and WBHL are discussed in more detail below.

Santa Monica Fault Zone

Dolan et al., (2000a) indicates that the SMFZ is part of a system of west-trending reverse, oblique-slip and left-lateral strike-slip faults that extends for >200km along the southern edge of the Transverse Ranges (Plate A). The Transverse Ranges is an east-west series of mountains produced by regional compressional tectonic forces that began between 2.5 and 5 million years ago. Dolan and Sieh (1992) referred to the SMFZ system as the Transverse Ranges Southern Boundary fault system. The SMFZ proper extends from Santa Monica along the Pacific Coast to the Cheviot Hills for a distance of approximately 12 to 14 km; however, the fault zone is believed to continue offshore to approximately Point Dume (Dolan et al., 2000a; Plate A). If the SMFZ continues off shore the approximate total length of the fault is considered approximately 40 km (Dolan et al., 2000a).

Wright (1991) and Tsutsumi (2001) provide deep well data indicating that the SMFZ has had a complex history involving numerous strands since the Miocene. During the Miocene, extensional normal faults occurred in the vicinity of the SMFZ participating in the creation of the Los Angeles Basin. Oil well and seismic reflection data suggest that the SMFZ consists of a northern and southern strand (Wright, 1991; Tsutsumi et al., 2001). The southern strand was originally a normal fault in the Miocene that since began accommodating reverse motion (Wright, 1991; Tsutsumi et al., 2001). The youngest documented sediments offset by the southern strand of the SMFZ are latest Pliocene and the fault is not documented to offset Quaternary deposits (i.e. Pico Formation; Wright, 1991; Tsutsumi et al., 2000).

The northern strand of the SMFZ is structurally above the southern strand and is considered active based on paleoseismic studies conducted at University High School and the Veterans Hospital Administration property (Crook and Proctor, 1992; Dolan et al., 2000a). Wright (1991) refers to the northern strand of the Santa Monica Fault as the Petrero Fault, and the southern fault strand as the Santa Monica Fault (SMoF). Figures 3 and 4 below provide structural contour maps by Wright (1991) demonstrating the complex history of the Santa Monica Fault (SoF, south strand) particularly in the region of the Cheviot Hills. Numerous fault strands of the SMFZ in the region of the Cheviot Hills are also shown in cross sections by Tsutsumi et al., (2001).

Figure 3 Structure Contour map of the northern Los Angeles Basin of the base of the lower Pliocene horizon (~4.5 Ma) of the Repetto Formation (Figure 9 of Wright, 1991). Faults associated with the Santa Monica Fault Zone are drawn as red with the triangle tips pointing in the down dip direction (north). This figure indicates that there was a hiatus of local deformation associated with the Santa Monica Fault Zone in the area of the Cheviot Hills in the early Pliocene. Contour interval is 2000 feet relative to below mean sea level.

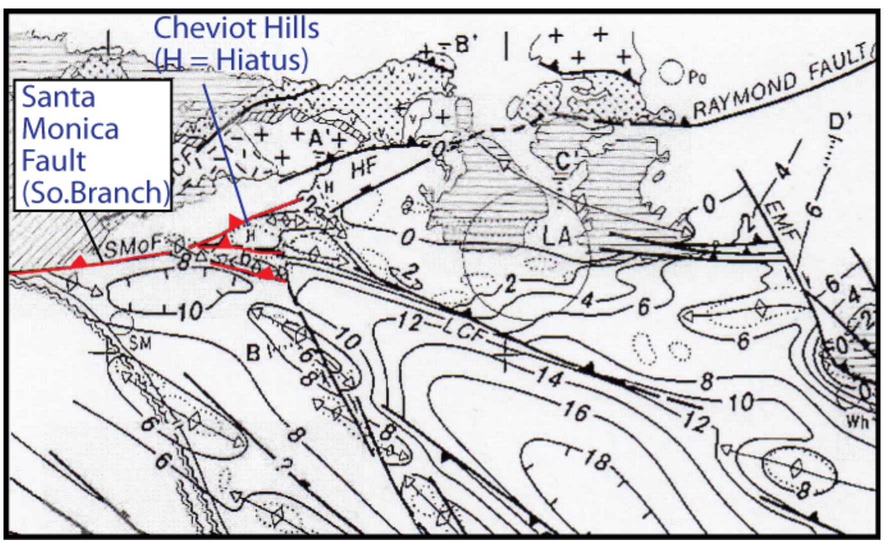
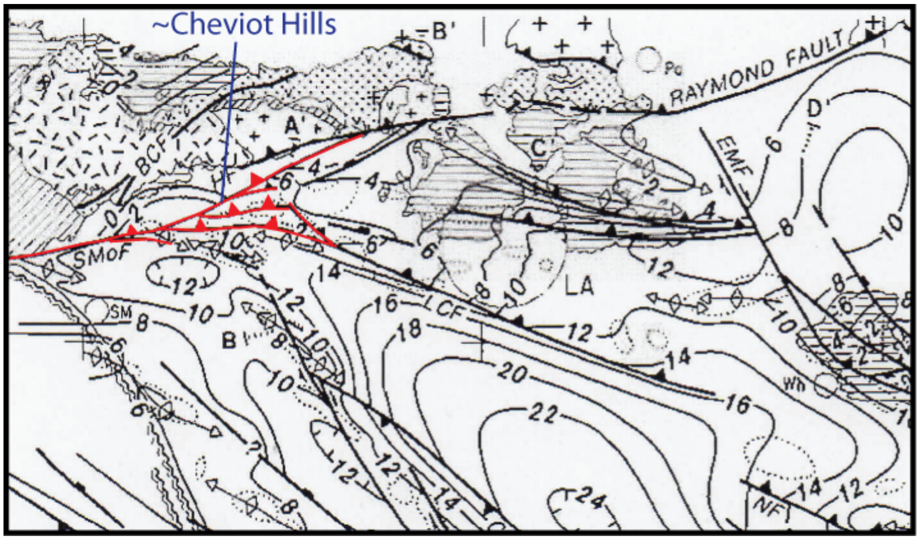


Figure 4 Structure contour map of the northern Los Angeles Basin (same area as Figure 3 above) during the late middle Miocene (~14 Ma). Contour interval is 2000 feet relative to below mean sea level.



Some of the active strands of the SMFZ are clearly associated with a series of scarps (lineaments) developed in deformed (uplifted) Quaternary Older Alluvial (Qoa) deposits (Crook and Proctor, 1992, Dolan et al., (2000a). A subsurface paleoseismic study along one of these scarps in the Veterans Administration Hospital site (Plate B) by Dolan et al. (2000a) identified that possibly 5 major earthquakes occurred on the Santa Monica Fault during the past ~50,000 years and that the fault zone probably experienced a major earthquake between 1,000 to 3,000 years ago. Catchings et al. (2008) interpreted seismic data showing that two shallow-depth low-angle fault strands which they referred to as Fault A (northern fault) and Fault B (southern fault). It should be pointed out that there is disagreement regarding the presence of the southern near surface fault south of the Veterans Administration Hospital (see Catchings, et al., 2010) and that no paleoseismic study has yet to expose a north dipping reverse/thrust fault associated with the SMFZ. Catchings et al. (2008) indicates that the northern near surface strand (their Fault A) likely projects to the surface near the base of the mapped topographic scarp very close to where it is also considered by Dolan et al., (2000a) and that the structurally lower strand (Catchings Fault B) extends toward the surface nearly 200 meters (~660-feet) south of the topographic scarp.

Numerous fault studies utilizing near surface trenching and seismic data have observed a series of relatively dense near-vertical faults in the hanging wall of the SMF (elevated portion of the local scarp) at both the University High School site (Crook and Proctor, 1992) and the Veterans Administration Hospital study site (Crook and Proctor, 1992; Dolan and Pratt, 1997; Pratt et al., 1998; Dolan et al., 2000a; Catchings et al., 2008). The fault trenching study by Dolan et al. (2000a) identified structural evidence strongly suggesting that motion on the near vertical secondary "hanging wall" faults is nearly pure strike-slip.

Dolan et al. (2000b) conducted an excellent analysis of the geomorphology of the onshore (terrestrial) section of the SMFZ which is provided below.

> *The most recently active trace of the Santa Monica fault onshore is marked by a series of south-facing scarps that extend 11.5 km from the west Beverly Hills lineament north of Century City, westward through west Los Angeles, Westwood, Santa Monica, and Pacific Palisades, where the fault trends offshore at Portrero Canyon (see Plate B). In contrast to the mountain-front location of the Hollywood fault, the Santa Monica fault scarps are 3-4 km south of the topographic mountain front. The presence of the deeply dissected old alluvial fans between the active fault and the mountain front and the conspicuous lack of active alluvial fans at the mountain front suggest relatively little, if any, recent uplift along any faults at the mountain front. In contrast, apices of young fans along the well-defined scarp imply that most recent deformation is occurring along these scarps.*
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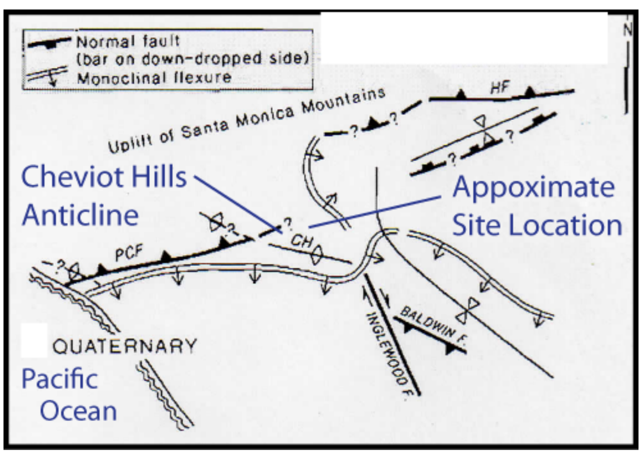
> *Some earlier maps (e.g., Crook et al., 1983) show the Santa Monica fault extending eastward across the alluvial plain south of Beverly Hills and Hollywood. East of the west Beverly Hills lineament, however, no geomorphologic evidence of recent surficial fault activity is seen in the gently sloping alluvial plain along strike of the Santa Monica fault. This suggests that the Santa Monica fault, at least in its most recent incarnation, does not extend east of the west Beverly Hills lineament as a surficial feature.*
>
> *A nearly continuous, N60E-trending scarp characterizes the easternmost 3 km of the Santa Monica fault. The scarp extends along the northern edge of Santa Monica Boulevard, which was originally built as a trolley line that followed the natural break in slope provided by the scarp; a major bend in the boulevard south of Westwood follows a bend in the scarp. The scarp height along this reach ranges from 7 to 12 m. West of the major bend south of Westwood the fault trends ~N70E for ~600 meters to the eastern edge of the 925-meter wide drainage of Sepulveda Canyon, where late Holocene erosion and deposition have obscured the scarp. The large Sepulveda fan is to the south of the fault; lines drawn on the fan surface perpendicular to contours converge on the fan's apex, which is located approximately at the fault crossing of the Sepulveda drainage. The scarp reappears on the west side of the Sepulveda fan near the southwest corner of the West Los Angeles Veteran's Administration Hospital grounds. The scarp height increases westward as onlapping distal Sepulveda fan deposits thin westward away from the fan apex.*
>
> *The central reach of the fault, between Interstate Highway 405 and the coast, exhibits three distinct, left-stepping, en echelon scarps. The eastern two scarp segments trend generally N70E, whereas the western segment changes trend westward, from N60E to N80W. Scarp heights typically range from 8 to 12 m for the two eastern scarps, although at the terminations of individual segments the scarp heights decrease to zero. The three en echelon segments overlap by as much as 750 meters. This overlap, as well as the lateral decrease in scarp height on the individual segments toward their terminations, is especially well illustrated along Bundy Drive in Santa Monica, where the two eastern segments overlap. The spacing between the two overlapping segments there, measured perpendicular to fault strike, is ~300 meters west of the western end of the easternmost en echelon segment (near the corner of Bundy Drive and Wilshire Boulevard), the scarp projects into the anomalous, N80E- to west-trending western extension. This feature, which projects ~25 m above the surrounding alluvium, probably represents an anticlinal ridge developed above a shallow blind thrust fault that may be a westward continuation of the easternmost en echelon segment.*
>
> *The westernmost en echelon scarp is broader than the other two, but its total relief (~10m) is similar to that of the scarps to the east. This results in the western scarp being more subdued topographically than the two eastern segments. The surface slope of the western scarp shallows westward, and the scarp is >300 m wide at its western end at Santa Monica Canyon. To the west of Santa Monica Canyon two distinct 3-5-m-high scarps extend across the broad marine terrace along the projected trace of the fault. These scarps project directly into the Portrero Canyon exposure of the fault. It is not clear, however, whether these features are fault scarps or terrace risers associated with Pleistocene (?) fluvial terraces inset into the stage 5e marine terrace. Thus, their presence along the trace of the fault may be simply coincidental.*

Plate B shows our evaluation of the same fault scarps and lineaments originally mapped by Crook and Proctor (1992), and Dolan and Sieh (1992). The fault scarps have been confirmed to be associated with strands of the Santa Monica Fault (Crook and Proctor, 1992; Dolan et al., 2000b). Based on the available data, the result of our analysis of the fault scarp-lineaments (Plate B) is generally consistent with earlier work; however, it was not clear that the onshore surface expression of the SMFZ exhibits a series of left-stepping fault traces.

Wright (1991) suggested that during the Quaternary, right-lateral movement on the Newport Inglewood Fault is being absorbed to the north by underthrusting and folding in the Cheviot Hills (Figure 5). This proposed mechanism could thus continue to the present time. An analysis of remnant preserved fan terraces across the western Cheviot Hills and to the north across Santa Monica Boulevard suggest that the style and magnitude of local folding and tilting changes across the mapped scarp of the SMFZ along Santa Monica Boulevard (Plate C). This topic will be discussed in more detail in the Findings section of this report.

Figure 5: Sketch map by Wright (1991, Figure 16) of the general tectonic behavior associated with the Santa Monica (Wrights Potrero Canyon Fault-PCF), Hollywood, and Inglewood fault zones and deformation associated with their intersection during the past 2 million years (Quaternary) in the region of the Cheviot Hills. The figure indicates that the Cheviot Hills anticline formed during the Quaternary and that complex deformation occurred in this region during the past 2 million years. Wright proposes that the Cheviot Hills anticline was produced by right-lateral motion on the Inglewood fault zone pushing toward the Santa Monica Fault Zone (Wrights PCF). Although this figure is generalized and not intended to be interpreted too literally, it is worth noting that Quaternary deformation in the area of the Cheviot Hills consisted of motion across the northern strand of the Santa Monica Fault Zone (Wrights PCF) that died out toward the east in the Cheviot Hills and secondary folding and uplift in the Cheviot Hills.



The late Quaternary Santa Monica Fault is believed to terminate prior to the West Beverly Hills Lineament (WBHL; discussed below) and possibly within the Cheviot Hills. Dolan and Sieh (1992) and Dolan et al. (2000a) provides geomorphic evidence that likely no active strands of the Santa Monica Fault extend east of the WBHL. Interpretation of Wright (1991) also suggests that the Santa Monica Fault (his

Potrero Fault) dies out within the Cheviot Hills and thus does not extend east of the northern projection of the Inglewood Fault (see Figure 5 for generalized Quaternary map by Wright).

Hollywood Fault Zone

The HFZ is an east-west trending reverse left-lateral, oblique slip fault extending along the base of the eastern Santa Monica Mountains. Based on geomorphic analysis (Dolan et al., 1997), the fault extends from close to the West Beverly Hills Lineament in the west to close to the Los Angeles River to the east. The HFZ is considered active based on Paleoseismic studies (Dolan et al., 1997). Although as pointed out by Dolan et al., (2000a; 2000b), the strongly dissected older alluvial fan surfaces extending from the base of the Santa Monica Mountains to close to Santa Monica Boulevard to the south do not appear to be deformed by recent (since latest Quaternary) faulting. However, a north dipping reverse fault was identified at UCLA that offset Quaternary older alluvium that essentially is on strike with the Hollywood Fault Zone mapped to the east (Crook and Proctor, 1992; see Plate B). In addition, there may be a slight warping of the Quaternary older alluvium fan surfaces along strike of the Hollywood fault immediately west of the West Beverly Hills Lineament (WBHL, Plate C). This suggests the possibility that the Hollywood Fault may extend west of the WBHL as a blind fault beneath the Quaternary older alluvial fan surfaces.

West Beverly Hills Lineament

The WBHL is a relatively strong north-northwest striking geomorphic lineament extending through a relatively linear canyon in the Cheviot Hills in the south to Santa Monica Boulevard, to along an east facing slope formed within Quaternary older alluvium north of Santa Monica Boulevard (Plates B and C). Thus, north of Santa Monica Boulevard, the lineament is defined as simply the contact and relative relief between the elevated and eroded Quaternary older alluvium (network of tributary channels eroding into preserved fan terrace surfaces) to the west, and a relatively recent fan apron to the east (Plate B). The lineament appears to mark the location of a 1.5 km left step in the eastern and western limits of the Santa Monica and Hollywood fault respectively. The Metro (2010) report provides a good summary regarding the lack of understanding regarding the type of structure the WBHL represents at depth.

> *Various tectonic interpretations have been proposed for the WBHL. For example Dolan et al (1997) speculated that it may represent an east-dipping normal fault associated with extension along the left step between the Hollywood and Santa Monica faults. Others have speculated that the WBHL may be the northernmost of a series of en echelon, left-stepping, right-lateral strike-slip faults of the Newport Inglewood fault (Wright 1991, Dolan and Sieh, 1992, Hummon et al. 1994, Tsutsumi et al. 2001), or a fold scarp along the northern extension of the back limb of the gently east-dipping Compton blind thrust fault (Dolan et al. 1997). However Lang (1994) reported that subsurface mapping within the Cheviot Hills and Beverly Hills oil fields, constrained by dense subsurface control, precludes the existence of the WBHL* [as produced by a distinct fault]. *Thus the prospect that the WBHL is the surface manifestation of an active fault has not been confirmed. Further evaluation of the WBHL and its significance to the project will be performed during forthcoming design level investigations for the project.*

Wright (1991) also shows a monoclinal (fold) flexture in the general area of the WBHL (see Figure 5) that developed during the Quaternary. It is therefore not well understood if the WBHL represents a tectonic structure (fault or folding), or simply due to erosion associated with south flowing streams across an uplifting area.

FINDINGS

Evaluation of Potential Moment Magnitudes and Displacements for the Santa Monica Fault Zone

Fault source parameters were estimated during this study and the analysis is provided in Appendix A. A summary of the findings is provided below.

Mw estimates for a fault length of 40 km

Mw = ~7.1 with average displacement D = 1.85 m (most probable).
Mw = ~6.9 with average displacement D = 1.00 m.
Mw = ~7.3 with *maximum* displacement D = 3.00 m (least probable).

Mw estimates for a fault length of 12 km

Mw = ~6.4 with average displacement of D = 0.55 m.

Note: Anderson, et al. (1996) proposes a correlation between slip rate and earthquake magnitude suggesting that the largest earthquakes will occur on the slowest slipping faults if the rupture length is held constant. Thus, slip rate is an important fault parameter regarding estimating major earthquakes magnitudes for specific faults. Essentially, their results suggest that a pure moment magnitude calculation as provided above may underestimate Mw values for faults exhibiting relatively slow slip rates as is currently understood for the Santa Monica Fault.

Geomorphic Evaluation of the Santa Monica Fault Zone – Century City Area

A geomorphic analysis was performed during this study utilizing 5-foot topographic contour maps prepared by the United States Geological Society in 1923 through 1925. The contours provided on the Hoots and Kew (1931) map (used as the base map in Plates B and C) were determined prior to mass urbanization in the region and thus provide an excellent representation of the natural landscape. Lineaments and alluvial terraces were mapped during the analysis that assisted in providing information regarding the potential location of near surface faulting and to characterize local deformation. The terrace and lineament evaluations are discussed separately below.

Alluvial and Marine Terrace Evaluation In the Century City Area

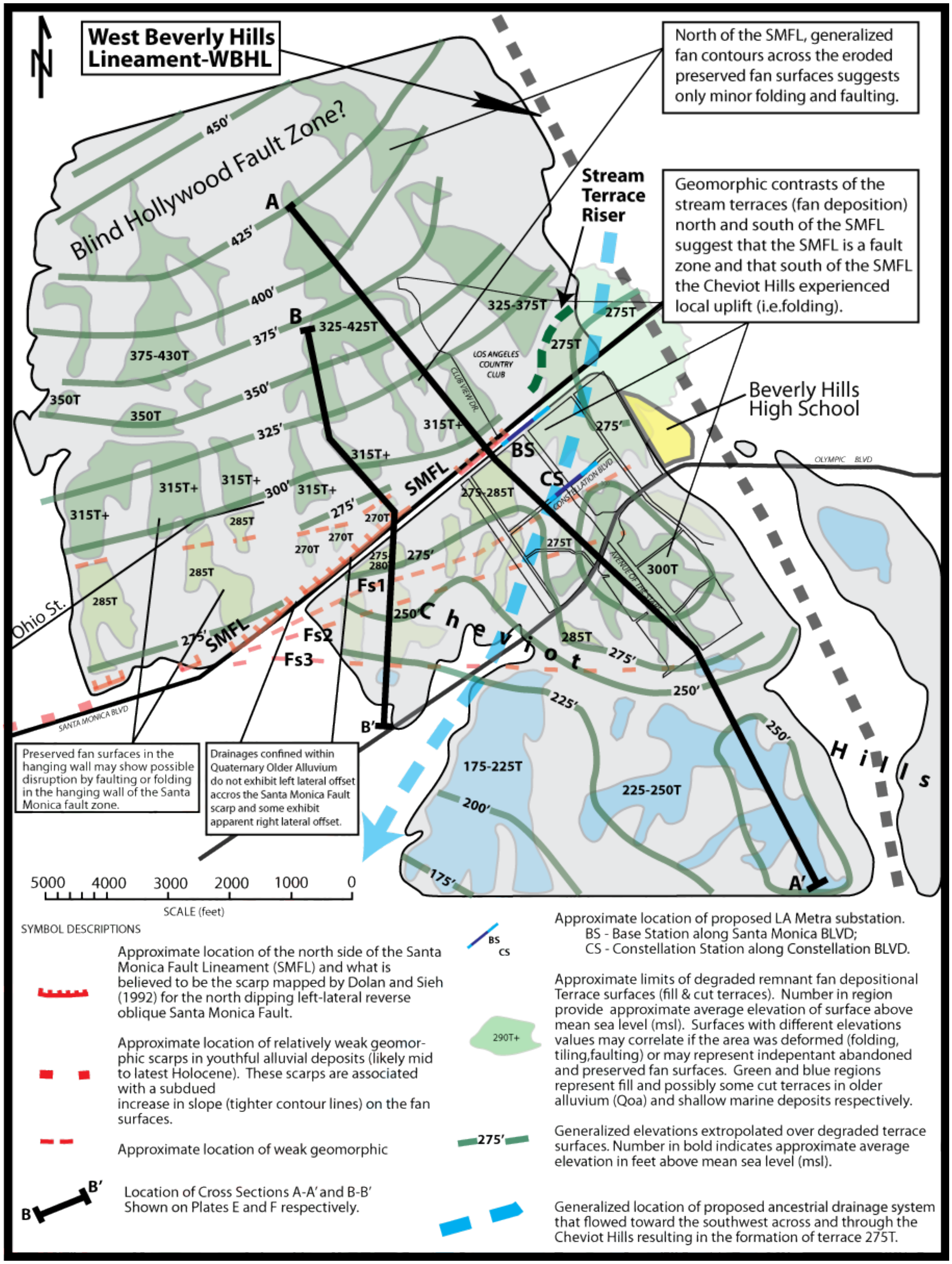
Actively depositing alluvial fans generally exhibit a network of distributary channels spreading out from the mountain front down slope and a relatively even slope (parallel and consistent contour lines on a topographic map). When an alluvial fan is no longer forming and deposition has ceased on the surface, generally the distributary drainage system is no longer supported and is replaced over time with a tributary drainage system as the fan sediments begin to erode. Elevated older alluvial fan deposits (Quaternary Older Alluvium-Qoa) can exhibit relatively deep canyons associated with a tributary system with remnants of the original fan surfaces preserved along the crests of the drainages. This is the case in the area of Century City. The preserved fan surfaces created by the cessation of deposition are referred to as fill terraces, which is generally the dominant form of terraces for alluvial fan systems.

Remnant terrace surfaces are preserved in the Century City area produced by erosion of the original fan sediments. It appears based on their relatively planar surfaces that some are clearly preserved and can be correlated across drainages and across the Santa Monica Fault Lineament (SMFL, discussed in the next section). These surfaces are green on Figure 6. However, cut terraces can also occur where the preserved surface was created by erosion, which may be the case for some of the marine terraces shown in blue on Figure 6 within the Cheviot Hills. Terraces were designated with average elevations across the surfaces. For example, the 315T terrace surface has an approximate average elevation of 315 feet above mean sea level (Figure 6 and Plate C).

Connecting common terrace elevations across the gullies from one preserved terrace surface to another provides a series of contours across both the older alluvial deposits north of the SMFL and within the Cheviot Hills south of the SMFL (Figure 6). These averaged contour lines are shown as dark green on Figure 6 and designated with it approximate elevation. Comparison of these extrapolated contours clearly show that the SMFL marks a strong change in the local geomorphology from the north within the area dominated by Quaternary older alluvium (fan fill terraces) and to the south where both older alluvium and marine terraces occur. The contours north of the SMFL indicate typical evenly spaced (constant slope) fan contours that on average trend northeast to southwest suggesting that the area has not been locally deformed with the exception of possibly vertical displacements across secondary faults north of the western end of the SMFL between terraces 315T and 285T. However, the relative elevations between these terraces could have been produced by deposition of different stream terraces or possibly local warping. In addition, there is a possible gentle warp of the dissected alluvial fan surface at elevations 425 to 450-feet above mean sea level that possibly could be associated with blind faulting associated with the western end of the Hollywood Fault Zone (see Figure 6 and Plate C).

South of the SMFL within the Cheviot Hills, the correlated terrace surfaces within both older alluvium and underlying marine sediments do not exhibit typical fan morphology but instead appear to demonstrate that local deformation and cross cutting drainages have occurred. The average strike of the extrapolated contour lines in this region is northwest to southeast and in strong contrast compared to north of the SMFL. Figure 6 shows a possible location of an ancestral drainage that entered the northern Cheviot Hills north of Beverly Hills High School at terrace 275T and flowed toward the southwest through the axis of this portion of the Cheviot Hills. In fact, terrace 275T bounded by the stream terrace riser to the north appears to geomorphicaly connect with the relatively young fan surface in the region of the WBHL to the east (Plate C and Figure 6). If a relatively young channel had cut across the northern Cheviot Hills and eroded into Quaternary older fan deposits (i.e. sediments associated with terraces 315T and 300T), it suggests that the Cheviot Hills have been locally uplifted since the late Quaternary.

Figure 6: Surface elevation contour map of terraces in the Century City area. This figure is simplified from Plate C. See text for discussion.



Although the age of the older alluvial stream terraces is unknown, similar geomorphic position suggests for example that stream terraces in the 300's (i.e. dark green on Plate C) may roughly correlate with a 50,000 year old terrace deposit evaluated at the Veterans Administration Hospital Site located a couple of miles west of Century City (Dolan et al., 2000a). However this age is speculative and a local soil profile analysis would need to be conducted to better estimate the age of the remnant terrace surfaces and deposits. Dolan and Sieh (1992) indicate that Hoots (1930) collected marine macrofossils from a marine terrace at elevation 57 to 63 meters (~173 to 206 feet above mean sea level) that indicates that the sediments were deposited in the mid to late Pleistocene. This terrace may correlate at least in terms of average elevation with a relatively prominent blue terrace surface shown on Plate C along the western flank of the Cheviot Hills.

Lineament Evaluation for the Santa Monica Fault Zone

Geomorphic lineaments represent roughly linear features observable for example on aerial photos and topographic maps. The features often correlate with erosion structures associated with bedrock foliation, bedding, and folding, or groundwater barriers and fault zones. Three types of lineaments are generally identified which include tonal (color contrast), vegetation and topographic. Tonal and vegetation lineaments are commonly identified on aerial photographs. Topographic lineaments, which are referred herein as geomorphic lineaments, can be identified on both aerial photographs and topographic maps. Lineaments are typically evaluated with a simple relative scale of strong to weak.

During this study no aerial photographs were evaluated and thus no tonal or vegetation lineaments were identified. Geomorphic lineaments were identified on the Hoots and Kew (1931) geologic-topographic map areas dominated by alluvial sediments (Plates B and C). The identified scarps shown on Plate B associated with the Santa Monica Fault are geomorphic (topographic) lineaments associated with changes in slope across alluvial fan surfaces. Changes in slope are identified by a tightening of a number of topographic contours relative to the original even spaced contours associated with the original fan surfaces. Weak lineaments associated with moderately subtle and broad increases in fan surface slopes across older alluvium (Qoa) suggest that surface deformation associated with the SMFZ is warping (folding) the surface. This is the case in the region east of Santa Monica Canyon to just south of Brentwood Knoll, which was mapped as a scarp associated with the Santa Monica Fault Zone by Dolan and Sieh (1992) and consistent with mapping in this report (Plate B).

Relatively strong lineaments generally trending between N60E to N70E associated changes in slope between Holocene alluvium at the base and elevated Quaternary older alluvium were identified in the region of University High School and the Veterans Administration Hospital property (Plate B). Both seismic and subsurface paleoseismic investigations conducted within these properties determined that the lineaments were produced by motion across the north dipping reverse Santa Monica Fault Zone (Crook and Proctor, 1992; Dolan and Pratt, 1997; Pratt et al., 1998; Dolan et al., 2000; Catchings et al., 2008). In addition, relatively deep well data evaluated by Wright (1991) appears to confirm that the lineaments are associated with the SMFZ, which he referred to as the Potrero Canyon Fault (PCF). It is at Potrero Canyon along the Pacific coast (Plate B) that Hoots and Kew (1931) mapped the only known natural exposure of the SMFZ. Note that the Potrero Fault of Wright (1991) likely connects with his Santa Monica Fault at depth.

Toward the east and entering into the Cheviot Hills, a relatively strong and straight geomorphic lineament trending approximately N50E exists along the current location of Santa Monica Boulevard (Plates B and C). This lineament is referred to herein as the Santa Monica Fault Lineament (SMFL, Plates B and C). A railroad line also runs parallel to the location of Santa Monica Boulevard in the early 1920's and thus it is difficult to know based on evaluation of the contours on Plate B what the natural lineament may have looked like. It is likely that the original railroad and Santa Monica Boulevard took advantage of the geomorphic erosional swale (depression area) of the lineament itself to transect through the Cheviot Hills.

Within the Cheviot Hills, Dolan and Sieh (1992) mapped the SMFL lineament as trending N60E for approximately 3 km west of the WBHL and as a continuation of the identified SMFZ scarps at the Veterans Administration Hospital site. The Dolan and Sieh (1992) geomorphic study indicates that the SMFL scarps range in height of 7 to 12 meters high. However, cross sections A-A' and B-B' shown on Plates E and F respectively demonstrate an alignment of preserved fan surfaces across the SMFL along Santa Monica Boulevard that surprisingly do not clearly indicate that correlated terraces to the north have moved upwards respective to the south. In fact, section B-B' appears to indicate that a likely correlative fan surface 315T north of the SMFL projects to a lower elevation than terrace 275-280T south of the SMFL. In addition, section A-A' (Plate E) shows that the 315T terrace north of the SMFL appears to not exhibit vertical displacement across the SMFL to a likely correlated terrace at average elevation 300T and there is a lack of surface outcrops of underlying unit Qm north of the SMFL. Regarding this last point, if the SMFL was produced by repeated vertical displacements across a north dipping reverse fault, it seems reasonable that underlying unit Qm would be exposed north of the SMFL similar to Qm exposures south of the SMFL (Plates B and C). Based on these data it appears likely that the SMFL is not a scarp associated with a north dipping reverse fault but instead may be associated with a steeply dipping dominantly strike slip fault or simply an structure controlled feature created primarily by erosion.

Additional evidence suggesting that the SMFL along the northern Cheviot Hills may have been produced by strike-slip faulting is the very straight alignment of the lineament transecting the hills, and a couple of south flowing drainages that turn abruptly and essentially captured when they encounter the SMFL. Thus, it may be possible that the SMFL resulted from a high angle strike-slip fault in the hanging wall of the Santa Monica Fault Zone similar to structures observed in trenching and seismic studies at the Veterans Administration Hospital site although at a larger scale. However, a model is also provided that suggests that the swale defining the SMFL was simply produced by erosion along a fold axis associated with a blind reverse fault.

Based on the provided geomorphic evidence, it appears likely that the SMFL was produced by either near surface strike-slip faulting in the hanging wall of the SMFZ, or by differential erosion along a fold axis that may overlie a blind reverse fault.

Evaluation of Potential Fault Deformation in the Century City area

Based on evaluation of the provided data in this report it appears clear that an understanding of the location, magnitude and style of deformation associated with the Santa Monica Fault Zone (SMFZ) in the region of the Base and Constellation Stations (Plate C) is poorly known. No local subsurface geologic data was available at the time of the preparation of this report. It does seem likely that the Santa Monica Fault Lineament (SMFL) mapped along Santa Monica Boulevard is associated with some form of faulting. Below three Fault Models (No.1, No.2, and No.3) are examined providing supportive and non-supportive evidence for each.

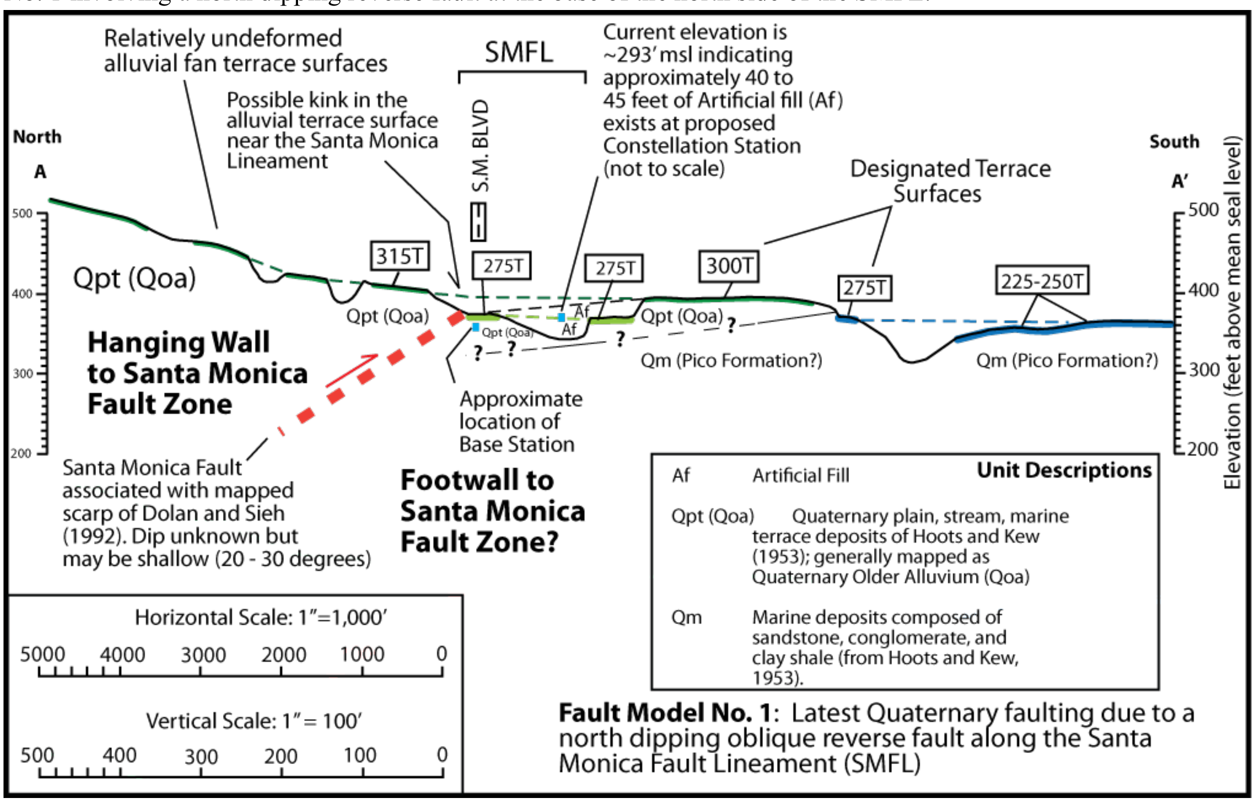
Fault Model 1 – SMFL Produced by a North Dipping Reverse Fault

In this model, the SMFL was produced by a north dipping dominantly reverse fault exhibiting vertical motion of the hanging wall (sediments above the fault) that projects to the surface somewhere south of the base of the northern "scarp" along the north side of Santa Monica Boulevard. Although based on the geomorphic analyses provided in this report, Fault Model No. 1 seems unlikely, it is provided here for discussion purposes and because in a simple interpretation, could be the interpreted mechanism and location of faulting based on published fault behavior characteristics in the area (i.e. Dolan and Sieh, 1992 could be over interpreted at the scale of this project site). The location of the north dipping Santa Monica Fault is shown on Plates B and C as red lines and north pointing tick marks. The current inflection point of the base of the scarp is mapped a few feet north on Club View Drive from Santa Monica Boulevard as shown on a composite photograph on Plate H. In addition, this where it is believed Dolan and Sieh (1992) placed the base of the fault scarp.

Reverse faults are generally projected to the surface near the base of scarps as is shown on Figure 7. However, subsurface fault investigations along a scarp associated with the Santa Monica Fault Zone conducted approximately 2 miles west of the proposed stations just west of Highway 405 indicate that the surface projection of the northern most strand of the north dipping Santa Monica Fault resides south of the base of the scarp (Dolan et al., 2000; Catchings et al., 2010; Catchings et al., 2008). In addition, the Catchings 2008 study indicated that the fault likely responsible for producing the scarp may be 7 meters deep (23 feet) just south of the base of the scarp. Assuming a 25 degree dip of the fault at 7 meters depth at the base of the scarp equates to a surface projection of the fault approximately 15 meters (50 feet) south of the base of the scarp. It should be pointed out that the scarp at the fault trenching sites is characterized by younger alluvium at the toe of the slope and that the scarp along Santa Monica Boulevard likely exposes older alluvium along both the scarp slope and base. This distinction may be significant in terms of predicting the surface project of the fault. A scarp characterized with younger alluvium at the base indicates that the young surface has deposited over the true base of the scarp and migrated up slope thus moving the base inflection point of the slope to the north. In contrast, the fault has a higher likelihood of projecting to near the base of the scarp slope if older alluvium exists along both the scarp slope and outboard of the scarp because in this scenario the inflection point of the base of the scarp has remained essentially in the same location due to a lack of deposition. However, both of these scenarios become complicated and thus possibly incorrect if the reverse fault is blind (fault rupture during a major event does not reach the surface) in which case the surface project of the fault would certainly be south of the base of the scarp.

Inherent in Fault Model No.1 for a single relatively well defined north dipping reverse fault is a well defined hanging wall and footwall above and below the fault respectively (Figure 7). Plate G provides a preliminary fault map relative to the proposed Base Station that shows the surface projection of the fault at the change in slope at the south end of Club View Drive (also see photographs on Plate H). If this is the correct surface projection of the Santa Monica Fault Zone and there are not other southward faults, then the Base and Constellation Stations would technically be in the footwall of the Santa Monica Fault and thus may not experience a large magnitude of displacement or deformation during a major earthquake event. In general for reverse faults, hanging wall rocks experience more more secondary deformation (folding, faulting, tilting) than footwall rocks (Philip and Meghraoui, 1983). However, fault trenching and seismic studies at the Veterans Administration Hospital site have demonstrated that the primary near surface strands of the Santa Monica Fault generally lie many feet south of the identified scarps at least where younger alluvium is exposed at the base of the scarp as discussed earlier. In addition, this report presented geomorphic data suggesting that the region of the Base and Constellation Stations within the Cheviot Hills have been uplifted since the late Pleistocene. Thus, without some site specific subsurface data, it is essentially impossible to know the true surface project, style and width of deformation of the Santa Monica Fault Zone based on the current geomorphic data.

Figure 7: Modified Cross Section A-A' from Plate E highlighting potential fault characteristics for Fault Model No. 1 involving a north dipping reverse fault at the base of the north side of the SMFL.



Fault Model No.2 – SMFL Produced by a Steeply Dipping Strike-Slip Fault

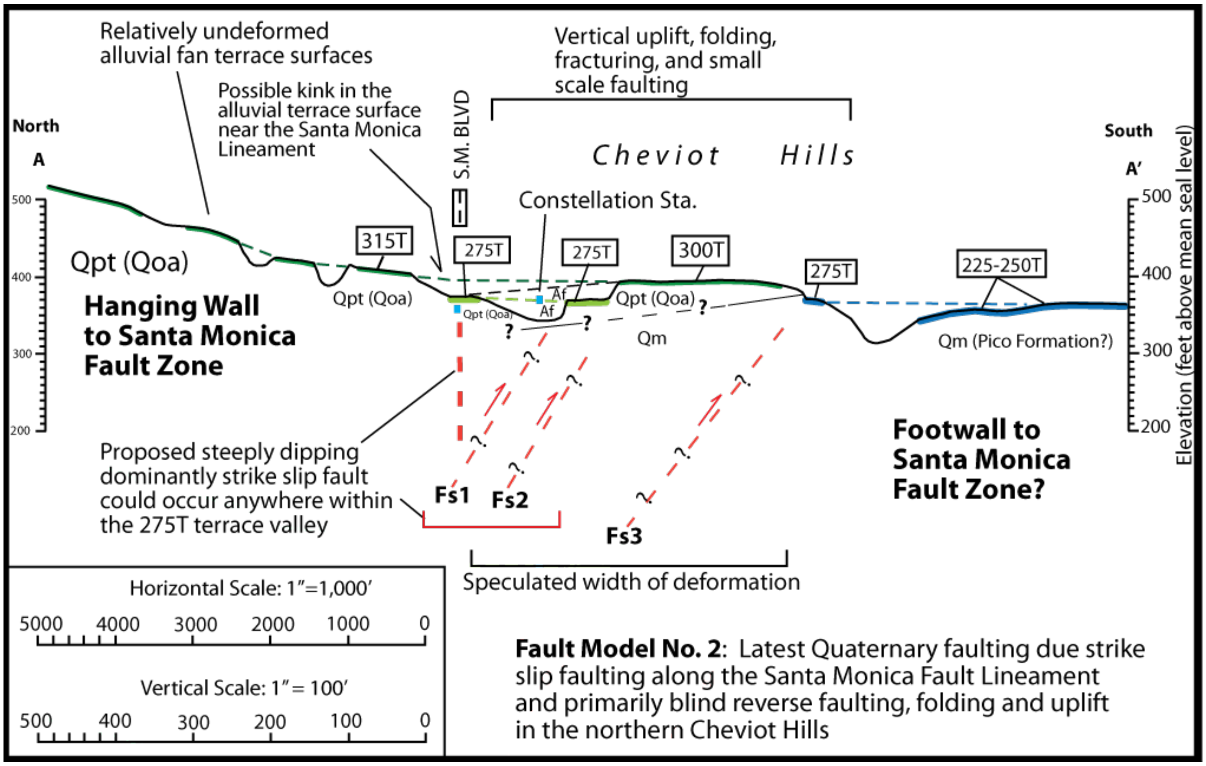
If the SMFL was produced by a secondary high angle fault similar to structures seen in fault studies in the University High School and Veterans Administration Hospital sites (Crook and Proctor, 1992; Dolan et al., 2000a), then it suggests that the region of the proposed Base and Constellation Stations are located within the fault deformation zone (Figure 8). In other words, there potentially exists in this model a relatively wide deformation zone (folding, fracturing, small scale faults, tilting, etc) separating the hanging wall and footwall regions.

The interpretation that the SMFL was produced by a dominantly strike-slip steeply dipping fault indicates that the north dipping reverse faults associated with the SMFZ likely occur south of the SMFL. Geomorphic evidence provided in this report indicates that the Cheviot Hills have experience fault deformation primarily in the form of vertical uplift and folding and a paucity of fault surface rupture. Based on these findings, it appears reasonable that north dipping reverse faults associated with the SMFZ extend under the Cheviot Hills as blind faults essentially on a similar strike of the fault zone in the west. This type of faulting is generalized on Figure 8 as various fault strands Fs1, Fs2 and Fs3. However, proposed blind subsurface faults Fs1, Fs2 and Fs3 are not complete conjecture. Fs1 and Fs3 represent weak geomorphic lineaments through the Cheviot Hills associated with weak saddles and slope breaks across designated terraces. Fs2 is simply projected along a similar strike of the SMFZ west of the bend in Santa Monica Boulevard.

Topographic contour analysis of terrace surfaces in the Cheviot Hills indicates that the relative magnitude of uplift may have been greater immediately west of the West Beverly Hills Lineament (WBHL) and decreases toward the west. In addition, the contours suggest that the Cheviot Hills may represent an antiformal type structure that strikes parallel to the WBHL. This indicates that uplift and deformation in the Cheviot Hills may be due to the complex interaction between the SMFZ, WBHL and possibly the Newport Inglewood Fault Zone to the south. This model is very similar to that described by Wright (1991) for the Quaternary behavior of the eastern SMFZ (see Figure 5).

The data and analysis presented here brings into question whether or not the mapped SMFL was even produced by a north-dipping reverse fault as discussed earlier. If it was, then the strike-slip fault producing the SMFL along Santa Monica Boulevard could occur anywhere within the erosional swale (see Figure 8). This point is also made on Cross Sections A-A' and B-B' on Plates E and F respectively.

Figure 8: Modified Cross Section A-A' from Plate E highlighting potential fault characteristics for Fault Model No. 2 involving a steeply dipping dominantly strike-slip fault as the causative agent to produce the SMFL.



Fault Model No.3 – SMFL Produced by erosion along a fault induced fold axis

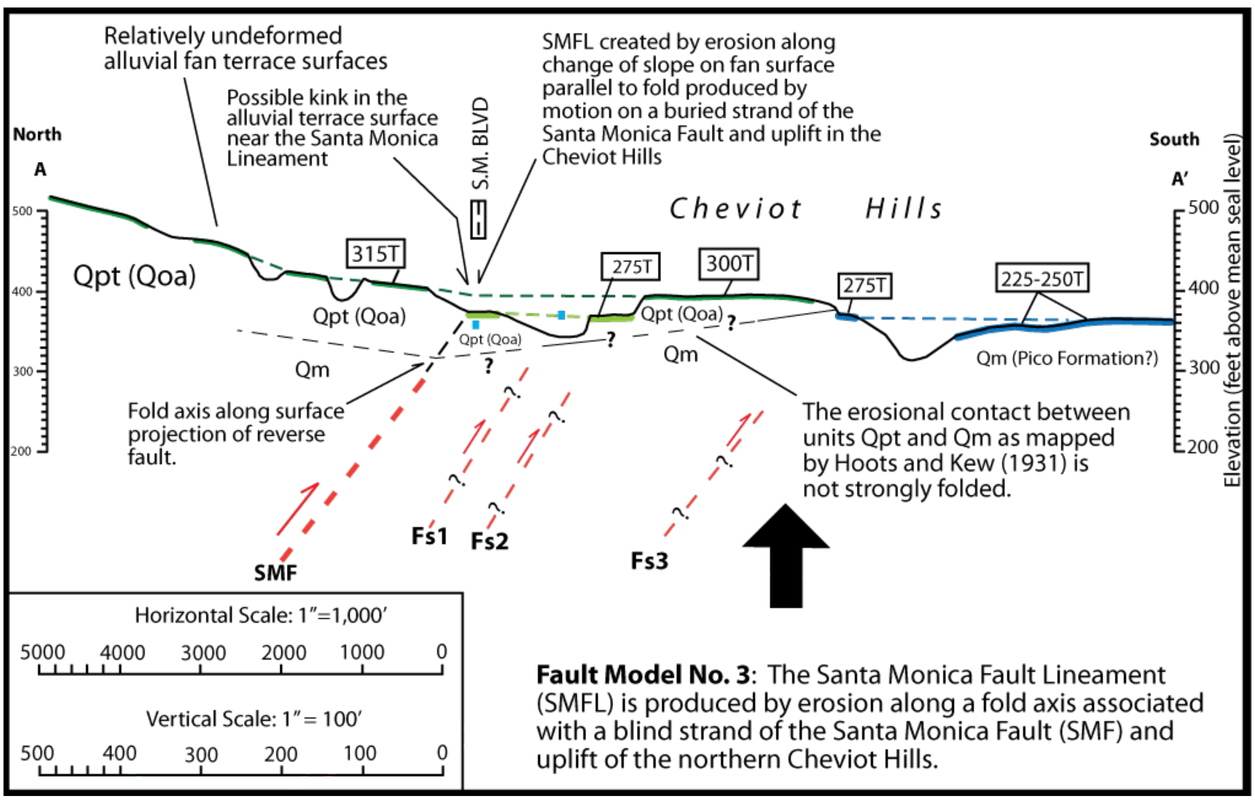
In this model a fault strands associated with the Santa Monica Fault Zone exhibiting a reverse component are blind causing uplift north of the SMFL and within the Cheviot Hills resulting in a kink fold axis parallel to the SMFL (Figure 9). Repeated events across the buried strand projecting to the SMFL would presumably move sediments upwards north of the SMFL relative to the south and produce a change in slope along the SMFL which may cause increased erosion along the SMFL to eventually develop into a relatively strong lineament (Figure 9). In addition, uplift across the northern Cheviot Hills produced by possible blind reverse faults and/or some mechanism associated with the WBHL would also contribute to a change in slope, possible plateau geomorphology and erosional characteristics south of the SMFL.

This model is supported by the relatively strong change of slope (the kink) of the older alluvial fan surfaces (terraces) observed across the SMFL. The surface expression of the kink may have been sufficient to capture drainage flow and thus allow for increased erosion along the SMFL as the general area was uplifted and the fan system as a whole was eroding. In addition, terrace 275T is postulated herein as produced by a southward flowing ancient channel system that entered the Cheviot Hills at the same location of the east end of the SMFL and had the ability to transect the Cheviot Hills during uplift (Figure 6).

This model is also supported by the contradictory observation of apparent right-laterally offset drainages across the SMFL. Most published literature support that the lateral component of motion across the Santa Monica Fault Zone is left-lateral and thus would produced left-laterally deflected drainages. However, if erosion is the dominant process producing the swale along the SMFL then tributary drainages on the eroding older fan surfaces that are captured along the SMFL could exhibit either an apparent left- or right-lateral deflection.

Active reverse fault strands of the SMFZ may become blind near the western limit of the SMFL near the northeastward turn in Santa Monica Boulevard along the western Cheviot Hills (Plates B and C). In the area of the turn in the SMFZ from ~N70E west of the SMFL to ~N50E along the SMFL relatively strong apparent geomorphic scarps exist that are very similar to the scarps investigated in the Veterans Administration Hospital site located ~2miles west of Century City shown to be produced by near surface reverse faults.

Figure 9: Modified Cross Section A-A’ from Plate E highlighting potential fault characteristics for Fault Model No. 3 suggesting that the SMFL was produced by erosional processes along a fold kink of the older alluvial fan sediments above a blind strand of the Santa Monica Fault.



CONCLUSIONS

No geomorphic scarp displaying evidence of significant vertical displacements was observed in the Century City area of the proposed Base and Constellation Stations. Only one strong geomorphic lineament was identified referred herein as the Santa Monica Fault Lineament (SMFL) and it clearly does not exhibit significant vertical displacements of terrace surfaces across the structure. This is shown on Cross Sections A-A' and B-B' on Plates E and F respectively. A couple of very weak geomorphic lineaments are observed in the Cheviot Hills south of the SMFL that may be associated with faulting but more likely resulted from erosion within the hills. There are sufficient preserved terrace surfaces in the Cheviot Hills providing structural marker horizons to indicate that the likelihood of a well defined north dipping reverse fault reaching the surface in this area is low. Therefore Fault Model No.1 is considered unlikely due to the lack of apparent vertical separation of correlation of preserved terrace surfaces across the SMFL.

Fault Model No. 2 suggesting that the SMFL was produced by a hanging wall secondary strike-slip fault is supported by its linearity, lack of vertical apparent motion across the structure, and presumably uplift south of the structure associated with blind reverse strands of the SMFZ in the Cheviot Hills. However this model is not supported by the presence of apparent right-laterally deflected drainages across the SMFL.

Fault Model No. 3 provides a scenario where the SMFL was produced by a northern blind strand of the SMFZ causing a fold axis in the older alluvial sediments and surfaces (terraces) allowing for a deflection of drainages along the SMFL thus increasing and concentrating erosion along its length. This deformation model also involves a second local source of uplift west of the WBHL. Wright (1991) and other publications suggest that the relative highlands west of the WBHL have been uplifted relative to areas east of the WBHL (see Figure 5). In other words, the Cheviot Hills extend well south of any of the project reverse fault strands (blind or not) associated with the SMFZ and areas north of the SBFL are also vertically above areas to the east of the WBHL. Although the structure of the WBHL is speculative, it does appear that late Quaternary relative vertical separation has occurred across the WBHL and that this uplift would have likely involved the Cheviot Hills and the older alluvial fan surfaces north of the SMFL in a zone roughly parallel to the WBHL. Therefore it seems likely based on evaluation of all the data, that two forms of deformation have occurred in the Century City area during the late Quaternary. Relatively broad north to south uplift occurring west of the WBHL and additional deformation where blind strands of the SMFZ enter into the Cheviot Hills likely causing the development of the SMFL. The uplift associated with the WBHL may have caused the bend from ~N70E of the general strike of the SMFZ to ~N50E of the SMFL in the Cheviot Hills (Plate B).

Fault Model No.3 is supported by the observation of apparent right-laterally offset drainages along the SMFL that could be produced by just erosion, the capturing of an ancient channel system that emanated from the relatively young fan surfaces overlying the WBHL that cut through the Cheviot Hills, and the lack of vertical separation across the SMFL. The ancient channel system is associated with the 275T terrace surface and essentially represents an antecedent stream through the Cheviot Hills. In other words, the stream system that formed terrace 275T was able to cut through the Cheviot Hills as the hills were uplifting during the late Quaternary. Based on the evaluation of all the data, Fault Model No.3 is considered the most probable deformation model for the Century City area.

Whether or not the SMFL was produced by a north-dipping reverse fault (Fault Model No.1), a steeply dipping strike-slip fault (Fault Model No.2), or a kink fold axis (Fault Model No.3), it appears based on evaluation of the data that the active surface expression of the Santa Monica Fault Zone is weakening and possibly terminating within the Cheviot Hills near the WBHL. The Evidence for this is the lack of a vertical displacement across the SMFL scarp, local uplift of the Cheviot Hills, lack of any geomorphic evidence of the SMFZ east of the WBHL (Dolan et al., 2000a), and a general decrease in the width of hanging wall deformation toward the east along the length of the SMFZ (see Plate B). With this in mind, the total displacement during a major earthquake near the proposed Base Station would likely be much less than the average displacement observed along the entire fault length. It was determined via a source parameter evaluation of the SMFZ (Appendix A) that reasonable source parameters for the SMFZ would include a moment magnitude Mw=7.1, with an average vertical displacement of ~2 meters (see next section for summary of source parameter evaluation). Thus, in the area of the proposed LA Metro Century City stations at the presumed eastern end of the SMFZ, the total displacement during a major earthquake would be much less than 2 meters. For discussion, we could reasonably indicate that the total vertical displacement may be on the order of 1 meter or less.

Based on the geomorphic data provided in this report, no scarp was identified in the study area that would have accommodated approximately 1 meter of offset across a discrete reverse or left –lateral fault over the course of thousands of years and presumably numerous major earthquakes. Therefore, it is the conclusion of this report that a north dipping reverse fault or a dominantly left-lateral fault accommodating close to 1 meter of displacement per event does not exist in the study area. If reverse faulting does enter into this region it therefore likely does not reach the surface and is primarily manifested by warping and uplift of the Cheviot Hills. The 1 meter or less of proposed total vertical displacement entering the Cheviot Hills could be partitioned to a series of bifurcated blind faults at depth causing local uplift and relatively small scale offsets across numerous strands. The reality of this discussion is simply that the nature of faulting and deformation in the area is not well understood and in particular, the nature and location of the fault possibly responsible for producing the SMFL however based on the geomorphic data, it is difficult to place more than just a few centimeters of slip per event across any fault that may have produced the SMFL. As discussed earlier, Fault Model No.3 provides an erosion model for producing the SMFL along a fold axis above a blind reverse fault strand of the SMFZ. Therefore, it is possible that the SMFL was not produce by a surface rupturing fault at all.

The location of the proposed Base Station is within the swale defining the SMFL, which the interpretation of geomorphic data provided in this report suggests was produced by either a strike-slip fault exhibiting by definition dominantly lateral (horizontal) displacements (Fault Model No.2) or by erosion along a blind fault fold axis (Fault Model No.3). If Fault Model No.2 is true, then the presumably steeply dipping strike-slip fault zone could reach the surface anywhere within the SMFL geomorphic swale or even across most of the width of the swale. Also, because the SMFZ is considered to be a reverse left lateral oblique fault zone, the proposed strike-slip fault producing the SMFL would be by default a secondary fault within the hanging wall of the SMFZ in which case would likely accommodate a very small percentage of total displacement during a major earthquake (much less than ~1 meter). However, the lack of left laterally deflected drainages across the SMFL suggests that repeated left-lateral displacements have not occurred over the course of many earthquakes which indicates that the SMFL was either not created by a strike-slip fault, or that the lateral displacement per event may be very small.

In the case of the proposed Constellation station, no moderately strong or strong geomorphic lineaments were identified in the area of the station. A very weak geomorphic lineament associated with a series of weak changes in slope across designated terraces transects the proposed station location (Fs1). However, there is evidence suggesting the general area of the Cheviot Hills has been vertically uplifted and possibly tilted during the late Quaternary and is continuing till the late Holocene. In addition, it is reasonable to assume based on the provided data and analysis of this report, that the area of the proposed Constellation and Base Station are underlain by at least one if not more blind reverse faults associated with the eastern end of the SMFZ. In addition and discussed earlier, mechanisms for local deformation may be more complicated with the possibility that it involves kinematics between the poorly understood WBHL, SMFZ and Inglewood Fault Zone.

Therefore at a minimum, engineering should consider that the proposed Base and Constellation stations could experience minor fracturing, and tilting and relatively small scale offsets across secondary faults during a major earthquake on the Santa Monica Fault Zone and even possibly during an event on the Newport Inglewood fault due to the postulated kinematic involvement of the various faults in the region.

Although numerous fault deformation models are presented in this report primarily based on geomorphology and that a subsurface investigation is recommended to understand the location and style of local faulting, it is my opinion based on the provided data that no significant fault reaches the surface in the Century City area that would exhibit ~ 1 meter of offset in a narrow zone per event, and that it is possible that no surface rupturing faults exist near the proposed Base and Constellation Stations.

On a side note, based on my cross section analysis, it appears that the proposed Constellation station may reside in man made artificial fill placed within a local drainage (see Section A-A' on Plate E).

Thank you for the opportunity to provide this geomorphic fault evaluation report to you and if you have any questions please do not hesitate to contact me.

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APPENDIX A

Evaluation of fault source parameters for the Santa Monica Fault Zone

Seismic Moment (Mo) was calculated utilizing the equation:

Mo = uAD Kanamori and Anderson (1975)

u = rigidity constant- Shear Modulus (3.0×10^{11} dyne/cm^2 from DePolo and Slemmens 1990. Note that values of u range from $.0 \times 10^{11}$ dyne/cm^2 to 3.5×10^{11} dyne/cm^2 for southern California. The 3.0 value was utilized as this is the same value used by Wells and Coppersmith (1994).

A = area of seismogenic fault plane in units of cm.

The area was calculated by assuming that the seismogenic portion of the fault was on a 30 degree dipping plane from a depth of 2 to 14 km.

D = Average Displacement on the fault in cm.

Moment magnitude (Mw) was calculated utilizing the equation:

Mw = 2/3Log(Mo) – 10.7 Hanks and Kanamori (1979).

Santa Monica Fault Parameters

Fault Length:

Based on evaluation of published reports and fault maps, and geomorphic evaluation of the Santa Monica Fault (terrestrial), a reasonable surface expression of the Santa Monica Fault includes the terrestrial Santa Monica fault (~12 km) and offshore faults running parallel to the Malibu Coast fault in the Pacific Ocean (24 km). This equals a total mapped length (Jennings, 1994) of 36 km. However, fault rupture is known to extend at depth without surface rupture, which indicates that the published fault length for the Santa Monica Fault of 40km is reasonable (Dolan et al., 2000a). The 40 km depth was utilized in the provided calculations.

The ~12 km terrestrial length of the Santa Monica fault (SMF) extends from the Pacific Ocean coastline eastward to the West Beverly Hills Lineament within the Cheviot Hills which provides a reasonable boundary between the SMF and the Hollywood fault (HF) to the east. It is not fully understood whether or not the SMF extends further east of the Cheviot Hills since the latest Quaternary. Wright (1991) indicates that older strands of the SMF clearly extended to the east and southeast from the Cheviot Hills. Geomporphic analysis of the SMF suggest that at least since the late Quaternary the eastward termination of the fault zone may be near the West Beverly Hills Lineament. Also, based on published data, the SMF may have a larger vertical component than the Hollywood fault suggesting slightly varying stress regimes for the two fault zones weakly supporting a non-coseismic event involving the SMF and HF zones.

Fault Rupture Area:

The fault rupture area (length times down-dip width) was calculated based on a fault plane dipping 30 degrees. The Santa Monica fault has a complex history extending back to normal displacement during the Miocene that subsequently was reactivated (Wright, 1991). Boring data evaluation by Wright (1991) and near surface seismic profiling (Catchings, et al., 2008; Dolan and Pratt, 1997; Pratt et al., 1998 indicate that the fault dips to the north, and that the near surface dip may be as low as 20 degrees. However, the true dip extending to the brittle ductile shear zone (~14km) is not fully known. Fault motion since the latest Quaternary is considered to be oblique left lateral reverse. For the calculation of fault area, a dip of 30 degrees was utilized on a plane extending from a depth of 2 to 14 km.

Average Displacement:

Kanamori and Anderson (1975) indicate that the average displacement value should be utilize in the seismic moment calculations. During fault rupture, displacement is obviously zero at the ends of the rupturing fault somewhere below the surface, and has a max somewhere along the length of the rupturing fault (thus not to be assumed near the center region). In theory, the average displacement value is simply the average displacement occurring across the entire rupturing fault plane. The average displacement values were determined utilizing Wells and Coppersmith (1994). Unfortunately, Wells and Coppersmith (1994) provides source parameters for reverse, lateral (strike-slip) and normal faults and thus does not provide data involving oblique faults although oblique earthquake event data was utilized in their regressions. However, regression curves for all of these fault types on Figure 13 comparing surface rupture length and average displacement all intersect near the surface rupture length of 40 km. This provides an average displacement value of D = ~1.85 meters.

Note: Wells and Coppersmith were also utilized to compare the relationships of numerous fault parameters during this analysis.

Estimated reasonable Mw values for the Santa Monica Fault Zone

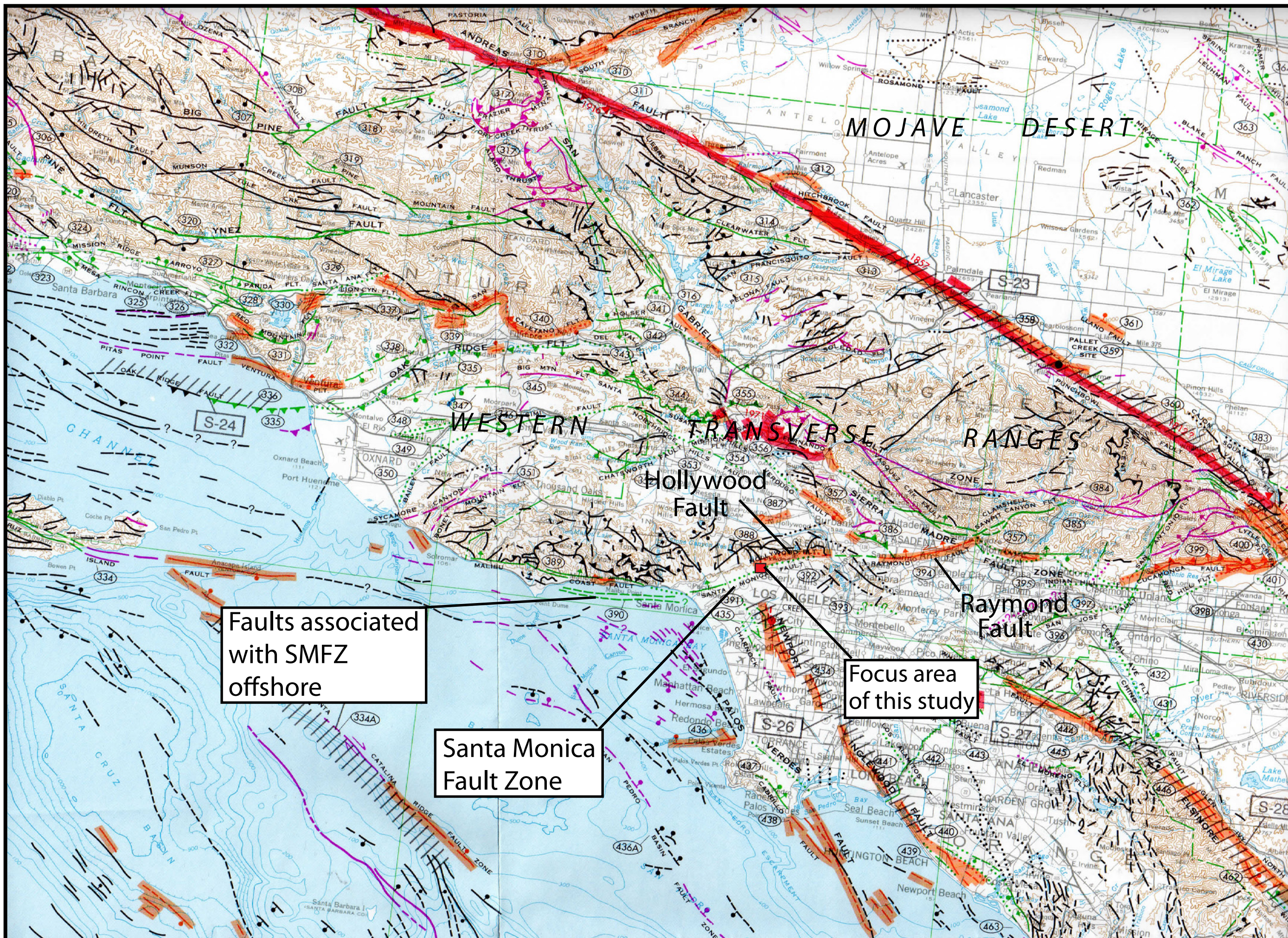
Mw estimates for a fault length of 40 km (A = 9.6×10^{12} cm^2).

Mw = ~7.1 with average displacement D = 185 cm (most probable).
Mw = ~6.9 with average displacement D = 100 cm.
Mw = ~7.3 with *maximum* displacement D = 300 cm (least probable).

Mw estimates for a fault length of 12 km (A = 2.88×10^{12} cm^2)

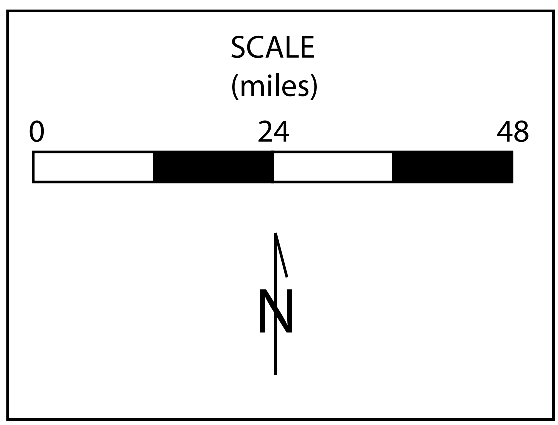
Mw = ~6.4 with average displacement of D = 55 cm.

Note: Anderson, et al. (1996) proposes a correlation between slip rate and earthquake magnitude suggesting that the largest earthquakes will occur on the slowest slipping faults if the rupture length is held constant. Thus, slip rate is an important fault parameter regarding estimating major earthquakes magnitudes for specific faults. Essentially, their results suggest that a pure moment magnitude calculation as provided above may underestimate Mw values for faults exhibiting relatively slow slip rates as is currently understood for the Santa Monica Fault.



Geologic Time Scale	Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary – Late Quaternary – Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
Quaternary – Late Quaternary – Holocene	10,000		? ? ?	Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
Quaternary – Late Quaternary – Pleistocene	700,000		? ? ?	Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Pleistocene age.
Quaternary – Early Quaternary – Pleistocene	1,600,000		? ?	Undivided Quaternary faults – most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
				Late Cenozoic faults within the Sierra Nevada, including parts of, but not restricted to, the Foothills fault system. These faults may have been active in Quaternary time.	
Pre-Quaternary	4.5 billion			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive. Pre-Quaternary faults not shown in Nevada and Oregon.	Fault cuts strata of Pliocene or older age.

Base Map: Jennings, C.W., 1994, Fault Activity Map of California & Adjacent Areas; California Geologic Survey, Geologic Data Map No.6



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Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone

REGIONAL FAULT MAP OF SOUTHWESTERN CALIFORNIA

Kenney GeoScience

J.N. 723-11

M. Kenney

05/02/2011

Plate A

Santa Monica Fault deformation characteristic notes:

The fault dips between 20 and 30 degrees to the north and is considered an oblique left lateral thrust fault.

On shore (terrestrial) hanging wall deformation may narrow from a relatively wide zone in the west to a very narrow zone localized at the primary geomorphic scarps toward the east (this study). This suggests that the slip rate on the Santa Monica fault may decrease toward the east and indicate that the Santa Monica Fault may terminate near the West Beverly Hills Lineament.

Note: This is the Santa Monica Fault of Wright (1991) that is not considered active and does not extend to the surface. This is Fault B of Catchings 2008

5000 4000 3000 2000 1000 0

Scale (feet) - 1:24,000
Contour interval 5 and 25 feet,
Datum is mean sea level.
Base survey data collected from 1923 to 1925 by the USGS.

N

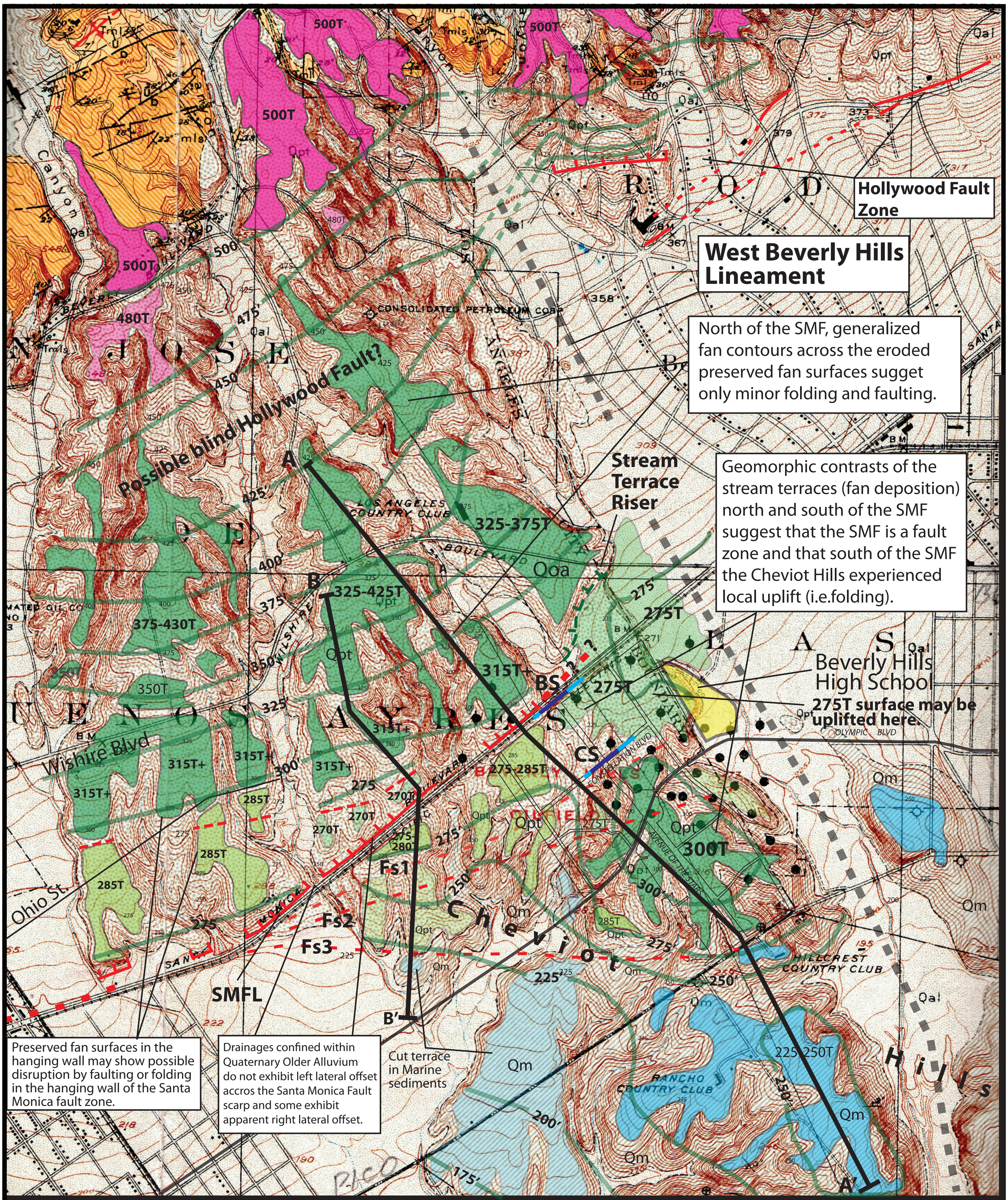
Local Geologic Unit Descriptions

Qpt	Quaternary (upper Pleistocene) older alluvial, stream and marine terrace deposits (Hoots and Kew, 1931). Locally these deposits are believed to be terrestrial alluvial fan sediments (Qoa of Dibblee, 1991).
Qm	Quaternary (upper Pleistocene) marine sandstone, conglomerate and clay shale.
smsl smss smsp	Triassic (?) Santa Monica Slate

Reference: Base Geologic Map from: Hoots, H.W., Kew, W.S.W, 1931; Geologic Map of the Eastern Part of the Santa Monica Mountains and adjacent areas, Los Angeles County, California; USGS Professional Paper 165, Plate 16.

DATA SOURCES:
Geomorphic and other fault data shown on this map is compiled from the base map (Hoots and Kew, 1931), Pipkin and Proctor (1992), discussions with Richard Proctor, work conducted by M. Kenney with Dr. Thomas Rockwell on the Hollywood Fault, Dolan and Sieh (1992), Dolan et al. (2000), Dolan and Pratt (1997), Pratt et al. (1998), Catchings et al. (2008), and geomorphic analysis by the author (M. Kenney).

CLIENT: ALSTON & BIRD LLC.	Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
PRELIMINARY MAP OF THE TERRESTRIAL SANTA MONICA AND WESTERB HOLLYWOOD FAULT ZONES BASED ON EXISTING DATA AND GEOMORPHIC ANALYSIS	Kenney GeoScience J.N. 723-11	M.Kenney	05/02/2011
		Plate B	



SYMBOL DESCRIPTIONS

Approximate location of relatively strong geomorphic lineament likely associated with a strand of the the Santa Monica Fault Zone (scarp). These scarps are delineated by elevated Quaternary older alluvium deposits (late Pleistocene). Tick marks on down dipping side.

Approximate location of relatively weak geomorphic scarps in youthful alluvial deposits (likely mid to latest Holocene). These scarps are associated with a subdued increase in slope (tighter contour lines) on the surfaces.

Approximate location of weak geomorphic lineaments or projected potential subsurface faults. These lineaments occur across Quaternary older alluvial and/or marine terrace deposits and represent changes in slope of remnant fan surfaces and/or erosional saddles.

BS CS — Approximate location of proposed LA Metra substation.
BS - Base Station along Santa Monica BLVD;
CS - Constellation Station along Constellation BLVD.

290T+ — Approximate limits of degraded remnant fan depositional surfaces (fill & cut terraces). Number in region provide approximate average elevation of surface. Surfaces with different elevations values may correlate if the area was deformed (folding, tiling, faulting) or may represent independant abandoned and preserved fan surfaces. Green and blue regions represent fill and possibly some cut terraces in older alluvium (Qoa) and shallow marine deposits respectively.

275 — Generalized elevations extropolated over degraded terrace surfaces. Number in bold indicates approximate elevation in feet above mean sea level (msl).

Reference: Base Geologic Map from: Hoots, H.W., Kew, 1930; W.S.W, Geologic Map of the Eastern Part of the Santa Monica Mountains and adjacent areas, Los Angeles County, California; USGS Professional Paper 165, Plate 16.

B — B' Location of Cross Sections A-A' and B-B'

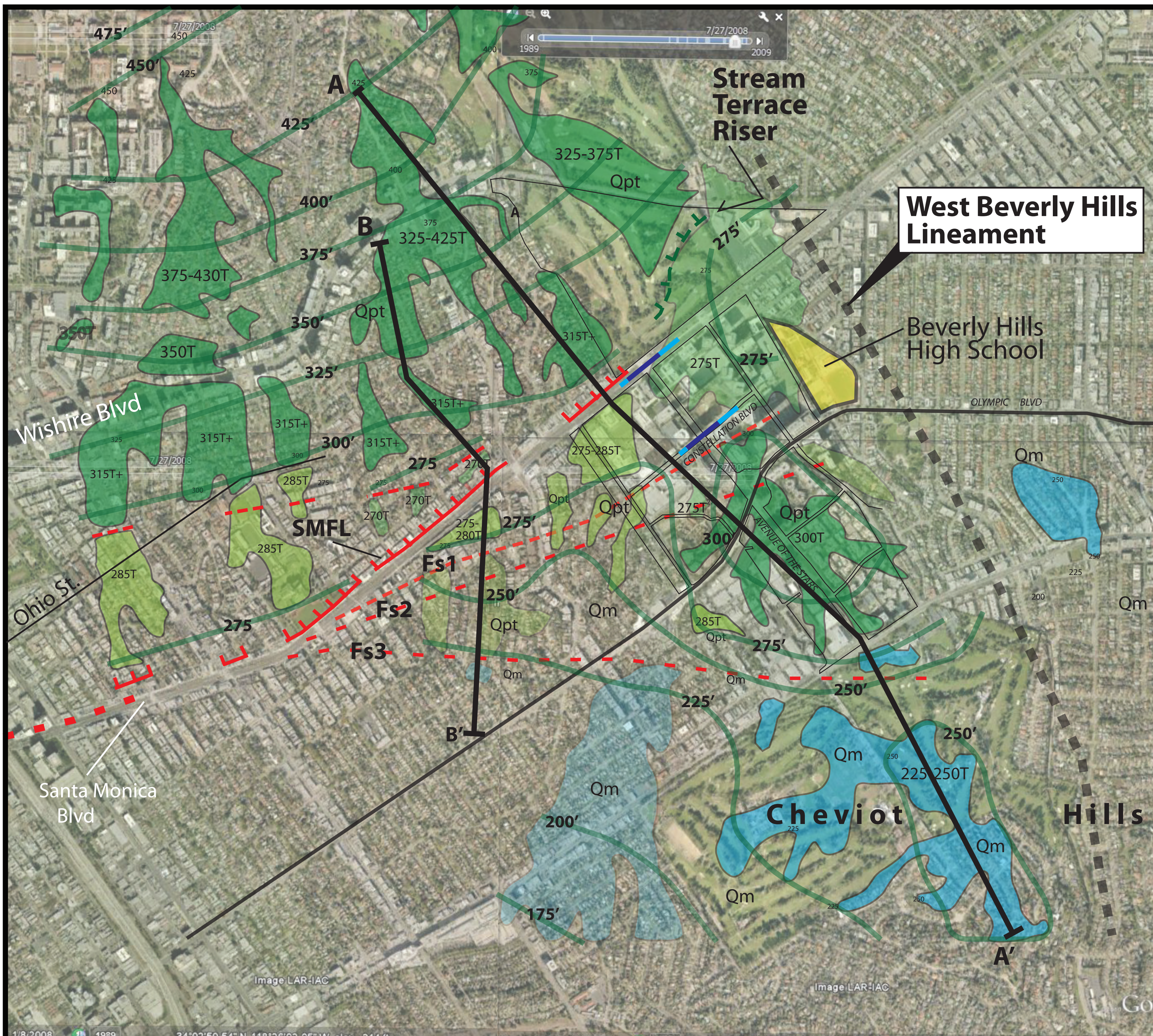
Qpt	Quaternary (upper Pleistocene) alluvial, stream and marine terrace deposits
Qm	Quaternary (upper Pleistocene) marine sandstone, conglomerate and clay shale.
smsl smss smsp	Triassic (?) Santa Monica Slate

5000 4000 3000 2000 1000 0

Scale (feet) - 1:24,000
Contour interval 5 and 25 feet, datum is mean sea level.
Base survey data collected from 1923 to 1925 by the USGS.

N

CLIENT: ALSTON & BIRD LLC.	Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
PRELIMINARY MAP OF THE SANTA MONICA AND HOLLYWOOD FAULT ZONES BASED ON EXISTING DATA AND GEOMORPHIC ANALYSIS	*Kenney GeoScience* J.N. 723-11	M. Kenney	05/02/2011
		Plate C	



Base Imape from Google Earth

SYMBOL DESCRIPTIONS

Approximate location of relatively strong geomorphic lineament likely associated with a strand of the the Santa Monica Fault Zone (scarp, SMFL). These scarps are delineated by elevated Quaternary older alluvium deposits (late Pleistocene). Tick marks on down dipping side. See text for details.

Approximate location of relatively weak geomorphic scarps in youthful alluvial deposits (likely mid to latest Holocene). These scarps are associated with a subdued increase in slope (tighter contour lines) on the surfaces.

Approximate location of weak geomorphic lineaments or projected potential subsurface faults. These lineaments occur across Quaternary older alluvial and/or marine terrace deposits and represent changes in slope of remnant fan surfaces and/or erosional saddles.

BS CS — Approximate location of proposed LA Metra substation.
BS - Base Station along Santa Monica BLVD;
CS - Constellation Station along Constellation BLVD.

290T+ — Approximate limits of degraded remnant fan depositional surfaces (fill & cut terraces). Number in region provide approximate average elevation of surface. Surfaces with different elevations values may correlate if the area was deformed (folding, tiling, faulting) or may represent indepentant abandoned and preserved fan surfaces. Green and blue regions represent fill and possibly some cut terraces in older alluvium (Qoa) and shallow marine deposits respectively.

275 — Generalized elevations extropolated over degraded terrace surfaces. Number in bold indicates approximate elevation in feet above mean sea level (msl).

B — B' Location of Cross Sections A-A' and B-B'

Qpt — Quaternary (upper Pleistocene) alluvial, stream (Qoa) and marine terrace deposits

Qm — Quaternary (upper Pleistocene) marine sandstone, conglomerate and clay shale.

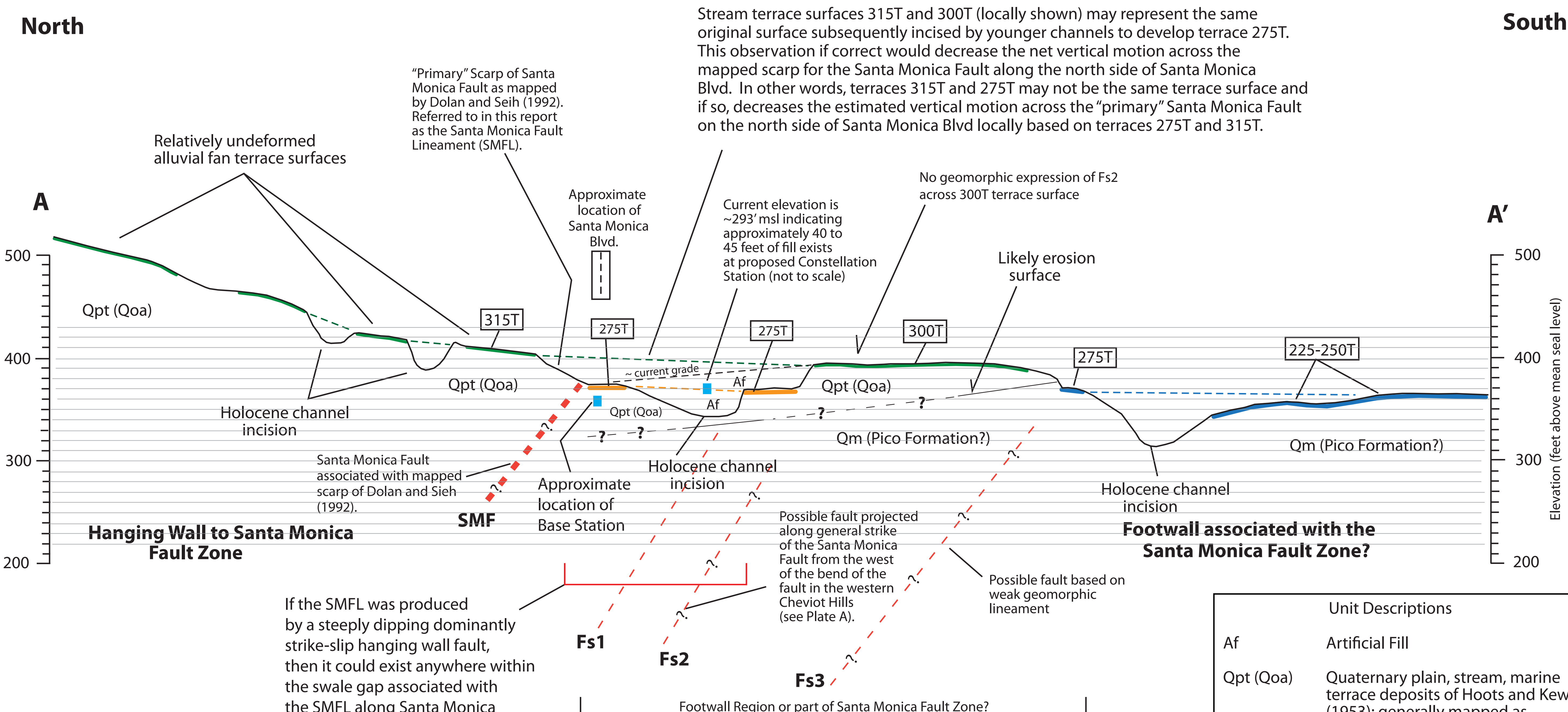
5000 4000 3000 2000 1000 0

Scale (feet) - 1:24,000
Contour interval 5 and 25 feet, *datum is mean sea level.*
Base survey data collected from 1923 to 1925 by the USGS.

N

CLIENT: ALSTON & BIRD LLC.	Preliminary Geomorphic Fault Evaluation Report for the Eastern Santa Monica Fault Zone

PRELIMINARY MAP OF THE SANTA MONICA AND HOLLYWOOD FAULT ZONES BASED ON EXISTING DATA AND GEOMORPHIC ANALYSIS	Kenney GeoScience J.N. 723-11	M. Kenney	05/02/2011
		Plate D	



Region of possible blind faulting and secondary deformation assocaited with the Santa Monica Fault Zone. The fault zone may locally represent numerous fault splays , uplift, folding, tilting of Quaternary Older Alluvial (Qpt or Qoa) and marine terrace sediments (Qm) associated with the fault terminating near the surface in the Cheviot Hills. In this type of deformation zone, secondary deformation as described could occur anywhere.

Horizontal Scale: 1"=1,000'

5000 4000 3000 2000 1000 0

Vertical Scale: 1" = 100'

500 400 300 200 100 0

Unit Descriptions

Af	Artificial Fill
Qpt (Qoa)	Quaternary plain, stream, marine terrace deposits of Hoots and Kew (1953); generally mapped as Quaternary Older Alluvium (Qoa)
Qm	Marine deposits composed of sandstone, conglomerate, and clay shale (from Hoots and Kew, 1953).

CLIENT: ALSTON & BIRD LLC.

Preliminary Geomorphic Fault Evaluation Report for the Eastern Santa Monica Fault Zone

PRELIMINARY CROSS SECTION A-A' ACROSS THE EASTERN END OF THE SANTA MONICA FAULT ZONE IN THE CHEVIOT HILLS, CA

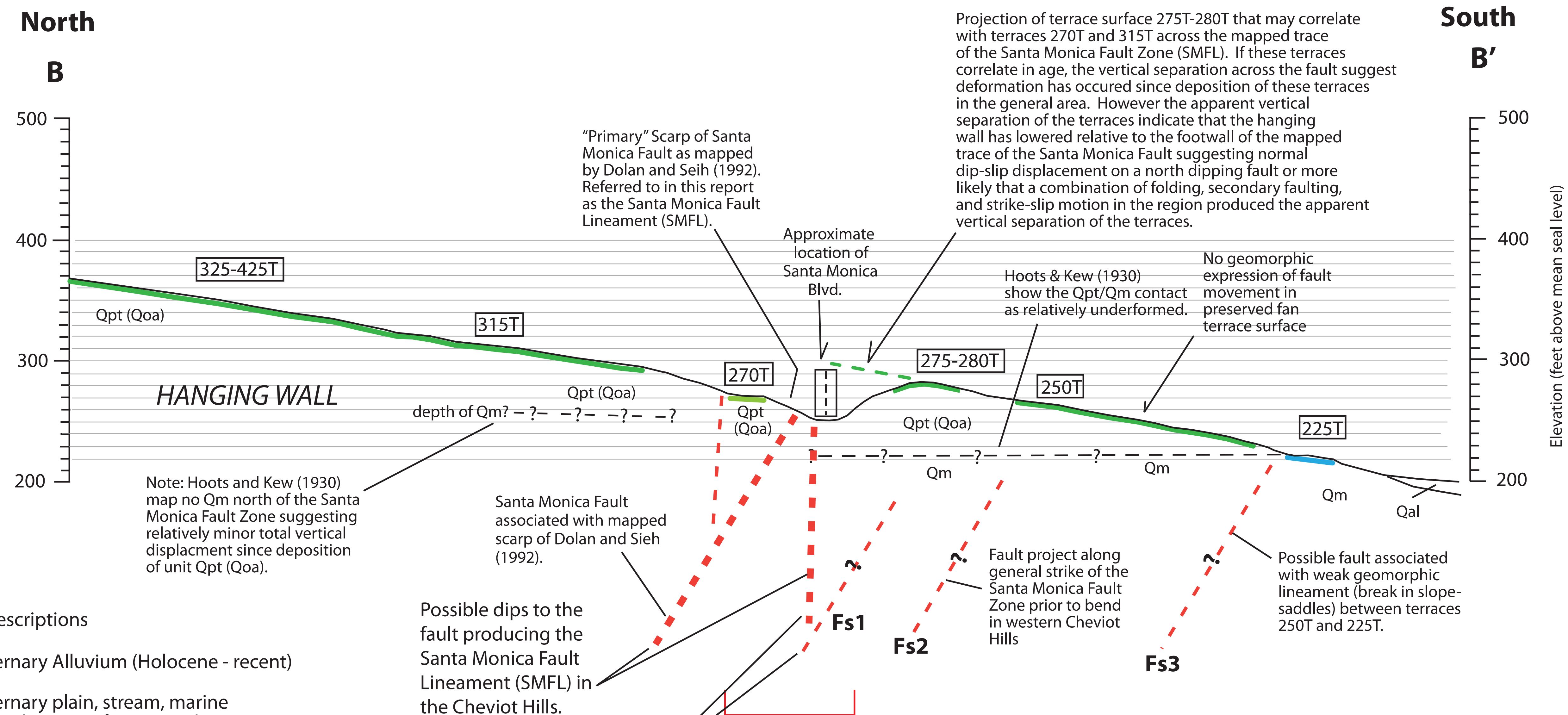
Kenney GeoScience

J.N. 723-11

M. Kenney

05/02/2011

Plate E



Unit Descriptions

Qal — Quaternary Alluvium (Holocene - recent)

Qpt (Qoa) — Quaternary plain, stream, marine terrace deposits of Hoots and Kew (1953); generally mapped as Quaternary Older Alluvium (Qoa)

Qm — Marine deposits composed of sandstone, conglomerate, and clay shale (from Hoots and Kew, 1953).

If the SMFL was produced by a steeply dipping dominantly strike-slip hanging wall fault, then it could exist anywhere within the swale gap associated with the SMFL along Santa Monica Boulevard

FOOTWALL(?)

Footwall Region or part of Santa Monica Fault Zone?

Region of possible blind faulting and secondary deformation assocaited with the Santa Monica Fault Zone. The fault zone may locally represent numerous secondary fault splays (Fs1, Fs2 and Fs3), uplift, folding, tilting of Quaternary Older Alluvial (Qpt or Qoa) and marine terrace sediments (Qm) associated with the fault terminating near the surface in the Cheviot Hills. In this type of deformation zone, secondary deformation as described could occur anywhere.

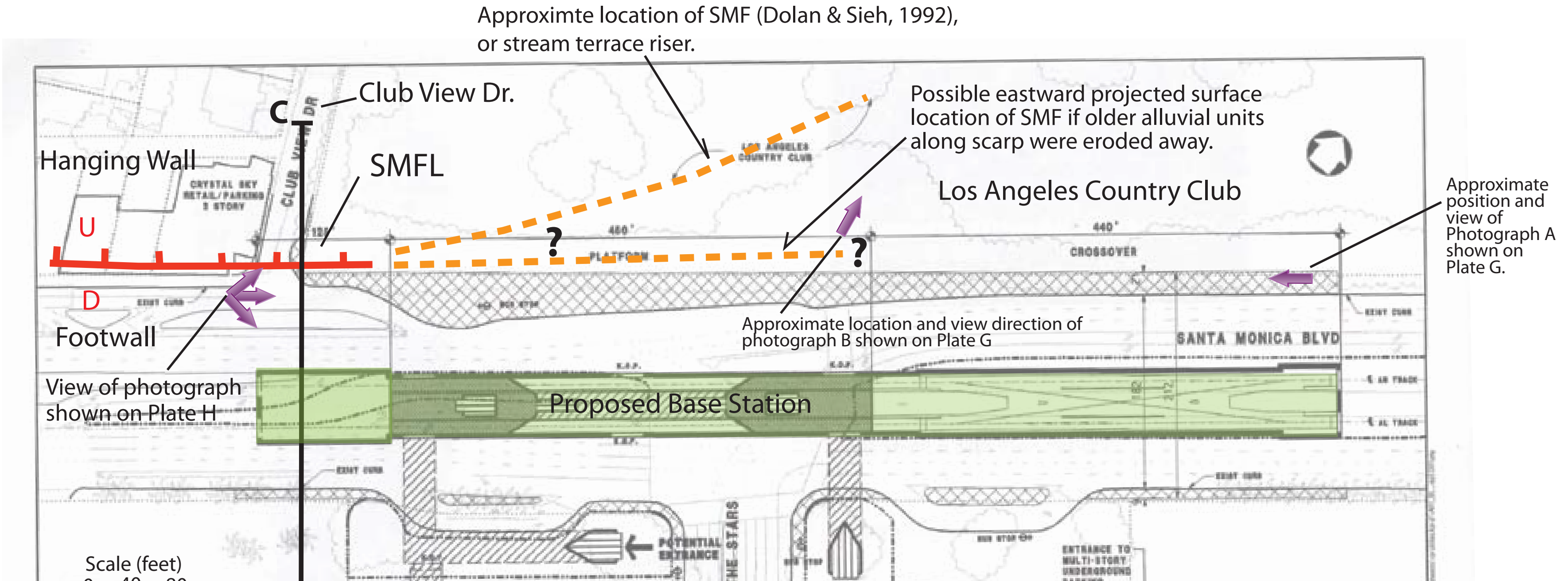
Horizontal Scale: 1"=1,000'

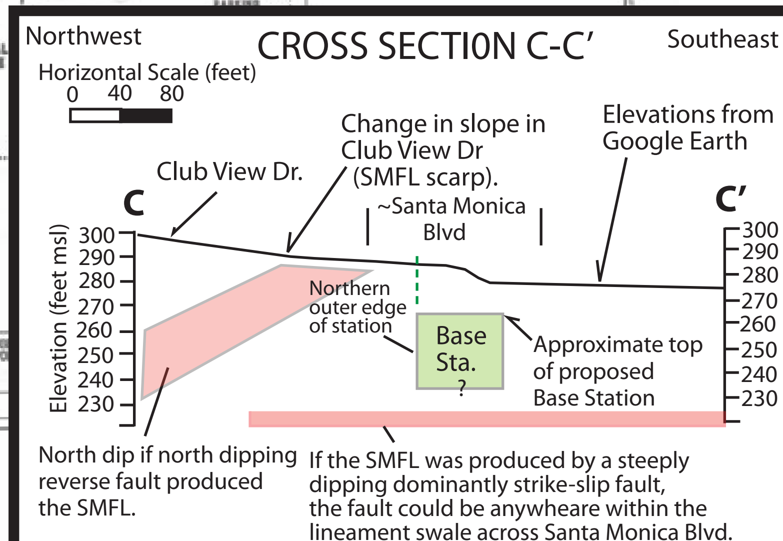
5000 4000 3000 2000 1000 0

Vertical Scale: 1" = 100'

500 400 300 200 100 0

CLIENT: ALSTON & BIRD LLC.	Preliminary Geomorphic Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
PRELIMINARY CROSS SECTION B-B' ACROSS THE EASTERN END OF THE SANTA MONICA FAULT ZONE IN THE CHEVIOT HILLS, CA	Kenney GeoScience J.N. 723-11	M.Kenney	05/02/2011
		Plate F	





Hanging Wall

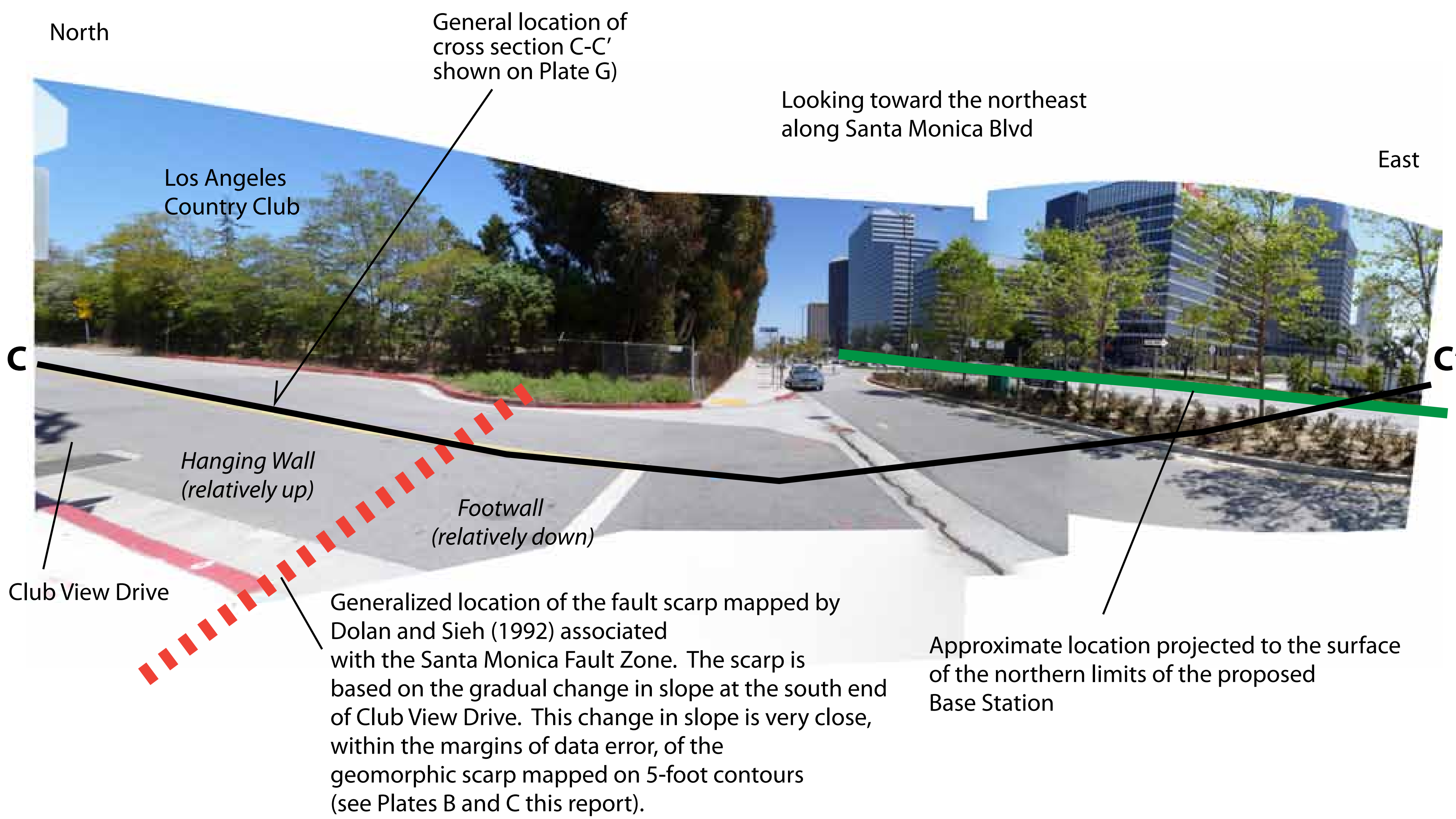
U

D

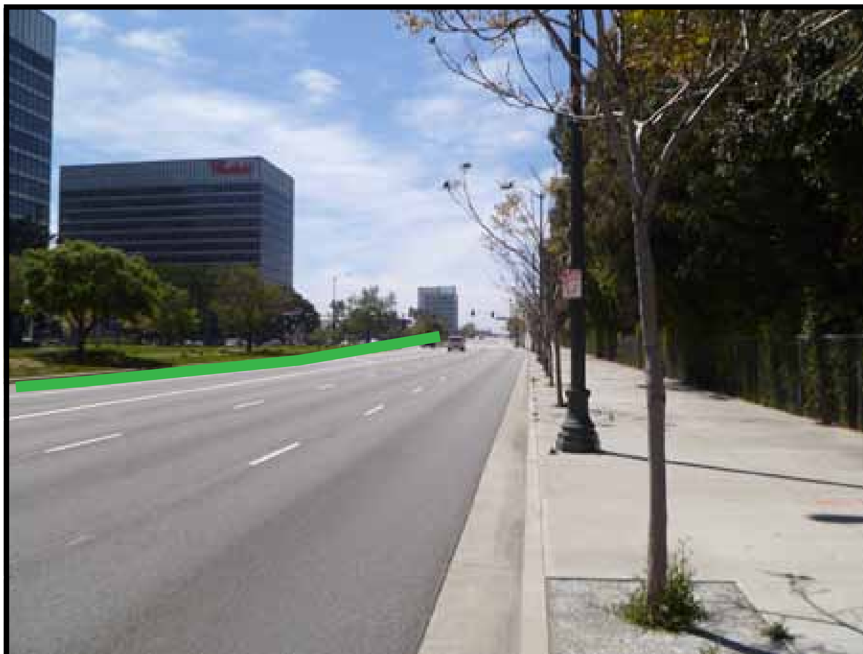
Footwall

Approximate location of the fault responsible for producing the Santa Monica Fault Lineament (SMFL) based on break in slope across existing roadways. This location is very close (within error of data accuracy) of the scarp based on geomorphic analysis of pre-construction 5' contour maps shown on Plate B based on this study and Dolan and Sieh (1992). Fault presumed to dip towards the north. U = upward movement direction of hanging wall rocks; D = relative downward movement direction of footwall rocks. Dashed line indicates potential eastward subsurface location of fault.

CLIENT: ALSTON & BIRD LLC.	Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
PRELIMINARY FAULT SCARP MAP WITH CROSS SECTION C-C' FOR PROPOSED LA METRO BASE STATION	Kenney GeoScience J.N. 723-11	M. Kenney	05/02/2011
		Plate G	



CLIENT: ALSTON & BIRD LLC.	Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
Photograph of the Intersection of Santa Monica Blvd. and Club View Dr.	Kenney GeoScience J.N. 723-11	M. Kenney	05/02/2011
		Plate H	



Photograph A

View toward the southwest along Santa Monica Blvd. Green solid line represents the approximate location of the northern wall of the proposed Base Station projected to the surface. This location is based on the map shown on Plate G

Photograph B

View toward the north from Santa Monica Blvd onto the Los Angeles Country Club. Grass covered topographic rise within the golf course (blue dashed line) correlates very well with the eastern most fault scarp mapped by Dolan & Sieh (1992). Another reasonable interpretation for the creation of this geomorphic lineament involved fluvial processes (stream terrace riser of Plate D). See text for discussion.

CLIENT: ALSTON & BIRD LLC.	Preliminary Fault Evaluation Report for the Eastern Santa Monica Fault Zone		
Photographs of Santa Monica Blvd. & Los Angeles Country Club	Kenney GeoScience J.N. 723-11	M. Kenney	05/02/2011
		Plate I	