APPENDIX E – GEOLOGY AND SOILS; GROUNDWATER AND HYDROLOGY; AND HAZARDOUS MATERIALS

Kleinfelder, Inc. *Hydrogeologic Update Memorandum*. June 12, 2012.

Kleinfelder, Inc. *Preliminary Geologic, Geotechnical, Hydrogeologic, Erosion, Drainage and Environmental Phase I Assessment Proposed Ferrini Ranch Subdivision Monterey County, California*. July 14, 2008.

Soil Surveys, Inc. *Geotechnical Investigation Report*. December 31, 2007.

Whitson Engineering. *Preliminary Drainage Report for Ferrini Ranch Development*. February 11, 2010, revised August 11, 2011.

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MEMORANDUM

FROM: **Nathan Stoopes, PG**
Michael Clark, CEG
Charles Almestad, PG, CEG CA

DATE: **June 12, 2012**

SUBJECT: **Proposed Ferrini Ranch Subdivision – Hydrogeologic Update**

In July 2008, Kleinfelder provided a report to PMC for the proposed Ferrini Ranch subdivision in Monterey County, California. The title of the report is: "Preliminary Geologic, Geotechnical, Hydrogeologic, Erosion, Drainage, and Environmental Phase I Assessment, Proposed Ferrini Ranch Subdivision, Monterey County, California." The report includes a preliminary hydrogeologic assessment of the subject property based on information readily available at that time. This memorandum clarifies and updates selected issues in the hydrogeologic portion of the 2008 Kleinfelder report.

The 2008 Kleinfelder report states that California Water Service Company (CWSC) provided information by telephone interview on February 21, 2007 that water delivered to the proposed Ferrini Ranch subdivision would not be derived from the Salinas Groundwater Basin. Notwithstanding the February 2007 statement of CWSC, it is apparent that water for the subdivision as proposed, in fact, would be sourced from the 180/400-foot aquifer of the Salinas Groundwater Basin.

According to CWSC's Urban Water Management Plan (CWSC, 2007), potable water for the proposed project will be provided by wells within CWSC's Salinas District. It is significant to note that although the project site is located in the northeast portion of the Corral de Tierra Area Subbasin wells that will supply water to the proposed project are located within an adjacent subbasin. Water for the proposed project would be provided from the 180/400-Foot Aquifer Subbasin, a portion of the Salinas Valley Groundwater Basin.

Water for the proposed subdivision would be acquired from a variety of wells located in the Spreckels area, along River Road that draw water from the 180/400-Foot Aquifer Subbasin, and it is our understanding that no water for the project will be drawn from wells within the Corral de Tierra Area Subbasin. Transport of water from the 180/400-Foot Aquifer Subbasin and consumed and discharged in the Corral de Tierra Area Subbasin, in point of fact, will increase recharge to the local subbasin. According to CWSC's 2007 water quality report, water procured from the Spreckels' area wells is in compliance with California Department of Water Resources' primary and secondary drinking standards in accordance with the Safe Drinking Water Act.

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The 180/400-Foot Aquifer Subbasin is one of eight defined subbasins of the larger Salinas Valley Groundwater Basin. The aerial extent of the 180/400-Foot Aquifer Subbasin includes the lower reaches and mouth of the Salinas River. The subbasin is bounded by the Sierra de Salinas on the southwest; the Corral de Tierra Area Subbasin on the west; the Seaside Area Subbasin and Monterey Bay on the northwest; the Pajaro Valley Groundwater Basin and Eastside and Langley Area Subbasins on the northeast; and the Lower Forebay Subbasin, near the City of Gonzalez, on the southeast (DWR, 2004).

The 180/400-Foot Aquifer Subbasin has an estimated total storage capacity of approximately 7,240,000 acre feet of groundwater. The two main water-bearing units within the subbasin are referred to as the 180-Foot Aquifer and the 400-Foot Aquifer (named for the average depth at which they occur). The 180-Foot Aquifer consists of 50 to 150 vertical feet of complex interconnecting sand, gravel and clay lenses. The sand, gravel and clay strata of the 400-Foot Aquifer has an average thickness of about 200 feet. The 180-Foot Aquifer and 400-Foot Aquifer are separated by 10 to 70 feet of discontinuous aquitard material (low permeable strata).

According to CWSC's Urban Water Management Plan, the Salinas District has a total of 59 wells, including one leased well. The design capacity of the active operational wells is 30,990 gpm, a rate that potentially can produce 44.6 mg/d (million gallons per day). The five-year average average-day demand within the Salinas District is 18.4 mg/d and the average maximum-day demand is 30.1 mg/d leaving an average minimum buffer of about 14.5 mg/d. Given the most recent estimate of total water consumption for the Ferrini Ranch project (from 9-14-2011 DEIR by PMC) of 95.17 af/y (acre feet per year), the average daily water consumption would be about 0.008 mg/d which would be a very small fraction of the existing well-capacity buffer.

High dependence on groundwater within the Salinas Valley Groundwater Basin has, in the past, resulted in over drafting the basin. However, to reduce or stop the progress of further groundwater degradation, the Salinas Valley Water Project (SVWP) was implemented to provide long-term management and protection of groundwater resources. The SVWP supplies sufficient surface water to attain a hydrologically balanced groundwater basin in the Salinas Valley to meet current and future water demands through the year 2030. The proposed Ferrini Ranch subdivision will be located in assessment Zone 2C of the Salinas Valley Groundwater Basin and as such will receive the benefits of the SVWP improvements including sustained long-term potable water supplies.

In the event of water shortage in the Salinas Valley Groundwater Basin (either from a catastrophic event or long-term deprivation), CWSC has developed and can implement its Water Shortage Contingency Plan and Water Supply Allocation Plan which includes defined allocation methodologies. In the event of water-shortage conditions, the CWSC Water Shortage Contingency Plan provides for the Ferrini Ranch subdivision to have an

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available source of water proportional to the rest of the Salinas Valley Groundwater Basin.

Given the conditions presented in this memorandum, we conclude that there will be sufficient water supply for the proposed Ferrini Ranch subdivision and the development will not violate water quality standards or substantially deplete groundwater supplies or adversely interfere with groundwater recharge.

REFERENCES

California, State of. Department of Water Resources (DWR), 2004, *Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin*, Bulletin 118. February 27, 2004.

California Water Service Company (CWSC), 2007, *Urban Water Management Plan – Salinas District.*

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PRELIMINARY GEOLOGIC, GEOTECHNICAL, HYDROGEOLOGIC, EROSION, DRAINAGE, AND ENVIRONMENTAL PHASE I ASSESSMENT
For
Preparation of an Environmental Impact Report Addressing the Proposed Ferrini Ranch Subdivision Monterey County, California

A Report Prepared For

Pacific Municipal Consultants
585 Cannery Row, Suite 304
Monterey, California 93940

Attention: Mr. Patrick Kelley

July 14, 2008

REGISTERED PROFESSIONAL ENGINEER
CATHERINE HAYNES ELLIS
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PRELIMINARY GEOLOGIC, GEOTECHNICAL, HYDROGEOLOGIC EROSION, DRAINAGE, AND ENVIRONMENTAL PHASE I ASSESSMENT PROPOSED FERRINI RANCH SUBDIVISION MONTEREY COUNTY, CALIFORNIA

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July 14, 2008
File No. 74732/REPORT

Pacific Municipal Consultants
Mr. Patrick Kelley
585 Cannery Row, Suite 304
Monterey, California 93940

SUBJECT: Executive Summary of Preliminary Geologic, Geotechnical, Hydrogeologic, Erosion, Drainage, and Environmental Phase I Assessment for the Proposed Ferrini Ranch Subdivision, Monterey County, California

Dear Mr. Kelley:

Kleinfelder is pleased to submit this preliminary geologic, geotechnical, hydrogeologic, erosion and drainage, and environmental phase I report for the proposed Ferrini Ranch Subdivision, Monterey County, California. This report is provided to Pacific Municipal Consultants' (PMC) for inclusion in the project EIR. The accompanying report summarizes the results of our field investigation, data collection and review, and geologic, geotechnical, hydrogeologic, erosion, drainage interpretation for the project site. The Environmental Phase I Assessment for the project site is provided under separate cover.

This report presents feasibility-level findings that are intended to provide information to be included in the project EIR. This report does not include design-level site information. Before site development begins, design-level investigations should be completed that describes geotechnical and other pertinent conditions and provides recommendations for each building site. The geologic, geotechnical, hydrogeological, erosion and drainage, and environmental findings provided in this report are intended to serve as a conceptual and preliminary assessment for inclusion in the subdivision Environmental Impact Report.

At the request of PMC, this report has been edited since its original submission date of January 2, 2007 to finalize certain portions. No adjustments for data published or that have become available after the original submission date has been added to the report.

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We appreciate working with PMC to compile a thorough documentation for the Ferrini Ranch Subdivision Environmental Impact Report. If you have any questions, please call the undersigned or an author listed above.

Respectively submitted,

KLEINFELDER WEST, INC.

Michael Clark
Project Manager

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PRELIMINARY GEOLOGIC, GEOTECHNICAL, HYDROGEOLOGIC, EROSION, DRAINAGE, AND ENVIRONMENTAL PHASE I ASSESSMENT PROPOSED FERRINI RANCH SUBDIVISION MONTEREY COUNTY, CALIFORNIA

1 INTRODUCTION

This report presents the results of Kleinfelder's preliminary geologic, geotechnical, hydrogeologic, erosion, drainage, and environmental Phase I assessments for the proposed Ferrini Ranch subdivision in Monterey County, California. As shown on the *Site Vicinity Map*, Plate 1, the project site is located on 870 acres of property on the east side of Highway 68 between River Road on the north and San Benancio Road on the south.

This report is divided into several sections that present geologic, geotechnical, hydrogeologic, erosion, drainage, and environmental Phase I findings and conclusions for for inclusion in the project Environmental Impact Report (EIR). These conclusions are based on the surface and subsurface conditions encountered at the locations of our explorations and the provisions and requirements outlined in the Additional Services and Limitations section of this report. The findings presented herein should not be extrapolated to other areas or used for other projects without our review. Before site development begins, design-level investigations should be completed that describes geotechnical conditions and recommendations at each building site.

1.1 SITE DESCRIPTION

The 870-acre Ferrini Ranch project site is generally undeveloped graze lands located about three miles south of El Blanco Road in Salinas. The project site consists of two separated elongate parcels located east of Highway 68 (Monterey Highway a State designated Scenic Route) (Site Vicinity Map, Plate 1 and Site Plan, Plate 2). A few unimproved roads cross the property to some of the proposed building sites. A single-family residence accessed by an unimproved road off of San Benancio Road is located in the southwest corner of the property near San Benancio Elementary School. The

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Ferrini Ranch property is mostly hillside uplands with some level or nearly level ground in and near stream valleys. Generally the hillsides slope toward the western margin of the property where the land flattens and merges with the El Toro Creek flood plain. Ephemeral streams tributary to El Toro Creek emerge from side canyons where their waters generally disappear into the porous alluvium before reaching the creek channel.

Land surrounding the project site is rural and includes farms, ranches, a public elementary school, and regional park. Property elevations range from about 65 feet above mean sea level in the north portion of the site along River Road to about 700 feet in the southeast portion of the property north of San Benancio Road.

Vegetation on the property consists of mostly grassland, chaparral and coastal live oak trees. Forested areas and northern mixed chaparral generally follow sheltered slopes and increase in density to the south. Small clusters of sycamore trees are located in a few lowland areas adjacent to Highway 68. Chaparral borders and mixes with forested areas generally on hillsides, with the remaining, flatter potions of the property in grassland, shrubs and scattered oak trees.

The Ferrini Ranch project site is located in the El Toro area of Monterey County. This is a rural area characterized by low density residential development, located on properties along San Benancio Roads which is a County-designated scenic route. The character of the area is defined mainly by the vistas of the woodlands on the slopes of the Sierra de Salinas Range, including Mount Toro. For most of the property length along Highway 68 and on the northwest side of the highway the nearly flat alluvial plain is occupied by the higher density Toro residential and commercial development. The area to the northwest of the Toro development is dominated by chaparral-covered slopes on property of the former Fort Ord. San Benancio Elementary School lies at the south margin of the Ferrini Ranch property and adjacent to San Benancio Road.

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1.2 PROPOSED DEVELOPMENT

Based on information provided by the project applicant, we understand that the Ferrini Ranch Subdivision is a 212-unit project comprised of 146 market-rate residential lots (ranging from 0.28 acres to approximately 72 acres with an average of 1.22 acres); 23 market-rate clustered housing units/lots; and 43 inclusionary-housing units. The proposed project will include a wine tasting facility along River Road, and construction of roadways, infrastructure, utility improvements, and trails. Approximately 600 acres of the project site will be dedicated as permanent open space that will continue to be used as grazing land.

The project is located on 870 acres of property (APN: 161-011-019, -030, -039, -057, -058, -059, and 161-031-016, 017) between River Road on the north and San Benancio Road on the south in the Toro Area Plan. Toro Regional Park divides the project site into two separate properties. The properties are mostly hillside uplands with some level and nearly level areas in and near stream valleys. Most of residential lots are proposed to be located on or near ridge crests in the southern parcel, while several lots are also on flatland in the far north along River Terrace Road and far south portions of the property along Road B and along San Benancio Road. The residences are assumed for this proposal to consist of detached, one- and two-story wood-frame structures with driveways. Also included with the development will be underground utilities, access roadways, and margin landscaping.

1.3 REFERENCE DOCUMENTS

The following documents have been supplied by PMC (Pacific Municipal Consultants) for review and input to this report.

- Westec Services, Inc., May 14, 1975, Toro Vista Project, Environmental Resources, Survey Report
- MacKay & Somps, July 1990, Preliminary Site Analysis, Toro Vista

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- Fugro McClelland, March 1993, Preliminary Hydrogeologic Assessment, Toro Vista Area, Monterey County
- Fugro West, Inc., February 1996, Additional Hydrogeologic Update, El Toro Area, Monterey County, California
- Monterey County Water Resources Agency, January 2003, Salinas Valley Water Project, Engineer's Report
- California Groundwater, Bulletin 118, February 27, 2004, Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin
- California Water Service Company, November 23, 2004, Will-provide-service letter
- Department of Forestry and Fire Protection, September 28, 2005, Bollenbacher and Kelton Parcels (PLN040758), SCH # 2005091055
- Department of Health Services, October 3, 2005, Notice of Preparation for the Bollenbacher and Kelton Parcels (PLN040758) draft Environmental Impact Report, State Clearinghouse No. 2005091055

1.4 REPORT DIVISIONS

The following sections present findings and conclusions of each of the subject topics. The subject topics are described in the sections listed in the following table.

Subject	Section
Geologic	2
Geotechnical	3
Hydrogeologic	4
Erosion and Drainage	5
Environmental Phase I	Under separate cover

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2 GEOLOGIC ASSESSMENT

2.1 GEOLOGIC PURPOSE AND SCOPE

The purpose of the geologic assessment portion of this study was to identify geologic or seismic-related factors that could impact development or restrict use of the property. Our scope of services for the geologic assessment included site reconnaissance, aerial photographic review, review of readily available published data, geologic mapping, subsurface exploration by means of test pits, review of geotechnical data obtained from our soil borings and laboratory testing, and report preparation. These aspects of the geologic portion of our study included:

- Review of the general geologic and seismic setting of the property and surrounding area, including research and review of readily available geologic/seismic reports published by the U.S. Geological Survey and the California Geological Survey (formerly the California Division of Mines and Geology), and other published reports in our files.
- Review of selected aerial photographs covering the property to assess the geomorphic setting, and possible evidences of faulting or landsliding on or in the vicinity of the property.
- Site reconnaissance and geologic mapping by a Certified Engineering Geologist using a 1-inch equal 200 feet topographic base map. Surface features potentially relating to faulting and landslide conditions were noted where observed.
- Performance of a field subsurface exploration program under the direction of Kleinfelder's geologic staff. The field exploration program included excavation and logging of 17 exploratory test pits.
- Review of boring log data obtained from the geotechnical field investigation for additional evaluation of the subsurface conditions.

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- Geologic analysis of data obtained from our office review and field investigation for inclusion in this report presenting our findings. Conclusion regarding the location and potential activity of faults, landsliding, potential for liquefaction, seismic settlement and compaction, flooding, tsunamis and seiches, lurching and lateral spreading were considered.
- Construction of a cross section showing an interpretation of the geologic conditions beneath a portion of the property.
- Preparation of the geologic portion of this report.

2.2 INVESTIGATIVE METHODS

Investigative methods used for our preliminary geologic assessment included review of stereoscopic pairs of historical aerial photographs, geologic mapping, and excavation and logging of 17 exploratory test pits. We reviewed aerial photographs of the site for evaluation of landforms and as an aid in geologic interpretation. Our aerial photographic review included geomorphic analysis of possible landslides on the property and distribution of surficial units. Several landslides were noted and are shown on the Preliminary Geotechnical Map, Plates 3a and 3b.

Geologic mapping of the property was performed by a senior engineering geologist with our company using a 1-inch = 200 feet scale topographic base map provided by Pacific Municipal Consultants. Existing rock outcrops, which are mainly limited to areas adjacent to Highway 68, were observed along with many of the slopes and hillside drainages within the property. Many, but not all, of the hillsides within the property were observed for evidence of landslides and general geologic conditions. The results of our site mapping and surface geologic interpretation are presented on the Preliminary Geologic Map.

Field exploration for both the geologic evaluation and the geotechnical investigation was performed between November 6 and November 16, 2006, and consisted of 17 exploratory test pits and 13 soil borings. Details regarding the exploratory soil

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borings are presented in the Geotechnical Assessment portion of this report. The approximate locations of the exploratory test pits and borings are shown on the Preliminary Geotechnical Map, Plates 3a and 3b. These approximate locations were based on references to existing site features and were not surveyed. Prior to our fieldwork, Underground Service Alert was notified to have its member companies locate and mark underground utilities at the site.

The test pits were excavated with a four-wheel-drive backhoe to depths of about 5 to 8 feet. The test pit locations were concentrated in areas of proposed development. Test pit walls were picked with hand tools and logged by an engineering geologist from our office. Graphic logs of the test pits are presented in Appendix A, Plates A-2 through A-12. Appendix A-1 is the Boring and Test Pit Log Legend.

The exploratory test pits for this investigation were loosely backfilled with excavated soil. Soil backfill was tamped with the backhoe's bucket and wheel-rolled, but was not compacted to any specification. The backfill will not be able to support future improvements. To avoid differential settling of future foundations and utilities these test pits should be located and the loose backfill should be removed and re-compacted as engineered fill.

2.3 REGIONAL GEOLOGY

The site is located in the north extent of the Sierra de Salinas range and southeast of the former Fort Ord military reservation. The El Toro Valley within which the project site is situated is a geomorphic lowland within the Coast Ranges Geomorphic Province, a discontinuous series of northwest-southeast trending mountain ranges, ridges, and intervening valleys characterized by complex folding and faulting. The general geologic framework of the Central Coast Ranges of California is illustrated in studies by the California Geological Survey (2002) and Jennings and Strand (1958). The general geologic setting of the project site and vicinity is shown on Plate 4, *Regional Geologic Map*, which is a portion of Geologic Map of the Spreckels 7.5-Minute Quadrangle, Monterey County, California by Clark, Brabb, and Rosenberg, (2000).

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Geologic structures within the Coast Ranges Province are generally controlled by the San Andreas fault system, which is a major tectonic transform plate boundary. This right-lateral strike-slip fault system extends from the Gulf of California in Mexico, to Cape Mendocino in northern California and forms a portion of the boundary between two global tectonic plates. In this portion of the Coast Ranges Province, the Pacific plate moves north relative to the North American plate, which is located east of the transform boundary. Deformation along this plate boundary occurs across a wide zone that is referred to as the San Andreas fault system. The general trend (about N30-45W) of the faults within this system is responsible for the strong northwest-southeast structural grain of most geologic and geomorphic features in the Coast Ranges Province.

The Salinian block, which is one of the major geologic features of the central Coast Ranges, is located west of the San Andreas fault and covers a wide area. This large wedge of basement rock is composed of Cretaceous Age (about 140 to 65 million years old) granitic and high-grade metamorphic rocks. This is a tectonic sub-province defined as a northwest trending, elongate slice of the Coast Ranges. The Salinian Block is bounded by the San Andreas fault on the east and the Sur-Nacimiento fault zone on the west (Page, 1966).

Overlying the granitic basement rocks of the Salinian block are Cretaceous and Tertiary (about 65 to 1.6 million years old), marine and continental sedimentary rocks and occasional Tertiary volcanic rocks. These Cretaceous and Tertiary age rocks are typically folded and faulted into a series of generally northwest-southeast trending folded and faulted blocks, largely as a result of stresses related to movement along the San Andreas fault system. The inland valleys, including Salinas Valley and El Toro, are filled with unconsolidated to semi-consolidated alluvium (stream channel and over-bank deposits) of Quaternary age (about the last 1.6 million years).

Regional geomorphic features within Monterey County are the result of a complex geologic history of uplift and folding ultimately caused by the interaction between the

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North American and Pacific tectonic plates. About 760,000 years ago, much of California's Central Valley was covered by a great freshwater inland sea referred to as Corcoran Lake. The ancient lake drained through the southern end of the Central Valley toward Paso Robles and flowed to the Pacific Ocean along the antediluvian Salinas River to the Monterey Bay (LaJoie, K., U.S.G.S, personal communication; Bartow, 1991). Monterey Bay and the offshore Monterey Canyon are the result of erosion as large quantities of detrital material were transported from the Sierra Nevada to the Pacific Ocean via the Salinas River. The Salinas River eroded and widened the northwest-southeast trending valleys that had been formed earlier by the two tectonic plates grinding past each other. The detrital deposits originally transported to the area by the Salinas River and reworked by wind formed thick deposits of sand referred to as Aromas Formation and old dune sand (Dibblee, 1973) which cover most of the former Fort Ord area.

About 560,000 years ago, continued tectonic uplift caused the water of Corcoran Lake to rise sufficiently and carve into the soft soils at Carquinez Strait northeast of the Golden Gate and then fill the basin now referred to as the San Francisco Bay. The uplift that allowed the formation of San Francisco Bay also plugged the Salinas Valley outlet of Corcoran Lake shutting off the Salinas Valley from the Central Valley. Its headwaters removed, the Salinas River became an underfit river in an overly large ancient fluvial system. As the river's energy diminished, alluvial material from the margins of the Salinas River, that once was carried away by the stronger river flow, was transported down from the surrounding hillsides and began to collect along the margins of the river valley to form large coalescing alluvial fans (bahadas).

2.4 FAULTING AND SEISMICITY

The Monterey Bay Region and northern coastal California are considered to be one of the most seismically active regions in the United States. This area is dominated by the San Andreas fault system. Periodic earthquakes have occurred throughout the Monterey and San Francisco bay regions in historic time, several of which had

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magnitudes of 6 to 8 on the Richter scale. The largest and most destructive earthquakes were the 1868 earthquake, which was centered on the Hayward fault, and the 1906 earthquake that occurred on the San Andreas fault. Considerable damage also occurred in Monterey County during the 1989 Loma Prieta earthquake that was centered on the San Andreas fault in the nearby Santa Cruz Mountains. In January 1999, a minor earthquake was felt in the nearby Coyote – Morgan Hill area but did not cause any significant damage. The earthquake was centered on the Calaveras fault.

Table 1 lists significant faults, which are considered by the Uniform Building Code (UBC) to be active or potentially active seismogenic sources and gives selected seismic parameters. The closest map distance from the site to these faults and associated parameters presented in Table 1 are based on data derived from the USGS/CGS for the State of California (Cao et al., 2003) and by the Working Group on California Earthquake Probabilities (2003) for the San Francisco Bay Area. The locations of the faults presented on Table 1 and other active and potentially active faults in the area with respect to the subject site are shown on Plate 5, *Regional Fault Map*. Preliminary seismic analysis conducted for the property indicates that peak ground accelerations at the site could range from approximately 0.34g to 0.37g, where g is the acceleration of gravity. These values are similar to estimated peak ground accelerations provided in the Monterey County General Plan (2004).

TABLE 1
SIGNIFICANT NEARBY FAULTS

Fault Name	Approximate Closest Distance to Fault mi. (km)	Magnitude of Maximum Earthquake	Fault Length (km)	Slip Rate (mm/yr)
Reliz-Rinconada	0.3 (0.5)	7.5	190	1
Monterey Bay-Tularcitos	6 (9)	7.3	84	0.5
Zayante-Vergeles	14 (22)	7.0	58	0.1
San Gregorio	15 (24)	7.4	176	3 - 7
San Andreas (Creeping)	17 (27)	6.2	125	34
Calaveras	21 (34)	6.9	123	6 - 15

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A number of large earthquakes have occurred within this area in the past 200 years. Some of the significant nearby events include the 1906 (M7.9) "Great" San Francisco earthquake, the 1838 (M7) San Francisco Peninsula earthquake, the 1865 (M6.4) Santa Cruz Mountains earthquake, the 1868 (M6.8) Hayward earthquake, the 1890 (M6.2) Pajaro Gap earthquake, the 1899 (M5.8) and 1984 (M6.1) Morgan Hill earthquakes, the 1882 (M5.8) and 1892 (M5.8) Hollister earthquakes, the 1897 (M6.2) Gilroy earthquake, the two 1903 (M5.5) San Jose earthquakes, the 1910 (M5.8) Watsonville earthquake, two 1926 (M6) Monterey Bay earthquakes, and the 1989 (M6.9) Loma Prieta earthquake. A recent study by Toppozada and Borcherdt (1998) indicates an 1836 (M6.8) earthquake, previously attributed to the Hayward fault, occurred in the Monterey Bay area and was of an estimated magnitude M6.2. In terms of measured seismic shaking, the 1989 Loma Prieta earthquake has provided relevant information of seismic conditions in the vicinity of the project site.

2.5 SITE GEOLOGY

In general, the geology of the site and adjacent areas is complex and consists of deformed sedimentary bedrock overlain by various types of younger surficial deposits. This complexity is due to the combination of tectonic forces and weathering acting on the various earth materials over time. The rolling hillsides that dominant the eastern portions of the property are underlain by marine and non-marine sedimentary bedrock units that are broadly folded and steeply inclined in some areas. These bedrock units include the Miocene Monterey Formation and Santa Margarita Sandstone and Plio-Pleistocene continental deposits, and are mantled by soil and localized deposits of landslide debris. The adjoining hillside drainages are underlain by Holocene alluvium and older flood plain deposits. Pleistocene terrace deposits underlie the elevated plains within the property and are located along the north side of El Toro Creek and the south side of the Salinas River.

The distribution and general structural relationships of the various surficial and bedrock units are depicted on the *Preliminary Geotechnical Map* (Plates 3a and 3b). This map

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presents geologic data complied during our review of aerial photographs, field mapping and subsurface investigation and from regional geologic maps covering the subject property. A cross section depicting the general subsurface conditions within a portion of the site is included as Plate 6, *Geologic Cross Section*. Following are descriptions of the various geologic units that underlie the site.

2.5.1 Surficial Units

Alluvium (Qal - Holocene) – These deposits fill the bottom of the hillside drainages and the main flat lying areas along the southern portion of the property. The alluvium is composed of unconsolidated layers of dark brown silty sand and sandy silt with occasional lenses of gravel and silty clay. Gravel is typically fine-grained and composed of subangular granitic rock clasts.

Colluvium (Qcol – Holocene) – These deposits are found in the hillside areas, typically along the base of slopes and in topographic swales. They consist of unconsolidated mixtures of silt, sand, and gravel and can attain vary from a few feet to 20 feet in thickness.

Older Flood-Plain Deposits (Qof – Holocene) – These deposits are mapped along the northern portion of the property in the main flat lying area adjacent to Highway 68. Where observed, this unit consists of unconsolidated layers of yellowish brown well-graded sand and sandy gravel. Gravel is subrounded to rounded and composed of primarily granitic rock clasts with a minor amount of shale.

Terrace Deposits (Qt – Pleistocene) – These deposits are mapped along the elevated plains directly south of River Road and are composed of weakly consolidated layers of brown to dark brown sandy clay with variable amounts of silt and gravel. Zones of carbonate accumulation and blocky soil structure are locally present in the upper portions of the deposits. Gravel is typically fine-grained and composed of subangular granitic rock and shale clasts.

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Landslide Deposits (Qmf, Qls – Quaternary) – Landslide debris present on the property include both shallow and deep-seated type deposits. Shallow earth flow and debris flow deposits, commonly known as mudflows (Qmf), mantle the lower portions of many of the slopes and bottoms of the adjoining hillside drainages. These deposits typically consist of unconsolidated layers of sandy silt with fine- to coarse-grained sand and variable amounts of clay and gravel, and vary in thickness from about 1 to 5 feet. Deposits thicker than 5 feet may also be present. A general depiction of a typical shallow landslide is shown on the *Geologic Cross Section*, Plate 6. A few deep-seated landslides (Qls) are also mapped within the property, with the most prominent of these situated in the southern portion of the site at the location of proposed Lots 80 through 85 (Plate 3b). This landslide is composed of bedrock derived layers of clayey sand and moderately weathered sandstone and siltstone, and covers an area of about 5 acres. The thickness of this landslide could not be determined from our limited subsurface data.

Other significant landslide deposits depicted on the Preliminary Geologic Map (Plates 3a and 3b) include those adjacent to Lots 22 and 23, 32 through 35, 48, 103 through 105, and 131 through 133. The landslides adjacent to Lots 32 through 35 and 103 through 105 may be deep-seated, while the remaining landslides may be surficial in nature. It should be noted that there may be other landslides on the property that were not identified during this study.

2.5.2 Bedrock

Bedrock units underlying the site include the Continental deposits, Santa Margarita Sandstone, Monterey Formation, and Unnamed sandstone. These units follow the nomenclature used by Clark, Brabb, and Rosenberg (2000), whose map is included as the regional geologic map for this report (Plate 4).

Continental Deposits (QTc - Pleistocene-Pliocene (?)) – These deposits cover a large portion of the property and are composed of non-marine semiconsolidated beds of silt, fine- to coarse-grained sand and gravel. Gravel clasts are commonly subrounded and

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consist of granitic rocks with a minor amount of shale. Duripan horizons, which are resistant to weathering, form prominent ledges on some of the rolling hillsides. Landslides are commonly found on the slopes directly below these horizons. It should be noted that previous workers (Beal, 1915; Herold, 1935) correlated these beds with the Paso Robles Formation of the southern Salinas Valley. However, more recent studies by Dupre (1990) and Clark et al. (2000) preferred not to use the name "Paso Robles" and called these beds "continental deposits", which is used herein.

Santa Margarita Sandstone (Tsm - Miocene) – This formation is present in the southern portion of the property and consists of marine silty fine-grained sandstone. Where observed, the sandstone appears massive to thickly bedded and moderately fractured. Impressions of marine shells were observed in the sandstone at test pit TP-14. According to Clark et al. (2000), this unit conformably overlies the Monterey Formation.

Monterey Formation (Tmd - Miocene) – This formation is present in the southern portion of the property and consists of diatomaceous sandy siltstone. According to Clark et al. (2000), the mapped outcrop is part of the upper unit of the Monterey Formation and is very thickly bedded to laminated.

Unnamed sandstone (Tuss - Miocene) – This unit is exposed in the northern portion of the property and is similar to the Santa Margarita Sandstone. The unnamed sandstone is composed of silty fine-grained micaceous sand and appears massive to thickly bedded.

2.5.3 Geologic Structure

Geologic structures mapped within the limits of the property include fracturing and inclined bedding planes within the bedrock formations along with broad westerly plunging folds. Regional geologic mapping by Clark et al. (2000) indicates that the northern portion of the property is transected by broad westerly plunging folds. However, bedding orientations within the unnamed sandstone suggest that these folds

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may not extend into the property. Bedding within the overlying continental deposits was observed to be near horizontal or dipping at low angles to the north-northwest.

2.5.4 Faulting

Based on the information provided in Hart and Bryant (1997) the site is not located within a State-designated, Alquist-Priolo Earthquake Fault Zone where site-specific studies addressing the potential for surface fault rupture are required and no known active faults traverse the site. The site area is situated within a region traditionally characterized by numerous active faults and high seismic activity.

An active fault is a fault that has experienced seismic activity during historic time (since roughly 1800) or exhibits evidence of surface displacement during Holocene time (Hart and Bryant, 1997). Faults considered to be active are shown in orange or red on the *Regional Fault Map*, Plate 5 (Jennings, 1994). The definition of "potentially active" varies. A generally accepted definition of "potentially active" is a fault showing evidence of displacement that is older than 11,000 years (Holocene age) and younger than 1.7 million years (Pleistocene age). These "potentially active" faults are shown in green or purple on Plate 5. However, "potentially active" is no longer used as criteria for zoning by the CGS. The terms "sufficiently active" and "well-defined" are now used by the CGS as criteria for zoning faults under the Alquist-Priolo Earthquake Fault Act. A "sufficiently active fault" is a fault that shows evidence of Holocene surface displacement along one or more of its segments and branches, while a "well-defined fault" is a fault whose trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The definition "inactive" generally implies that a fault has not been active since the beginning of the Pleistocene Epoch (older than 1.7 million years old).

The San Andreas fault is the nearest active fault shown on published maps by the CGS, and is located approximately 17 miles northeast of the property. Significant potentially active faults close to the site include the Chupines, Reliz-Rinconada, Monterey-Tularcitos and San Gregorio faults. Recent studies by Kleinfelder (2005) on

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the Chupines fault indicate that the movement along the fault may have occurred within the last 11,000 years (Holocene). A major seismic event on these or other nearby faults may cause substantial ground shaking at the site.

The Harper fault, which is considered inactive, transects Toro Regional Park, which divides the northern and southern portions of the property. A few miles south of the site, the Harper fault juxtaposes quartz monzonite of Pine Canyon against the Continental deposits, and then continues north beneath the alluvium of Toro Canyon.

2.5.5 Groundwater

The regional groundwater table lies over 100 feet below the surface of the main alluvial filled valleys on the property. Perched groundwater is present in local areas at depths varying from approximately 15 to 25 feet below the surface within the alluvial sediments. Springs are also present on the property, located on the hillsides and lower reaches of the hillside drainages.

2.6 GEOLOGIC AND SEISMIC HAZARDS

Hazards associated with geologic conditions and earthquakes include ground rupture along faults, strong ground shaking, landslides, liquefaction, flooding, and erosion. Other less common geologic hazards and impacts include volcanic eruptions and loss of mineral resources. Geologic and seismic hazards and impacts pose potential constraints to development of the land and often require some level of mitigation in order to reduce risks associated with development to an acceptable level. The following sections describe the more common hazards that are present at the site and provide guidance for reducing their potential impacts. Detailed geologic and geotechnical studies will be required in order to provide specific mitigation measures for future designs.

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2.6.1 Landslides

Landslides present on the property include both shallow and deep-seated type deposits. Landslides pose a significant impact to the stability of the proposed improvements including both lots and roadways. Shallow landslides, commonly referred to as mudflows, are typically fast moving and can damage and bury structures that are caught in their path. Structures located at the base of hillsides and the mouth of hillside drainages are susceptible to damage from such failures. Larger deep-seated type landslides are relatively slow moving events that often incorporate up to 10 feet or more of the underlying slope. Structures located within the limits of and adjacent to deep-seated landslides can sustain varying amounts of damage depending upon the rate and amount of movement. Factors often cited for contributing to the activation of landslides include long periods of intense rainfall, rises in groundwater levels, lack of slope maintenance, and poor control of surficial drainage.

Many of the landslides mapped on the property are classified as shallow earth flow and debris flow type deposits. The finer grained earth flow deposits, or mudflows, fill the bottom of many of the hillside drainages. The potential for mudflows to occur during intense rainstorms is considered high for all of the slopes within the property. Mitigation measures such as deflection walls, debris fences, slope reconstruction and others should be considered in the design-level geotechnical report and during the design and development of the property.

Deep-seated landslides within the property are located in the areas of Lots 80 through 85, 32 through 35, and 103 through 105. The most prominent of these deep-seated landslides is located under proposed Lots 80 through 85 and appears to involve bedrock. However, this landslide appears to be ancient (pre-Holocene, greater than 11,000 year old) based on its geomorphic aspects. The surface of the landslide is hummocky, but may have undergone significant erosion based on its moderately sloping surface. In addition, the middle and lower portions of the landslide appear to be underlain by relatively dense materials. Based on these preliminary observations, the landslide may be stable under the current site conditions, but could be reactivated by

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excessive grading or other conditions associated with development. The subsurface characteristics of the other deep-seated landslides located near Lots 32 through 35 and 103 through 105 are not known. Additional subsurface investigations and engineering stability analyses are recommended in order to assess the stability of these landslides. During grading of the project site, caution should be used in the vicinity of mapped or discovered landslide deposits. A qualified Engineering Geologist should be on site during grading operations on the slopes or in the vicinity of landslide deposits to observe landslide conditions as they are exposed and to make remediation recommendations as needed.

2.6.2 Ground Shaking

The project site will most likely be subjected to at least one moderate to severe earthquake (Magnitude 5.0 to 7+) and associated seismic ground shaking during the lifetime of the proposed development. More frequent earthquakes of less magnitude are more likely. The intensity of shaking will depend on the distance to the earthquake epicenter, the earthquake magnitude, and the response characteristics of the foundation materials. Some structural damage from stronger shaking can be expected.

In order to reduce the impact of ground shaking, structures should be designed in accordance with the applicable seismic design procedures for Seismic Zone 4 as defined by the 1997 UBC/2001 CBC and local building design requirements.

2.6.3 Liquefaction

Soil liquefaction is a phenomenon in which saturated, cohesionless or granular soils undergo a substantial loss in strength due to excess build-up of pore water pressure during cyclic loading such as that induced by earthquakes. The primary factors affecting the liquefaction potential of soil include: 1) intensity and duration of seismic shaking, 2) soil type and relative density, 3) overburden pressure, and 4) depth to water. Soils most susceptible to liquefaction are generally clean, loose, fine-grained sands that are saturated and uniformly graded. However, silty and clayey sands have

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also been known to be susceptible to liquefaction. The occurrence of liquefaction is generally limited to saturated soils located within about 50 feet of the ground surface.

Regional studies conducted by Monterey County (2004) indicate that the alluvial soils at the site have a high potential for liquefaction. The results of our preliminary subsurface investigation indicate that the Holocene age alluvial soils (map symbol: Qal) do have a potential to liquefy in localized areas where relatively loose soil materials are saturated. Areas of concern include the area adjacent to the intersection of San Benancio Road and Highway 68, where Lots 1 through 30 are proposed, and the area adjacent to proposed Lot 146. Both of these areas are underlain by alluvial soils where localized perched groundwater conditions were encountered. Additional subsurface investigations and engineering analyses should be conducted in these areas during future design-level studies in order to quantify the potential for and amount of liquefaction-induced settlement. Potential mitigation measures may include in-place densification of liquefiable layers, and removal and recompaction methods.

Other phenomenon associated with liquefaction and strong ground shaking include lateral spreading and dynamic compaction. The potential for these phenomenon to occur at the property during an earthquake is considered low, however, their potential should be addressed during future design-level studies.

2.6.4 Faulting and Surface Rupture

No known active faults transect the northern or southern portions of the property. The likelihood that surface rupture along a fault to occur during an earthquake is considered low. As such, no mitigation measures are considered necessary at this time.

2.6.5 Tsunami, Seiche, and Flooding

Flood hazards are generally considered from three sources that include tsunami and seiche, seismically related dam failure and 100-year storm events. The site is located at the northern extent of the Sierra de Salinas range and approximately 8 miles east of the Pacific Ocean. The northwest corner of the property near the intersection of

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Highway 68 and River Road is the lowest point on the site and rests at an elevation of approximately 65 feet above mean sea level. Based on the site's location, it is highly unlikely that it will be impacted by a tsunami. The property is not located downstream from any major lakes or reservoirs and is therefore unlikely to be impacted by a seiche or flooding due to seismically related dam failure.

Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) that cover the property, the majority of the site is located outside of the 100- year flood boundaries. The FIRM maps indicate that the majority of the site is situated within Zone C, which is defined as areas where minimal flooding could occur during 100-year storm events. A portion of El Toro Creek that is designated as Zone A7 runs through the western corner of the project site. According the FEMA Community Panel Number 0601950140D, this portion of El Toro Creek is an area inundated by a 100-year storm event for which base flood elevations within the creek channel range from 225 to 235 feet (based on the 1929 National Geodetic Vertical Datum). Although Lots #1 through #17 are located adjacent to the creek, they are proposed in an area designated as Zone C, which not within the 100-year flood zone (A7), and from 10 to 15 feet above the base flood elevations. Since no lots are proposed within Zone A7 this would be considered a less than significant impact.

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3 GEOTECHNICAL ASSESSMENT

3.1 GEOTECHNICAL PURPOSE AND SCOPE

The purpose of the geotechnical portion of our investigation was to explore and evaluate general subsurface conditions at the property and to develop general guidelines for planning and preliminary design for inclusion in the project EIR. Our scope of services for this geotechnical investigation included:

- Review of geotechnical information from previous investigations in the site vicinity and the findings from our geologic investigation.
- Performance of a field subsurface exploration program under the direction of our engineering staff. Our exploration program included 13 exploratory borings and 17 test pits, which were excavated as part of our geologic assessment.
- Laboratory testing of selected samples obtained from the borings to evaluate pertinent engineering properties of the site's soils.
- Engineering analysis of the field and laboratory data to prepare the conclusions and design guidelines contained in this report.
- Preparation of the geotechnical portion of this report.

The following sections contain general guidelines for project planning and preliminary design. When details on development of the project have been finalized, a design-level geotechnical investigation should be conducted for each lot to confirm and refine the guidelines in this report and to develop site- and project-specific design recommendations. The guidelines presented below are not intended to serve as final geotechnical recommendations for design and construction of the project.

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3.2 SUBSURFACE INVESTIGATION

Our field investigation consisted of a site reconnaissance and a subsurface exploration program consisting of 17 exploratory test pits and 13 exploratory borings at selected sites on the property. Details regarding our exploratory test pits are included in the Geologic Assessment section of this report. A key for the classification of the soil is presented in Appendix B as the *Boring and Test Pit Log Legend*, Plate A-1.

The exploratory borings (Borings B-1 through B-13, Appendix B) were drilled on November 6, 2006, through November 8, 2006, using a Mobile B53 truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. The borings were drilled to depths of between about 19 and 50 feet below the existing site grades. The approximate locations of the borings are shown on the *Preliminary Geotechnical Map* (Plates 3a and b). These locations were estimated based on pacing and measurements from existing site features and GPS methods.

Samples of subsurface soils were obtained from the borings as the drilling progressed. The samples were obtained by driving a 1-3/8-inch inside diameter standard penetration sampler or a 2-inch inside diameter Modified California tube sampler up to a depth of 18 inches into the underlying materials using a 140-pound hydraulic hammer falling 30 inches. The number of blows required to drive the sampler was recorded for each 6-inch penetration interval, and the number of blows required to drive the sampler the last 12 inches, or indicated interval, is shown as blows per foot on the boring logs at the approximate sample depth. The blowcounts presented on our boring logs are field measured blowcounts and have not been corrected for energy efficiency or other parameters. We also obtained one bulk sample of the near-surface soil from Boring B-4 for laboratory R-value testing. The borings were backfilled with drilling spoils after completion of drilling and sampling.

Visual classification of the soils encountered in our exploratory borings was made in general accordance with the Unified Soil Classification System (ASTM D2488) by our

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engineering staff. The results of the laboratory tests were used to refine the field classifications based on ASTM D2487. The logs of the borings are presented on Plates B-1 through B-13 in Appendix B.

3.3 LABORATORY TESTING

Soil samples were obtained from the exploratory borings at selected depths. The samples were returned to our laboratory for further evaluation. Laboratory tests were performed on selected soil samples to evaluate the natural moisture content, in-place density, Atterberg Limits, gradation, percent fines, and preliminary corrosivity screening. A bulk sample composed of near-surface soils from Boring B-4 was also obtained for laboratory Resistance Value “R-Value” testing. Most of the laboratory test results are presented on the individual boring logs. The results of the gradation tests are shown on Plates C-1 through C-6, Atterberg Limits tests on Plate C-7, , and R-Value on Plate C-8 in Appendix C.

Four soil samples collected from boreholes B-5, B-7, B-9, and B-11 at depths of 2 feet were submitted to Cerco Analyticval, Inc. in Pleasanton, California for corrosion testing. Cerco’s report (attached as Appendix D) indicates that the samples from soil borings B-7, B-9, and B-11 are classified as "moderately corrosive" and the sample from B-5 is classified as "negligibly corrosive." According to Cerco, all buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

Cerco also indicates in their report that the chloride ion concentrations reflect none detected with a detection limit of 15 mg/kg. The sulfate ion concentrations reflect none detected with a detection limit of 15 mg/kg. The pH of the soils range from 6.7 to 7.4 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

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Cerco states that the redox potentials range from 390 to 420-mV. Sample from boring B-11 is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions, and the remaining samples are indicative of aerobic soil conditions. The project applicant should consult with an experienced corrosion expert for a complete interpretation of Cerco's laboratory results.

3.4 EARTHWORK

3.4.1 Site Clearing and Stripping

Site clearing should include removal of existing improvements, stumps and primary roots of trees and brush, and other below-grade obstructions and deleterious material. Depressions, voids and holes (including those from removal of underground improvements) that extend below proposed finished grades should be cleaned and backfilled with acceptable material compacted to project specifications. Abandonment of existing wells should be in accordance with the requirements of local jurisdictions.

The test pits excavated for this investigation were loosely backfilled. These test pits should be located and the loose backfill should be removed and re-compacted as engineered fill.

Surface vegetation together with the organic-laden topsoil present at the time of grading should be stripped. Soils containing more than 3 percent of organic matter by weight or excessive visible organic material as determined by the Geotechnical Engineer should be considered organic. The actual stripping depth should be determined at the time of grading or by a design level geotechnical report. Stripped material should be removed from the site or stockpiled for use in landscaping areas if approved by the project landscape architect.

3.4.2 Excavations, Temporary Construction Slopes, Shoring and Dewatering

Shallow excavations in soils and soft rocks should be readily accomplished with conventional earth-moving equipment, depending on the amount of equipment wear

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and tear the contractor is willing to accept. Excavations in harder rocks may require special excavation techniques, such as blasting and/or jet hammering. Excavations should be constructed in accordance with OSHA and CAL-OSHA safety standards and local jurisdiction requirements.

The sides of trench excavations may be constructed vertical or at a slope if sufficient area is available. Vertical temporary excavations should be properly shored or braced for stability and personnel protection. Where the excavation perimeters will be sloped, the inclination should comply with CAL-OSHA guidelines. Design, installation, maintenance and removal of temporary shoring and bracing is the responsibility of the contractor, and may involve soldier piles and lagging (with or without tiebacks), or other appropriate systems.

Groundwater was encountered in the following borings at approximate depths indicated.

Boring	Initial Depth to Water (feet)	Elapsed Time (minutes)	Final Depth to Water (feet)
B-1	26.6	10	25.5
B-3	22.5	30	16.3
B-4	22.5	Note that Borings B-4 and B-10 were backfilled after drilling and that groundwater elevations may not have had time to stabilize.	
B-10	28.0		

We did not encounter free water in our other exploratory borings. In general, groundwater is not expected in shallow excavations for foundations and utility trenches; however, it is possible that at the time of construction that localized free water levels could occur at some excavation locations. We suspect that any free water that enters the excavations can be controlled by pumping.

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3.4.3 Subgrade Preparation

Soil subgrades in areas to receive engineered fills, concrete slabs-on-grade, foundation and pavements should be properly prepared. Subgrade preparation typically consists of a 6-inch to 12-inch deep scarification, followed by moisture conditioning and compaction to meet project specifications. Subgrade preparation should extend beyond the limits of improvements, at least 5 feet in building and slabs-on-grade areas, and at least 2 feet in pavement areas. After the subgrades are prepared, the areas may be raised to design grades by placement of engineered fill.

Soils with moisture content above the optimum value are typically encountered during earthwork construction, especially during and after rainy months. Wet soils will require mitigation during subgrade preparation. If the construction schedule does not allow for air drying, other means such as lime or cement treatment of the soil or excavation and replacement of the soil may be considered. Geotextile fabrics may also be used to help stabilize the subgrade. The method to be used should be determined at the time of construction by the Geotechnical Engineer.

Prepared soil subgrades should be non-yielding when proof-rolled by a fully loaded dump truck or similar weighted piece of equipment. Moisture conditioning of subgrade soils should consist of adding water if the soils are too dry and allowing the soils to dry if the soils are too wet. After the subgrades are properly prepared, the areas may be raised to design grades by placement of engineered fill.

3.4.4 "Non-Expansive" Fill

The near-surface soils encountered in our borings generally consisted of low plasticity gray to brown silty sand. These soils are considered to have a low expansion potential. Some medium to high expansive potential clay and silt soils were encountered more than 8.5 feet below the ground surface in our exploratory borings. If expansive soils are encountered within the upper 1 to 2 feet at the building sites and a post-tensioned foundation system is not used, concrete slabs-on-grade should be constructed on a

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layer of "non-expansive" fill meeting the requirements presented in the "Material for Fill" section below. Thickness of the "non-expansive" fill should be determined by the Geotechnical Engineer in the design-level geotechnical investigation. Typical thickness of "non-expansive" fill may vary from 12 to 24 inches.

3.4.5 Cut and Fill Slopes

As a preliminary design guideline, fill slopes and cut slopes in soil should be constructed at inclinations no steeper than 2.5:1 (horizontal:vertical). If slopes are as steep or steeper than 2:1 the slopes will generally require geogrid reinforcement in this material. A qualified engineering geologist should observe all cut slopes at the time of grading. If seepage or soft material is exposed at the cut slopes, mitigation measures such as subsurface drainage, flattening of the slopes, or slope reconstruction may be necessary.

Cut and fill slopes should be protected from erosion by a surface cover of vegetation such as by hydroseeding. The crests and toes of cut and fill slopes should be rounded to create smooth transitions into adjacent slopes. Drainage ditches should be implemented to help direct and control surface runoff. No water should be allowed to flow onto slopes in an uncontrolled manner.

3.4.6 Material for Fill

In general, on-site soils with an organic content of less than 3 percent by weight or without visible organic matter deemed excessive by the Geotechnical Engineer and free of deleterious materials or hazardous substances may be used as engineered fill except where prohibited. If expansive clays are discovered during site grading, the expansive clays should not be used as engineered fill in structural slopes and under building areas. Special materials including non-expansive fill (with plasticity index of 15 or less) and capillary break rock are recommended under the concrete slabs with moisture-sensitive flooring.

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Import fill material should be predominantly granular, should not contain rocks or lumps larger than 3 inches in greatest dimension and should not contain more than 15 percent of material larger than 1½ inches. The material should contain sufficient fines to allow excavations to be made without caving and should have a low expansion potential (as indicated by Atterberg limits, expansion index or other appropriate test). Expansive clay soils should not be accepted as import fill.

3.4.7 Fill Placement and Compaction

Fill materials should be placed and compacted in horizontal lifts each not exceeding 8 inches in uncompacted thickness. Compaction of fill should be accomplished by mechanical means only. Due to equipment limitations, thinner lifts may be necessary to achieve the recommended degree of compaction. "Relative compaction" or "compaction," as used in this report, is defined as the in-place dry density of the compacted soil divided by the laboratory-compacted maximum dry density as determined by ASTM D 1557, latest edition, expressed as a percentage.

If expansive clays are discovered during site grading, engineered fills consisting of expansive clay soil should be compacted to at least 90 percent relative compaction at a soil moisture content at least 2 percent above the laboratory optimum moisture content. Please refer to the “Material for Fill” section for restrictions on the use of on-site expansive clay soils. On-site or imported soils with low expansion potential should be compacted to at least 90 percent relative compaction at a soil moisture content above the laboratory optimum moisture content. In pavement areas, the upper 12 inches of subgrade soil should be compacted to at least 95 percent relative compaction at a soil moisture content above optimum value. Aggregate base materials in pavement areas should be compacted to at least 95 percent relative compaction at soil moisture content slightly above optimum value.

Fill placed on existing sloping ground with inclination steeper than 5:1 (h:v) should be properly keyed and benched into the existing slopes. The keys at the toes of the fill slopes should be at least 5 feet deep and 10 feet wide. The bottom of the toe key

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should slope down at least 2 percent toward its uphill side where a drain should be installed. Benches should be constructed by cutting into the existing slopes as the fills are being placed. Benches should be at least 5 feet wide and be spaced no more than 5 feet vertically. Material cut out of the benches may be mixed with the on-site soil (not imported fill) and compacted as engineered fill. The drain should be determined by the project Civil Engineer and design level Geotechnical Engineer.

3.4.8 Trench Excavation and Backfill

Shallow excavations in soils and soft rocks should be readily accomplished with conventional earth-moving equipment, depending on the amount of equipment wear and tear the contractor is willing to accept. Excavations in harder rocks may require special excavation techniques, such as blasting and/or jet hammering. Excavations should be constructed in accordance with OSHA and CAL-OSHA safety standards and local jurisdiction requirements.

The walls of utility trenches excavated into the near-surface sandy soils with little or no cohesion will require shoring or sloping of the sidewalls at a safe inclination to increase stability. In addition, excavations should be located so that no structures are located above a plane projected 1.5:1 (horizontal:vertical) upward from any point in the excavation, regardless of whether the trenches are shored or not. All excavations should be constructed in accordance with current OSHA safety standards. Safety in and around the site is the responsibility of the general contractor.

Pipe zone backfill, extending from the bottom of the trench to one foot above the top of pipe, should consist of free-draining sand unless concrete is specified. Above the pipe zone, underground utility trenches should be backfilled with on-site soil or imported soil. Imported sand should not be used as trench backfill on sloped areas to reduce the possibility of trench blow-out in the event that the trench becomes saturated due to subsurface seepage.

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Additionally, depending on the utility layout, lean concrete or clay plugs may be required at intervals along the utility trench alignment to reduce the possibility of trench blow-out. On slopes steeper than 5:1 (horizontal:vertical) or as directed by the geotechnical engineer, trench backfill should consist of a lean concrete slurry.

3.4.9 Surface Drainage

Final site grading should provide surface drainage away from the proposed structures, slabs-on-grade and edges of pavements to reduce the percolation of water into the underlying soils. Surface water should not be allowed to collect adjacent to structures and along edges of concrete slabs or pavements. Surface water should be directed away from exposed soil slopes. Rainwater from the roofs of the buildings should be conveyed through gutters, downspouts and closed pipes which discharge directly into the site storm water collection system or pavement. The sites slopes should not be denuded of vegetation or excessively irrigated.

3.4.10 Seepage Control

Where utility lines extend through or beneath perimeter footings or curbs at pavement areas, permeable backfill should be terminated at least one foot from the footings or curbs. Concrete or compacted clayey soil should be used around the pipes to act as a seepage cutoff. Beneath footings, the pipes should be "sleeved" through concrete cutoffs, and the annular space around the pipes should be filled with waterproof caulk. This will help reduce the amount of water seeping through the pervious trench backfill and collecting under the building or pavements.

Where slabs or pavements abut against landscaped areas, the base rock and subgrade soil should be protected against saturation. If landscape water or surface runoff is allowed to seep into the pavement section or subgrade, the service life of the pavement may be reduced. Subdrains behind curbs in landscape areas or vertical cut-off structures are recommended to reduce lateral seepage under pavements or slabs from adjacent landscaped areas. Vertical cut-off structures may consist of deepened curb

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sections, or equivalent, extending at least three inches below the baserock/subgrade interface. Subdrains should discharge to a proper outlet as determined by the project civil engineer. Cut-off structures should be constructed such that they extend below the base section and are poured neat against undisturbed native soil or compacted clayey fill. The cut-off structures should be continuous. Utility trenches (irrigation lines, electrical conduit, etc.) that extend through or under the curbs should be sealed with compacted clayey soil or poured in-place concrete. In addition, care should be taken to prevent over-watering of landscaped areas.

3.5 FOUNDATIONS

We understand that the project will be limited to residential structures. Details regarding building types and loads have not been determined at this time. For this feasibility-level report, we have assumed the proposed residential structures will have one or two stories, be of wood-framed construction, and have either concrete slab-on-grade or raised wood floors.

Based on the presently available information and for planning and preliminary design purposes, we believe that shallow foundations and drilled piers and grade beams foundations may be suitable foundation alternatives for the structures. Other foundations such as post-tensioned slabs may also be used if recommended by the design-level Geotechnical Engineer. Selection of a foundation type will depend on various factors, including building location, soil conditions, proximity to slopes, proximity to landslides or faults, design loads, the owner's expectation and budget, or other factors. These factors will vary from site to site and from owner to owner, and should be defined clearly at the onset of the design process.

Foundation design should satisfy three independent criteria with respect to foundation soils. First, the foundation should have an adequate safety factor against bearing failure with respect to the shear strength of the foundation soils. Second, the vertical movements of the foundation due to consolidation of the foundation soils should be

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within tolerable limits. Third, the foundation should not be located in areas where adverse physical, geologic and soil conditions can impact its performance.

Foundation excavations should be observed by the design level Geotechnical Engineer prior to placement of reinforcing steel and concrete. If unsuitable soils are encountered in the foundation excavations, the conditions should be mitigated as recommended by the project Geotechnical Engineer.

Selection and design of a suitable foundation system should be based on a design-level geotechnical investigation tailored to address the specifics of each site and building.

3.5.1 Shallow Foundations

Conventional shallow foundations (continuous and/or isolated footings) are typically suitable for structures that are constructed on level ground with sufficient setback from slopes, landslides, faults and other adverse soil and geologic conditions (such as expansive soils or compressible soils) that can impact performance of the structures.

For preliminary design, continuous and isolated footings founded on and constructed neat against undisturbed native soils and/or engineered fill may be sized using a net allowable soil bearing pressure of 2,500 pounds per square foot due to dead plus live loads, with a one-third increase when including transient loads such as wind or seismic. For sites without expansive clays and for preliminary planning purposes, footing widths should be a minimum of 12 inches for one story buildings and 15 inches for two story buildings. Footings should be embedded at least 12 inches below pad grade or lowest adjacent finished grade, whichever provides a deeper embedment for one story buildings and 18 inches for two story buildings. For sites with expansive clays, deeper footings may be required and could be 18 to 24 inches deep depending on the design level recommendations. Footings should be reinforced per the project structural engineer. Settlements under footings should be evaluated during the design-level geotechnical investigation.

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3.5.2 Drilled-Pier and Grade Beam Foundations

Pier and grade beam foundations may be considered for support of the proposed residential structures. Piers should consist of cast-in-place, reinforced concrete caissons designed to derive their vertical load-carrying capacity from end bearing. For preliminary design, an allowable end bearing value of 3,500 pounds per square foot may be used for dead plus live loading. This value may be increased by one-third when including short-term wind or seismic loading. For preliminary determination of uplift capacity, assume the weight of the piers plus a skin friction of 100 pounds per square foot. Capacity from the upper 2 feet of the piers should be ignored.

Piers should be structurally connected with grade beams (perimeter and interior) to form one structural element. Grade beams should be at least 12 inches wide. Perimeter grade beams should be embedded at least 12 inches below lowest adjacent grade. If expansive soils are encountered at the particular building location, a void, 4 inches deep, should be provided at the bottom of the grade beams to reduce the impact of soil expansion.

Piers should be at least 18 inches in diameter, should extend at least 12 feet in depth, and should be reinforced throughout their entire length. Piers located on or within 15 feet of slopes should be at least 24 inches in diameter and should extend to depths of at least 20 feet.

3.6 SLABS-ON-GRADE

3.6.1 Concrete Floor Slabs

Concrete slabs-on-grade for this project are anticipated to include building floor slabs and exterior flatwork. Slab control joints should be spaced in accordance with the recommendations presented in the ACI Manual of Concrete Practice. The actual slab thickness and reinforcement should be designed by a Structural Engineer.

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3.6.2 Moisture Vapor Transmission

In order to provide enhanced subgrade support, we recommend the compacted subgrade be overlain with a minimum 4-inch thick layer of compacted crushed rock or angular gravel. If this layer is desired to also serve as a capillary break, there should be less than 5 percent by weight passing the No. 4 sieve size. A capillary break may reduce the potential for soil moisture migrating upwards toward the slab.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building or pavement, this subsurface moisture will collect. The current industry standard is to place a vapor retarder on the compacted crushed rock layer to reduce the impact of the subsurface moisture and potential impact of future introduced moisture (such as landscape irrigation or precipitation). This membrane typically consists of visqueen or polyvinyl plastic sheeting at least 10 mils in thickness. It should be noted that although vapor barrier systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems will not necessarily assure that floor slab moisture transmission rates will meet floor-covering manufacturer standards and that indoor humidity levels will be appropriate to inhibit mold growth. The design and construction of such systems are totally dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the slab-on-grade floor design. Building design and construction have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Various factors such as surface grades, adjacent planters, the quality of slab concrete and the permeability of the on-site soils affect slab moisture and can control future performance. In many cases, floor moisture problems are the result of either improper curing of floors slabs or improper application of flooring adhesives. We recommend contacting a flooring consultant experienced in the area of concrete slab-on-grade floors for specific recommendations regarding your proposed flooring applications.

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Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling in the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

It is emphasized that we are not floor moisture proofing experts. We make no guarantee nor provide any assurance that the use of a capillary break/vapor barrier system will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for floor slab moisture protection.

Exterior grading will have an impact on potential moisture beneath the floor slab. Recommendations for exterior drainage are provided in the “Surface Drainage” and “Seepage Control” sections of this report.

3.6.3 Exterior Concrete Slabs-on-Grade

Proper moisture conditioning and compaction of subgrade soils is very important. Exterior concrete slabs-on-grade should be constructed on properly compacted subgrade or engineered fill soils. Even with proper site preparation there will still be some effects of soil moisture change on concrete flatwork. Exterior flatwork will be subjected to edge effects due to the drying out or wetting of subgrade soils where adjacent to landscape or vacant areas. Lateral cutoffs such as an inverted curb are suggested to help reduce edge effects. Control joints should be spaced on a maximum of 10-feet centers to reduce the potential for unsightly panel cracks as a result of soil displacement. The use of steel reinforcement will aid in keeping the control joints and any other cracks tightly closed.

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Exterior concrete slabs-on-grade (sidewalks, steps, etc.) should be cast free from adjacent footings or other non-heaving edge restraint unless the potential for differential movements between adjoining structural elements is a hazard. In this case, the slab should be structurally tied to the adjoining structural element. Where separation is used, it may be accomplished by using a strip of 30-pound felt divider material between the slab edges and the adjacent structure. Frequent construction or control joints should be provided in all concrete slabs where cracking is objectionable. Continuous reinforcing or dowels at the construction and control joints will also aid in reducing uneven slab uplift.

The processed subgrade soil in areas of exterior flatwork should be compacted as recommended in the "Fill Placement and Compaction," section above. Once the subgrade soils have been moisture conditioned and compacted, the near surface soil should not be allowed to dry out prior to concrete placement.

3.7 RETAINING WALLS

Retaining walls are expected for this project, although details such as wall location, type and dimension are not available at this time. For development of the following guidelines, we have assumed retaining walls for this project will be reinforced concrete cantilever walls less than 10 feet high.

Retaining walls should be designed to resist lateral pressures due to the adjacent soil and any surcharges caused by loads on the backfill side of the walls. For preliminary design, the following lateral soil pressures (expressed in terms of equivalent fluid weight) may be assumed depending on the retained soil type and the backfill slope inclination. We have assumed that expansive clayey soils will not be used for the retaining wall backfill. These values are for static loading only and for a fully-drained backfill. At-rest soil pressure applies where lateral movement of the top of wall is restrained or undesired. Active soil pressure may be assumed where lateral movement of the top of wall is allowed and resulting settlement of the backfill is acceptable.

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Lateral movement ranging from ½ to 1 percent of the wall height is generally necessary to achieve active soil condition.

Backfill Slope	Preliminary Equivalent Fluid Weight, Pounds per Cubic Foot			
	At-Rest Soil Condition (Restrained Wall)		Active Soil Condition (Unrestrained Wall)	
	Soil Backfill	Rock-like Backfill	Soil Backfill	Rock-like Backfill
2:1 (h:v)	90	70	55	45
3:1 (h:v)	75	60	45	40
4:1 (h:v)	65	55	40	35
Level	55	50	35	30

Surcharge loads on retaining walls may include loads from floors, foundations, vehicles, trees, etc. The magnitude of surcharge force should be determined when details such as type and magnitude of loads, distance and direction from the wall, etc. are available.

To simulate the effect of seismic loading on retaining walls, we recommend a horizontal line force equal to $11H^2$ pounds per lineal foot (where H is the full height of the wall) be used. The resultant force should be applied at 0.6H above the base of the wall. The above seismic earth pressure value is for walls with level backfill. A reduced factor of safety for overturning and horizontal movement can be used when analyzing for seismic loading.

Backfill against retaining walls should be compacted to project specifications. Over-compaction should be avoided because increased compactive effort can result in lateral pressures significantly higher than those listed above.

Retaining walls should be fully drained to reduce the potential for build-up of hydrostatic pressure. A typical drainage system consists of a 1 to 2 foot wide zone of crushed, free draining gravel (with less than 5 percent fines) immediately adjacent to the wall. The

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drain rock should be wrapped in a woven geotextile filter fabric, such as Mirafi 700X or equivalent, or Caltrans Class 2 Permeable Material (Caltrans Standard Specifications, Section 68). A minimum 4-inch diameter, perforated, Schedule 40 PVC pipe should be placed with the perforations faced down in the lower portion of drainage blanket. The pipe should slope and discharge to a storm drain or other discharge facility. As an alternative, a prefabricated drainage board such as Miradrain or equivalent maybe used in lieu of the Class 2 Permeable Material or filter-wrapped drain rock.

Prefabricated drainage material (such as Miradrain® 2000 or an approved alternative) may be used behind retaining or below-grade walls. Prefabricated drainage material should be installed in accordance with the manufacturer's recommendations.

We recommend that design drawings of retaining walls showing height of wall, backfill material type, drainage details and the earth pressures used in design be reviewed by the Geotechnical Consultant of Record for conformance to their recommendations prior to wall construction. Certain proprietary wall systems, such as reinforced earth walls, segmental block walls, and criblock walls, are design-built systems requiring close coordination with the Civil Engineer on drainage outlets and connections. If any proprietary walls are planned, we recommend that the Geotechnical Consultant of Record review the type of wall proposed and make alternate appropriate lateral earth pressure recommendations for these walls. Furthermore, we recommend that the Geotechnical Consultant of Record be retained to review design plans prior to issuance for construction.

3.8 PAVEMENTS

3.8.1 Flexible Pavements

Pavements for the project are expected to consist of roads, driveways and parking areas. A bulk sample of the near surface soil from Boring B-4 was obtained from the site during our field investigation for laboratory R-value testing. The results of our laboratory testing indicate an R-value of 69. The recommended pavement sections

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presented in the table below are based on the Caltrans design method, which includes a factor of safety applied to the asphalt thickness. Based on our experience with similar projects, we assumed a Traffic Index (TI) of at least 4.5 for automobile parking areas, a TI of at least 5.5 for automobile and light truck traffic lanes, and a TI of at least 6.5 for heavy truck traffic areas, such as for garbage trucks. We anticipate that site access roads will have a TI of approximately 7.0 to 7.5. This recommendation should be verified by the project Civil Engineer and design level Geotechnical Engineer. For heavy vehicle areas, a minimum asphalt concrete section of 3 inches is recommended.

FLEXIBLE PAVEMENT SECTIONS ASPHALT CONCRETE PAVEMENT DESIGN R-VALUE = 69			
	Alternative 1		Alternative 2
T.I.	AC	AB	Full Depth AC
4.5	2.5	4.0	3.0
5.0	2.5	4.0	3.5
5.5	3.0	4.0	3.5
6.0	3.0	4.0	3.5
6.5	3.5	4.0	4.0
7.0	3.5	4.0	4.5
7.5	4.0	4.0	5.0
8.0	5.0	4.0	5.5
Note: Thicknesses shown are in inches. AC = Type A or B Asphalt Concrete AB = Aggregate Base (Minimum R-Value = 78)			

The anticipated traffic and the alternate pavement sections presented above should be reviewed by the project Civil Engineer in consultation with the owner during the development of the final grading and paving plans. We have made our pavement designs based on the pavement subgrade soil consisting of existing on-site gray silty sand surface material. If site grading exposes soil other than that utilized in our analysis, we should perform additional tests to confirm or revise the recommended pavement sections to reflect the actual field conditions.

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Subgrade preparation and engineered fill installation in pavement areas should be performed as discussed in the "Earthwork," section. Compacted pavement subgrade should be non-yielding. Removal and subsequent replacement of some material (i.e., areas of excessively wet materials, unstable subgrade, or pumping soils) may be required to obtain the minimum 95 percent compaction to the recommended depth.

Asphalt concrete should meet the requirements for 1/2- or 3/4-inch maximum, medium Type A or Type B asphalt concrete in vehicle areas. Asphalt concrete should comply with the specifications presented in Section 39 of the CalTrans Standard Specifications, latest edition. Class 2 aggregate base materials should conform with Section 26 of the CalTrans Standard Specifications, latest edition, with a minimum R-value of 78. Class 2 aggregate base should be compacted to at least 95 percent relative compaction at a soil moisture content slightly above the optimum moisture content. Asphalt concrete should be compacted to a minimum of 96 percent of the maximum laboratory compacted (Hveem) unit weight. ASTM test procedures should be used to assess the percent relative compaction of the pavement subgrade soils, aggregate base and asphalt concrete.

Pavement surfaces should be sloped at a minimum of 2 percent and drainage gradients maintained to carry all surface water off the site due to the slightly porous or permeable nature of asphalt concrete. Surface water ponding should not be allowed anywhere on the site during or after construction.

3.8.2 Rigid Concrete Pavements

Rigid pavements consisting of Portland cement concrete may be considered for use along portions of the proposed roads, driveways and parking areas.

Using the results of our laboratory R-value test and the Portland Cement Association Simplified Design Procedure, we recommend the use of a minimum concrete pavement thickness of 6.5 inches in areas subjected to occasional heavy truck traffic, and 5.0 inches in areas where only light cars and pickup trucks will be used. Our design is

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based on a modulus of subgrade reaction of 180 pounds per cubic foot (pci) at the top of the compacted subgrade, with doweled joints or aggregate-interlock joints and no concrete shoulder or curb, and a modulus of rupture for the concrete of 600 pounds per square inch. Where a concrete shoulder or curb is used, these minimum concrete pavement thickness may be reduced to 5.5 and 4.0 inches respectively. It should be noted that the modulus of rupture for concrete is based on flexural strength, not compressive strength, and should be specified accordingly. Concrete with a compressive strength of 3,000 psi is not expected to provide the desired flexural strength. Our experience is that the compressive strength will have to be on the order of 4,500 to 5,000 psi to achieve the required flexural strength. Laboratory testing to evaluate the design strength is recommended. Alternatives to this design may be considered, based on the final design of the site grading plans and more accurate traffic data.

The top 12 inches of subgrade soil in Portland cement concrete pavement areas should be moisture conditioned and compacted to at least 95 percent relative compaction at a soil moisture content slightly above the optimum moisture content. The compacted subgrade should be non-yielding. Portland cement concrete pavements may be constructed directly on compacted subgrade soil.

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4 HYDROGEOLOGIC ASSESSMENT

This section presents a preliminary hydrogeologic assessment of the Ferrini Ranch property, and is not intended to be a final hydrogeologic study of the site, or to provide design guidance. To provide an up-to-date and thorough water-source assessment, a project-specific hydrogeologic study should be completed. The scope of this Hydrogeologic Assessment section for the proposed Ferrini Ranch Subdivision consisted of the following:

- A site reconnaissance by a Certified Hydrogeologist and Certified Engineering Geologist;
- A review of project plans provided by PMC and review of readily available area maps;
- Obtaining, compiling and reviewing readily available documents related to hydrogeologic conditions at the site and the general area. Items that were compiled and reviewed included previous reports prepared by consultants, geological maps, topographic maps, and aerial photographs;
- Telephone interviews with Cal Water and Monterey County Water Recourses Agency personnel to evaluate project water source(s);
- Assessment of the water demand for the project; and
- Assessment of water quality for the area and groundwater-quality trends;

4.1 BACKGROUND

The Ferrini Ranch property is located within the California Water Service Company (Cal Water) service area which will serve water to the proposed development. In a letter dated November 23, 2004 (Appendix E), Mr. Michael Jones of Cal Water states that "Cal Water will provide service for domestic use and fire protection (for the Ferrini Ranch Subdivision) pending approval of the service area map by the Public Utilities Commission."

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In discussions with Mr. Jim Smith of Cal Water on February 21, 2007, he indicated that water delivered to the proposed Ferrini Ranch subdivision probably will be provided by boring under Highway 68 and connecting to a water line that services the El Toro residential development on the north side of the highway. However, he also stated that an engineering study would need to be completed before a specific water route could be identified. He indicated that water would not be derived from the Salinas Groundwater Basin. He further indicated that of the four wells in the El Toro development, three have been "lost" due to high arsenic content and the forth well was no longer used because its efficiency had dropped to an uneconomical level. The water that is provided to the El Toro development and that will be provided to the Ferrini Ranch subdivision will be collectively sourced from Cal Water's system wells that are located within the El Toro water basin between River Road and Indian Springs.

Mr. Smith stated that, based on his understanding, application of Zone 2c requirements should not affect groundwater use at the Ferrini Ranch property. Mr. Howard Franklin of the Monterey County Water Resources Agency (MCWRA) indicated that he did not know about possible influence of Zone 2c requirements to the site. The Salinas Valley Water Project web page of the MCWRA does not show the El Toro area to be impacted by zone requirements within the Salinas Groundwater Basin.

A study to reevaluate and update the El Toro groundwater basin has recently been contracted by the MCWRA. We have contacted the investigators for that study and have been told that the study is not far enough along to add new or relevant information to the Ferrini Ranch project.

4.2 INVESTIGATIVE METHODS

Our hydrogeologist reviewed readily available published reports, maps, and other technical documents which are listed below or in the attached list of References. Hydrogeologic research for this investigation included review of available documents from the Monterey County Health Department and Monterey County Water Resources Agency including the following:

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- *Toro Vista Project, Environmental Resources, Survey Report*, prepared by Westec Services, Inc., May 14, 1975.
- *Final Report, El Toro Area Groundwater Study,* Prepared by Anderson-Nichols & Co., Inc., for Monterey County Flood Control and Water Conservation District, October 1981
- *Preliminary Site Analysis, Toro Vista, Monterey County, California, prepared by McKay & Somps, July 1990.*
- *Hydrogeologic Update, El Toro Area, Monterey County, California*, prepared by Staal, Gardner and Dunne Inc., August, 1991.
- *Preliminary Hydrogeologic Assessment, Toro Vista Area, Monterey County*, prepared for Bollenbacher & Kelton, Inc., Fugro & McClelland, March 1993.
- *Additional Hydrogeologic Update, El Toro Area, Monterey County, California*, prepared by Fugro West, Inc., February 1996.
- *Luguna Seca Subarea, Phase III Hydrologic Update,* by Yates, E.B., Feeney, M.B., and Rosenberg, L.I., prepared for Monterey Peninsula Water Management District, November 2002.

4.3 PREVIOUS HYDROGEOLOGIC STUDIES IN THE PROJECT AREA

The reports listed above pertain to hydrogeologic conditions in the El Toro and Luguna Seca areas. Our review of previous hydrogeologic reports covering the El Toro area points out several disagreements between the various authors. The successive reports are a sequence of progressively more rigorous investigations; each building on the findings and conclusions of the last. A brief review of the previous findings for the El Toro area follows.

4.3.1 Westec Services, Inc., 1975

The Toro Vista Project report by Westec Services describes a Master Plan Concept to develop approximately 925 acres southeast and adjacent to State Highway 68.

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Appendix F of the report discusses alternative water sources for the development including several possible pipeline alignments to the site. The discussion regarding existing water supply systems is now outdated because of the redistribution of well and transmission ownership. This information is updated in subsequent reports.

4.3.2 Anderson-Nichols & Co., Inc., October 1981

The Final Report, El Toro Area Groundwater Study by Anderson-Nichols & Co., Inc. (October 1981) includes descriptions of the Corral de Tierra and Watson Creek watersheds. Pertinent conclusions of the report are:

- Overall quantity and quality of the groundwater supply in the El Toro area was considered sufficient to meet the demands of both the current population and the population projected for full development.
- Continuation of the existing moratorium (B-8) on subdivision within the El Toro area was not considered warranted by existing or projected groundwater conditions. There were no existing problems found with the overall groundwater supply that would justify such an area-wide restriction.
- Drops in water levels in wells in El Toro were attributed to the drought of the mid-1970's and to localized conditions and were not linked to a generalized overdraft condition.

4.3.3 MacKay & Somps, 1990

The MacKay & Somps Preliminary Site Analysis is a planning document that briefly refers to the water supply for the Toro Vista project site. The report states that the site was annexed in 1977 to Zones 2 and 2A of the Monterey County Flood Control and Water Conservation District. This annexation is explained to allow extraction of water from the El Toro groundwater basin. The report updates ownership of water-system sources and describes alternate routes of transmission lines.

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4.3.4 Staal, Gardner & Dunn, Inc., August 1991

Subsequent investigations by other authors suggest that several of the findings in the Anderson-Nichols & Co., Inc. report (October 1981), while potentially correct considering the data available at the time, have been found, based on more recent data, to be overly optimistic. The Staal, Gardner & Dunn, Inc. (August 1991) report concludes that local groundwater supply problems exist at the time of their study in some portions of the study area. According to Staal, Gardner & Dunn, Inc. (August 1991), groundwater supply problems will occur in parts of the study area unless build-out densities are reduced. Supply problems outlined include or a projected decline in groundwater table, and quality issues.

4.3.5 Fugro & McClelland, 1993

The Preliminary Hydrogeologic Assessment of the Toro Vista Area by Fugro & McClelland presents a water-balance analysis for the site now known at the Ferrini Ranch. The hydrogeologic assessment for the 1993 study was based on development of 482 homes which is about twice the density of the present Ferrini Ranch subdivision proposal. The report concludes, based on water supply availability either from the ground-water resources on the project property or from the adjacent Salinas Ground Water Basin, that a viable long-term water supply is available for the proposed project. Although the density of residential development and potential groundwater sources have changed since the Fugro & McClelland (1993) report was completed, its basic findings are used where appropriate in this preliminary hydrogeologic assessment. Our assessment of water availability for the Ferrini Ranch subdivision is based on updates of the Fugro & McClelland (1993) report.

4.3.6 Fugro West, Inc., 1996

In February 1996, Fugro West, Inc. presented its report "*Additional Hydrogeologic Update, El Toro Area, Monterey County, California"* to the Monterey County Water Resources Agency. This study attempts to present a refinement of water demand

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estimates, and reevaluation of groundwater recharge for the El Toro area. Fugro West, Inc. (1996) recommended that the B-8 regulation be revised to apply only to the area south of the Chupines fault (Calera subarea).

4.3.7 Yates, Feeney and Rosenberg, November 2002

Although the Phase III, Laguna Seca hydrogeologic study (Site Vicinity Map, Plate 1) concerns the groundwater basin west of El Toro, there is evidence of hydrogeologic connectivity between the two basins. Further, Yates and others (2002) presents data that pertains to and updates observations within the El Toro area.

4.4 PROJECT GROUNDWATER SOURCE AND AQUIFER STRATIGRAPHY

Water for the proposed Ferrini Ranch Subdivision is to be provided by the California Water Service Company probably by tapping water-transmission lines that presently exist on the northwest side of State Route 68. According to our telephone interview with Mr. Jim Smith of Cal Water, the water will be sourced from a variety of wells located between River Road and Indian Springs. The general locations of wells monitored by the Monterey County Water Recourses Agency within a two-mile radius of the Ferrini Ranch property are depicted on *Monitored-Well Location Map*, Plate 7. However, the precise wells that will supply water to the Ferrini Ranch Subdivision were not specified by Cal Water. Because the locations of wells to be drawn from for the proposed subdivision are not specified and because the water can be drawn from several wells at any given time, it is not possible in this study to determine what affect, if any, pumping will have on other nearby wells.

The site is located in the north extent of the Sierra de Salinas Range and south of the former Fort Ord military reservation. In general, the geology of the site and adjacent areas consists of dissected and infilled older (Holocene) stream channels surrounded by Plio-Pleistocene age non-marine Continental deposits on the hillsides and ridges. The flatlands along the northwest margin of the Ferrini Ranch property consists of Holocene age (less than 11,000 years old) Older Flood Plain Deposits. The deposition

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of the flood plain material is the result of the proto-El Toro Creek sweeping across its fluvial plain depositing sediment derived from the igneous and continental sedimentary rocks south and southeast of the site.

The earth materials underlying the El Toro Creek floodplain, mapped by Clark, Brabb, Rosenberg, (2000) as Older Flood Plain Deposits are described as relatively fine-grained, heterogeneous deposits of sand and silt, commonly including relatively thin layers of clay. Most of the hillside uplands of the project site are supported by undivided Pleistocene-Pliocene(?) age Continental deposits.

The Continental deposits lie unconformable upon the Santa Margarita Sandstone and locally upon quartz monzonite (Clark, Brabb, Rosenberg, 2000). The units consist of a series of nonmarine, semiconsolidated, oxidized, poorly sorted, fine- to coarse-grained, sand beds with common pebble and cobble gravel interbeds. Gravel clasts are angular to subangular and consist of granitic rocks, mica schist, quartzite, and locally Monterey Formation porcelanite and chert. Duripan (hardpan) horizons are common in these deposits and weather into prominent ledges, which locally form a barrier to shallow infiltration resulting in debris flows. Herold (1935) estimated the continental deposits to be as much as 700 feet thick along San Benancio Gulch near the south end of the site. A deep water well (MPWMD #5) just north of State Route 68 near the western margin of the quadrangle penetrated 1,100 feet of the Continental deposits before reaching the Santa Margarita Sandstone (Staal, Gardner & Dunne, Inc., 1991). For a more detailed description of the geologic units and structures in the area of the Ferrini Ranch see section 2, Geologic Assessment.

In the vicinity of the project site, Anderson-Nichols & Co (1981) indicate that the alluvial deposits (Qal, Qof, Qyf) are about 50 feet thick, the Continental deposits (QTc) about 300 feet thick, and the Santa Margarita Formation (Tsm) about 200 feet thick. This is a combined groundwater reservoir of about 550 feet thick (although not all of this thickness is available for storage nor are the deposits sufficiently interconnected everywhere to provide groundwater to wells). Other estimates put aquifer thickness at

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700 feet (Herold, 1935) and greater than 1,100 feet (MPWMD). Previous investigations suggest that these aquifers are in some part hydrogeologically contiguous beneath the watershed subareas of Corral de Tierra, San Benancio, Watson Creek, El Toro, at least the eastern portion Laguna Seca, and Calera Canyon (north of the Chupines fault). Available data describing which geologic units are tapped by the wells in the El Toro area is scarce or absent.

4.5 WELL-DATA SOURCES AND GROUNDWATER TRENDS

To examine the groundwater behavior in the El Toro area, data for wells within a two-mile radius of the project site, provided by MCWRA, were reviewed. The locations of these wells are depicted on the *Monitored-Well Location Map*, Plate 7. The agency also has provided water-level measurement data for these wells extending over periods of up to sixty-one years. The water levels of the wells in the San Banancio area provided by MCWRA were plotted to evaluate trends in water elevations over the monitored periods. Plate 8, *Groundwater Trends, San Banancio Area* presents plots for well numbers 14, 15, 16, 18, and 25 which are shown on Plate 7. Plate 9, *Groundwater Trends, Corral de Tierra Area* presents plots for well numbers 17 and 19 through 24 also shown on Plate 7.

The trend line extending through each water-level plot on Plates 8 and 9 is a logarithmic-best-fit line showing the overall trend of the measurements. In all cases (except well number 20), the data for the monitored wells provided by MCWRA in the San Banancio and Corral de Tierra areas show a downward trend. Using the data provided by the MCWRA (with the exception of well number 20), the average downward trend (over-draft condition) in the El Toro water-source area ranges from about ⅓ of a foot per year to almost 2 feet per year and averages almost a foot per year as summarized in the following table.

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San Banancio Area Wells			
* Well No.	Years measured	Total water-level change (ft)	Avg. water-level change/yr (ft)
14	38	-20	-0.53
15	45	-85	-1.88
16	45	-14	-0.31
18	33	-11	-0.33
25	45	-18	-0.40
	Avg.:	**-30**	**-0.69**

* Well No. refers to wells shown on Plate 7

Corral de Tierra			
* Well No.	Years measured	Total water-level change (ft)	Avg. water-level change/yr (ft)
17	45	-24	-0.53
19	43	-50	-1.16
20	41	14	0.34
21	45	-31	-0.69
22	36	-50	-1.39
23	41	-39	-0.95
24	38	-67	-1.76
	Avg.:	**-30**	**-0.88**

The behavior of well number 20, located at the confluence of Harper and San Banancio Creeks, differs substantially from that of other nearby wells (for unknown causes), and is therefore neglected in the above calculations.

4.6 AREA RAINFALL

To evaluate possible increase or decrease of influence of rainfall to water available in the El Toro area, we reviewed rainfall history for the area. The Western Regional Climate Center (http://www.wrcc.dri.edu/index.html) references three weather stations within a ten-mile radius of the Ferrini Ranch. The Carmel Valley station is located about seven miles south of the project site in a watershed separated by the 2,100-foot high

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Los Laurelles ridge. The Monterey station is about 7½ miles west of the site and the Salinas station is about five miles northeast of the site. The Carmel and Monterey stations are influenced by coastal marine climate and both receive more rainfall than the Salinas station. The Salinas station is inferred to more closely reflect climate conditions in the Ferrini Ranch area and is used in the following analysis.

Figure 4.6-1, *Annual Rainfall* shows rainfall at the Monterey and Salinas Airports since 1949. The heavy dashed lines in the figure represent the log trend of the annual rainfall at these stations. The log trend of rainfall at the Monterey station has increased from about 16-inches per year to about 21-inches per year over the recorded period. The Salinas station shows a more consistent level of rainfall of about 12-inches per year over the 57 year period.

As depicted in Figure 4.41, rainfall was below the 57-year norm for the nine years proceeding 1993. The below average rainfall recorded at the Salinas airport correlates well with drought conditions that existed in the Salinas / Monterey area and throughout most of northern California from 1987 through 1991 (Department of Water Resources, December 1991). Figure 4.1 also shows that rainfall has increased since 1988 and has been near average or higher than average from about 1991 through 1998 (with the exception of light rain years about 1996 and 2002). Given the relatively constant quantity of rainfall over the past 57 years near Salinas, minor changes in climatic conditions are not expected to affect levels of groundwater in the area.

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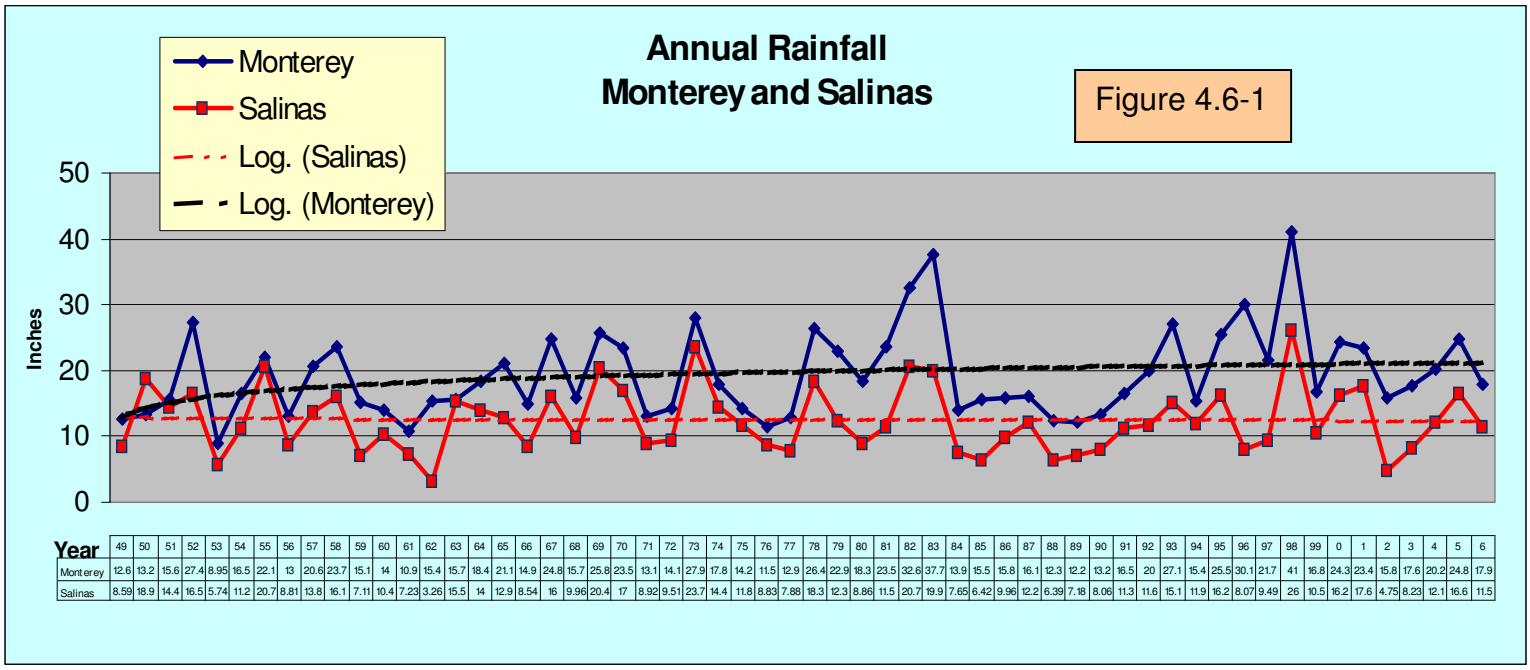

Year	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	0	1	2	3	4	5	6
Monterey	12.6	13.2	15.6	27.4	8.95	16.5	22.1	13	20.6	23.7	15.1	14	10.9	15.4	15.7	18.4	21.1	14.9	24.8	15.7	25.8	23.5	13.1	14.1	27.9	17.8	14.2	11.5	12.9	26.4	22.9	18.3	23.5	32.6	37.7	13.9	15.5	15.8	16.1	12.3	12.2	13.2	16.5	20	27.1	15.4	25.5	30.1	21.7	41	16.8	24.3	23.4	15.8	17.6	20.2	24.8	17.9
Salinas	8.59	18.9	14.4	16.5	5.74	11.2	20.7	8.81	13.8	16.1	7.11	10.4	7.23	3.26	15.5	14	12.9	8.54	16	9.96	20.4	17	8.92	9.51	23.7	14.4	11.8	8.83	7.88	18.3	12.3	8.86	11.5	20.7	19.9	7.65	6.42	9.96	12.2	6.39	7.18	8.06	11.3	11.6	15.1	11.9	16.2	8.07	9.49	26	10.5	16.2	17.6	4.75	8.23	12.1	16.6	11.5

4.7 WASTE-WATER DISCHARGE

Mr. Thomas Adcock of the California Utilities Service, Inc., a wastewater treatment company located in Salinas, California, has indicated by telephone interview that the proposed Ferrini Ranch subdivision is within the certified service area of the utility and that the utility will provide sewer service to the development once a contract is in place between the developer and the utility. California Utilities has indicated (personal communication, December 7, 2006) that effluent entering the sewer system will be transported to the treatment facility on Reservation Road about ½ mile from the northwest corner of the Ferrini Ranch project site. The treatment facility at Reservation Road is permitted for treatment of 300,000 gallons of sewage per day and is currently treating approximately 220,000 gal/day. After treatment, the water will be discharged to alluvial sediments in the Salinas River Valley Groundwater Basin.

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4.8 PROJECT WATER DEMAND

4.8.1 Residential and Commercial Demand

According to plans provided by PMC, the proposed Ferrini Ranch Subdivision is a 212-residential-unit project consisting of 66 cluster or inclusionary units, 129 single-family units on less than one acre each, 15 units on more than one acre each, one lot of 72.38 acres, and one commercial-use lot. The proposed average lot size is 1.22 acres.

The March 1993 Fugro & McClelland Preliminary Hydrogeologic Assessment for the Toro Vista Area includes discussions of estimates of water demand for different classes of residential lot sizes and land uses. The water demand per unit in this analysis is based on water-use factors derived from the Las Palmas and Hidden Hills developments which incorporate building codes that require water-efficient plumbing fixtures. The table below lists the various proposed categories of land use for the Ferrini Ranch property and incorporates expected gross demand values described above.

Residential Lot Size or Land Use	* Gross Demand Per Unit (ac-ft/yr**)	Number of Proposed Units	Project Gross Demand (ac-ft/yr)
Cluster and Inclusionary	0.25	66	16.5
Less than 1 acre	0.3	129	38.7
1 to 10 acres	0.4	15	6
Greater than 10 acres	1.7	1	1.7
Commercial	1	1	1
		TOTAL:	**63.9**

* From Fugro & McClelland (1993)

** ac-ft/yr = acre feet per year

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Assuming an average return from irrigation estimate of about 0.034 ac-ft/yr/unit (modifying values from Fugro & McClelland (1993)), the total return from irrigation for the 212 proposed units is about 7.2 ac-ft/yr. Using the number and types of domestic and commercial uses for the proposed subdivision and the estimated water demand and return values, the estimated total water demand for the project, as proposed, should be about 57 ac-ft/yr. Existing use of the portions of the Ferrini Ranch property for range-land grazing outside of the residential, commercial, and roadway development areas is assumed to remain the same as before development so that there should be no net increase or decrease of water uses in these areas.

From the perspective of a water-balance analysis, the development, as proposed, will derive its water from Cal Water's wells in the El Toro area and its waste water will be transported via California Utilities Service, Inc., sewer pipeline to the treatment facility on Reservation Road where the treated water will be discharged to the alluvial sediments of the Salinas Valley Groundwater Basin. Drainage from hard surfaces (roofs, roadways and other paved or impervious surfaces) resulting from the subdivision development is expected to be discharged to the porous sediments on the property. On-site recharge of storm water from these impervious surfaces after the site is developed should result in only minor change to local recharge. The Fugro & McCalland (1993) report assumes that requirements of Covenants, Coventries and Restrictions (CC&Rs) will be enforced by permit to constrain project water use. Therefore, the residential and commercial development of the Ferrini Ranch should have the affect of removing about 57 ac-ft/yr from the local groundwater system.

4.8.2 Fire Flow

Chapter 6.0 (SAFETY ELEMENT) of the Monterey County General Plan briefly describes requirements that affect required water "peak load" for fire protection for all new private subdivision include the following.

Policy HS-3.5 Water Supply Systems for Fire Suppression — The County and the fire authority having jurisdiction shall ensure that on-site fire protection peak load water

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supply systems are installed. Water systems constructed, extended or modified to serve a new land use, or an intensification of land use, shall be designed to meet, in addition to the average daily demand, the National Fire Protection Association's Standard 1142 and/or other adopted codes and standards. All new swimming pools should be plumbed to allow connection to fire fighting equipment. if required by the fire authority having jurisdiction.

New development shall be required to have adequate water systems to facilitate fire suppression. Where minimum water supplies are not available, alternate fire protection measures, including but not limited to automatic fire sprinkler systems. should be incorporated into the development as required by the fire authority having jurisdiction.

In its letter of November 23, 2004 (Appendix E), Cal Water states that "Cal Water will provide service for domestic use and fire protection (for the Ferrini Ranch Subdivision) pending approval of the service area map by the Public Utilities Commission."

4.8.3 Project Water Availability Conclusion

Groundwater in the El Toro area apparently has been in a state of overdraft for at least the last 45 years. Water for the Ferrini Ranch subdivision is proposed by Cal Water to be drawn from wells in the El Toro area. Unless other sources of water are used for the project, the inevitable conclusion is that any new homes developed in the El Toro area will increase the existing overdraft condition.

It is our experience that Monterey County Water Resources Agency does not consider "overdraft pumping" to be an acceptable long-term, sustainable water source. In the case of cause of additional aquifer overdraft, the County may rule that the impact of the decrease be avoided or minimized to the extent practicable or the County may rule on the requirement that the proposed development not show a negative impact to the environment.

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4.8.4 Project Water-Source Summary

The following table presents a summary of differences between the currently proposed Ferrini Ranch subdivision and the Toro Vista subdivision presented in the 1993 Fugro & McClelland report with respect to conditions relating to water use for the projects.

Fugro & McClelland report (1993)	This report (2007)
Number of water tie ins.	
482 homes consisting of: 99 single-family units at a density of 3.1/ac 140 single-family units at a density of 4.4/ac 72 multi-family units at a density of 4.8/ac 65 single-family units at a density of 0.8/ac 97 single-family units at a density of 1.9/ac 9 single-family units at a density of 0.5/ac	212 residences and one commercial lot: 66 Cluster and Inclusionary units 129 single-family units of less than 1 acre 15 single-family units of 1 to 10 acres 1 single-family lot of 72.38 acres 1 Commercial property
Water Source	
Water sourced from on property or from Salinas Groundwater Basin	Water sourced from several wells in the El Toro area operated by Cal Water
El Toro Groundwater Trends	
"General declining trend" "wells have fallen an average of 20 to 30 feet" over 11 year period.	Of the five wells in the San Banancio area monitored by the MCWRA all show a downward trend (average -35 feet) over the past 45 years.
Change in Rainfall	
Average rainfall at Toro Regional Park was 13.77. Long-term trend not evaluated.	Very little change in average rainfall of about 13 inches annually at the Salinas Airport over 57 year record

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Fugro & McClelland report (1993)	This report (2007)
Waste-Water Discharge	
Assumes on-site treatment and recharge via irrigation of common landscape areas.	Waste water will be transported to treatment plant located in the Salinas Groundwater Basin to recharge there after treatment
Project Net Water Demand	
147 ac-ft/yr	57 ac-ft/yr
Long-Term Water Availability Conclusion	
A viable long-term water supply is available for the proposed (Toro Vista) project.	Unless other sources of water are are made available for the project, new homes developed in the El Toro area will increase the existing overdraft condition. It is our experience that Monterey County Water Resources Agency does not consider "overdraft pumping" to be an acceptable long-term, sustainable water source. However, to allow the proposed development, the County may rule that the impact of overdraft be avoided or minimized to the extent practicable or the County may rule that the proposed development not show a negative impact to the environment.

The ratio of water demand for the proposed Ferrini Ranch subdivision to the demand for the Toro Vista project at the time of the Fugro & McClelland report (1993) (57 ac-ft/yr / 147 ac-ft/yr = 0.39) is similar to the number of units presently proposed to the number previously proposed (212 units / 482 units = 0.44). This similarity in findings is indicative of consistent water-data sources between the two analyses and consistent assumption of water conservation and restrictions.

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4.9 GROUNDWATER QUALITY

4.9.1 El Toro Area

Sewage from the proposed subdivision is to be piped to an offsite treatment facility so that nitrate-levels at the site should not be adversely affected by the development. At the time of our site visit, Ferrini Ranch predominately consisted of cattle grazing land. According to project plans provided by PMC, more than two-thirds of the 870-acre ranch property will remain graze land after the subdivision development. From an animal husbandry perspective and assuming that the number of livestock will remain about the same, there should be no increase of nitrate loading from activities on the property after development. No further additional factors are expected to impact groundwater quality beneath the site resulting from residential development of the Ferrini Ranch.

4.9.2 Salinas Groundwater Basin

Arsenic has become a contaminant of concern because of the recent EPA change in the drinking water standard from 0.050 milligrams per liter (mg/L) to 0.010 mg/L. Because arsenic is a primary drinking water constituent, regulatory agencies require arsenic treatment for water-supply systems. During our November 22, 2006 telephone conversation with Mr. Michael Jones with the California Water Service Company, he stated that the water to be supplied to the Ferrini Ranch subdivision would be in compliance with the Safe Drinking Water Act and other regulations, including the California Waterworks Standards which requires water utilities able to meet maximum daily demand through source and storage capacity. He also indicated that water quality to the project will comply with all primary drinking water standards, including the federal arsenic standard of 0.010 ml/L. The 2005 Water Quality Report for the Spreckles area provided by Cal Water indicates that average arsenic concentrations from the two source wells was 0.00134 mg/L. Other measured water-quality results provided by Cal Water for the Salinas area are summarized in the chart reproduced here on Plate E-2, Appendix E. Because the water purveyor for the proposed Ferrini

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Ranch Subdivision will be required to adhere to State and Federal mandated standards of water quality, it is assumed that the standards will be maintained and water quality for the project will be remain acceptable.

The 180-Foot Aquifer is characterized by calcium sulfate to calcium sodium bicarbonate sulfate groundwater (Jones-Stokes & Associates, 1990). Where this aquifer is intruded by seawater, the water is typically characterized by sodium chloride to calcium chloride. Total dissolved solids (TDS) values range from 223 to 1,013 mg/L, with an average value of 478 mg/L (based on 187 analyses; Department of Health Services, 2000), which is characterized as "very hard." TDS values from 30 public supply wells were reported as ranging from 233 to 996 mg/L, with an average value of 556 mg/L. Of the 194 wells sampled during 1995 for nitrate in both the 180- Foot and 400-Foot Aquifers, 21 exceeded the drinking water standard. The average nitrate values for these aquifers were 35 and 9 mg/L, respectively (MCWRA 1997). (Department of Water Resources, 2004). Plate 10, *Nitrate Values, Pressure Area* presents nitrate concentrations measured in wells within the northern Salinas Valley Groundwater Basin in 1995 (MCWRA, 2000). As stated above for arsenic, the water purveyor for the proposed Ferrini Ranch Subdivision will be required to adhere to State and Federal mandated standards of water quality and it is assumed that the standards will be maintained through appropriate treatment and water quality for the project will be maintained at acceptable quality levels.

4.9.3 Seawater Intrusion

Approximately 20,000 acres of the 180-Foot Aquifer and 10,000 acres of the 400-Foot Aquifer had been intruded by seawater (defined by chloride levels above 500 mg/L) by 1995 (MCWRA 1997). Since 1995, additional acreage of the Salinas Valley Groundwater Basin has been affected. Plate 11, *Historic Seawater Intrusion Map* depicts the seawater plume updated through 2003 Historically, landward migration of seawater has been progressing at an irregular and non-uniform rate. The projection of the seawater migration toward the Spreckles area, where wells that will supply water for

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the Ferrini Ranch Subdivision are located, will depend on future management of the basin. Plate 12, *Seawater Intrusion Time/Distance Plot*, shows a possible timeline of landward plume movement. The projection of the time line shown on Plate 12 suggests that wells in the Spreckles area may be adversely impacted by seawater sometime after 2015. Landward intrusion of seawater should continue as long as the basin remains in a state of overdraft.

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5 EROSION AND DRAINAGE ASSESSMENT

5.1 EROSION

This section presents a preliminary hydrologic assessment of the Ferrini Ranch property, and is not intended to act as an erosion control plan, Stormwater Pollution Prevention Plan or provide design guidance.

The County of Monterey's 1982 General Plan includes a "Relative Soil Erosion Hazards" map that covers the Ferrini Ranch area. The map included in the Plan is large scale and uses a rating system different from that used by the US Department of Agriculture (USDA). The two data sets appear to be in general agreement. Because the USDA maps are at a scale appropriate for this study the USDA data were used in our erosion assessment.

Monterey County defines erosion as "the wearing away of the ground surface as a result of the movement of wind or water." (Monterey County Erosion Control Ordinance 16.12.030). Management of an ongoing erosion control plan, during and after construction, will be crucial to its overall success. Final design of the drainage and erosion-control features should be reviewed by a qualified design professional prior to construction. This assessment addresses near-term and long-term erosion issues including the following:

- Preliminary analysis of the changes in peak flow caused by the proposed development.
- Erosion and sediment control during construction of roadways and home sites including implementation of Best Management Practices (BMPs).
- Application of BMPs in design of roadway drainage systems to effect long-term erosion and sediment control.

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5.1.1 Project Site Soil Characteristics

Assessing erosion potential at a site begins with mapping and defining soil types present on the property. The USDA (United States Department of Agriculture, 2006) identifies 17 different soil units on the project site (Erosion and Drainage Map, Plate 13). Each map unit represents an area dominated by one or more major kinds of soil. A soil-map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. However, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties might extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, each map unit is made up of the soils for which it is named and some minor components that belong to taxonomic classes other than those of the major soils. Within the definition of most of the soil-map units are descriptions of erodability and other factors that affect the physical characteristic of the unit. The aerial distribution of the soil types mapped on the Ferrini Ranch property are depicted on Plate 13 and are described below:

Map unit: Am - Arnold-San Andreas complex

Arnold loamy fine sand is 40-60 inches deep with a light colored surface layer on slopes of 50-75 percent.

San Andreas fine sandy loam is 20-40 inches deep with a dark colored surface layer on slopes of 50-75 percent.

Map unit: Ba - Badland

Badland weathered bedrock is a geomorphic feature with a lighter colored surface layer on slopes of 2-75 percent.

Map unit: Cbb - Chualar loam

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Chualar loam is more than 60 inches deep with a dark colored surface layer on slopes of 2-5 percent.

Map unit: Ccg - Cieneba fine gravelly sandy loam

Cieneba gravelly sandy loam is 7-18 inches deep with a lighter colored surface layer on slopes of 30-75 percent.

Map unit: Dbd - Diablo clay,

Diablo clay is 40-60 inches deep with a lighter colored surface layer on slopes of 9-15 percent.

Map unit: Dbe - Diablo clay

Diablo clay is 40-60 inches deep with a lighter colored surface layer on slopes of 15-30 percent.

Map unit: Dbf - Diablo clay

Diablo clay is 40-60 inches deep with a lighter colored surface layer on slopes of 30-50 percent.

Map unit: Ghc - Gloria sandy loam

Gloria sandy loam is more than 60 inches deep with a lighter colored surface layer on slopes of 2-9 percent.

Map unit: Hbb - Hanford gravelly sandy loam,

Hanford gravelly sandy loam is more than 60 inches deep with a lighter colored surface layer on slopes of 0-5 percent.

Map unit: Lae - Linne silty clay loam

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Linne silty clay loam is 24-40 inches deep with a dark colored surface layer on slopes of 15-30 percent.

Map unit: Lcg2 - Linne-Shedd silty clay loams

Shedd silty clay loam is 20-30 inches deep with a lighter colored surface layer on slopes of 50-75 percent.

Linne silty clay loam is 20-40 inches deep with a dark colored surface layer on slopes of 50-75 percent.

Map unit: Mg - Metz complex

Metz loamy sand is more than 60 inches deep with a lighter colored surface layer on slopes of 2-9 percent.

Metz fine sandy loam is more than 60 inches deep with a lighter colored surface layer on slopes of 2-9 percent.

Map unit: Pr - psamments and fluvents, occasionally flooded

Fluvents is more than 60 inches deep with a lighter colored surface layer on slopes of 0-5 percent.

Psamments is more than 60 inches deep with a lighter colored surface layer on slopes of 0-5 percent.

Map unit: Shd - Santa Ynez fine sandy loam

Santa Ynez fine sandy loam is more than 60 inches deep with a dark colored surface layer on slopes of 9-15 percent.

Map unit: Vae - Vista coarse sandy loam

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Vista coarse sandy loam is 20-36 inches deep with a lighter colored surface layer on slopes of 15-30 percent.

Map unit: Vag - vista coarse sandy loam

Vista coarse sandy loam is 20-36 inches deep with a lighter colored surface layer on slopes of 30-75 percent.

Map unit: Xd - xerorthents, dissected

Xerorthents variable is more than 60 inches deep with a lighter colored surface layer on slopes of 50-65 percent.

5.1.2 Erosion and Rutting Susceptibility

Of the 17 different soil types identified by the USDA on the Ferrini Ranch project site, 14 are rated for susceptibility to erosion. These ratings are based on how a soil unit behaves on different slope angles and on the soil erodibilty, or “K” factor (United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual (http://soils.usda.gov/technical/nfhandbook/)). Soils are rated as slight, moderate, severe, or very severe. The soil loss is caused by sheet or rill erosion where 50 to 75 percent of the surface has been exposed.

A rating of "slight" indicates that erosion is unlikely under ordinary conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

The remaining three soils not rated for susceptibility to erosion by the USDA (Ba - bad lands, Pr - psamment and fluents, and Xd - xerorthents) are rated by the USDA based on their "soil-rutting hazard". The soil-rating hazard is based on depth to the water

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table, rock fragments on or below the surface, the Unified Soil Classification, depth to a restrictive layer, and slope. Ruts can form as a result of the operation of heavy equipment during site development. Soil-rutting hazard is described as slight, moderate, or severe. A rating of "slight" indicates that the soil is subject to little or no rutting, "moderate" indicates that rutting is likely, and "severe" indicates that ruts form readily. The north portion of the Ferrini Ranch property mapped as Ba (Badlands) on Plate 13 is a geomorphic description that is severely subject to deep rill erosion and rutting.

It should be noted that these ratings are generalities and that actual conditions may vary within any of the soil types at the project site. The soil types present within the project boundaries are shown on "*Erosion and Drainage Map*" on Plate 13. This map combines several data sets from files downloaded from the USDA Soil Data Mart (http://soildatamart.nrcs.usda.gov). The data sets included the shapefile soilmu_a_ca053.shp and the text file mapunit.txt. These two files were combined using ArcMap with additional data from a report generated using an Access database template also obtained from the USDA web site. Erosion and Rutting Hazards are merged on Plate 13.

Several landslides, mudflows and slumps were mapped inside the project site during our geologic site reconnaissance and are discussed in more detail in the geology section of this report and depicted on the *Preliminary Geotechnical Map*, Plate 3a and 3b. Importance of the mapped landslide, mudflows and slumps in regard to the erosion assessment is that these features are potential sites of accelerated erosion and should be areas of greater concern during site development. Of special concern will be areas that are mapped as slumps and mud flows because these are areas of on going erosion.

5.1.3 Suggested Erosion-Control Measures

The following are general construction-related erosion-control guidelines and are intended to minimize on-site transport of soil by reducing soil disturbance and intercepting and capturing soil displaced from disturbed areas during construction.

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Basic materials and practice can include silt fencing at the toe of disturbed slopes during the rainy season. Use of straw, jute netting and hydroseeding or equivalent method/materials during and after grading activities to help stabilize soils. Operations should be restricted to seasonal periods of minimal rainfall. If grading operations are conducted between October 15 and April 15 they should be conducted in compliance with Section 16.12.090 of the Monterey County Erosion Control Ordinance. To keep erosion effects to a minimum, operations and heavy equipment should be limited to only those areas necessary for completion of the project. Project site entrances should be stabilized with gravel. Vegetation should be maintained to reduce erosion and filter runoff; revegetation of disturbed areas should proceed as quickly as possible after disturbance. Topsoil removed from disturbed areas should be retained for future revegetation and a perimeter silt fence should be used to minimize soil loss.

In order to minimize impact on the detention basins located on the project site, operations should consider runoff capture and controlled release. Flow velocities should be controlled through use of vegetative buffers, sediment traps, berms, temporary detention ponds, and check dams, Project site traffic and grading operations should be minimized while it is raining.

After construction, permanent measures must be used for proper storm-water management. These post-construction BMPs can include structural controls such as inlet filters, oil/sediment separators and the use of porous paving materials. Post-construction BMPs can also include design features such as grass swales, filter strips and detention/ retention ponds. In addition, plans for the handling and storage of hazardous materials, recycling and community education efforts are considered valuable post-construction BMPs.

5.2 DRAINAGE

The confluence of Corral de Tierra and San Benancio Creeks with El Toro Creeks is located in the southwest corner of the Ferrini Ranch property, Plate 13. San Benancio

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Creek enters the project site through an 8x6 (WxH) foot concrete box culvert beneath San Benancio Road. El Torro Creek, at the point that it leaves the project site, drains an area of approximately 30 square miles. The calculated peak flows of El Toro Creek below the confluence with the unnamed creeks is 851 cubic feet per second (cfs) for a 10-year storm event and 2,980 cfs for a 100 year storm event, these values were calculated using a synthetic unit hydrograph (Westec, 1975). It is likely that the land use in the study area has changed since the analysis by Westec was completed. Any design effort for this site should include an updated analysis at the design point evaluated by Westec.

In addition to these three creeks, the project site is drained by eight un-named intermittent streams as shown on Plate 13. The thalwegs of these streams were digitized from the US Geological Survey 7.5 minute Spreckles Quadrangle. Three of the intermittent streams are located in the northern section of the Ferrini Ranch property and the remaining five are in the southern section. All of these eight minor streams begin within or just east of the ranch property and have small watersheds (*Erosion and Drainage Map*, Plate 13) compared to the watersheds of other streams in the area such as Harper, Correl de Tierra, San Benancio, and El Toro Creeks. Only one of the eight smaller streams has seasonal surface flow sufficient to occasionally reach El Toro Creek. This stream lies just north of San Benancio Creek and drains an area of approximately 323 acres (Westec, 1975). This stream is channeled through a six-foot by six-foot reinforced concrete box culvert where it flows beneath Highway 68 and joins El Toro Creek.

The eight smaller streams do not have sufficient flow most of the year to maintain surface flow beyond the borders of the project site. Water in these streams infiltrates into the porous soils before it reaches El Toro Creek.

5.2.1 Preliminary Analysis Methodology

The 21 Drainage Areas, labeled DA-1 through DA-21 on Plates 14 through 17, were defined from the partial digital topography provided for the project area. Based on the

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topography at the project boundary, the Drainage Areas appear to extend beyond the east project boundary. A Design Point, designated as DP-#, was identified for each Drainage Area and is located at either a topographic low point for the Drainage Area or where a large Drainage Area connects to another large Drainage Area. The Design Point represents a location where a BMP may be installed and where additional infrastructure (e.g. culvert) may be required to convey collected stormwater from the project site.

A simplified calculation methodology based on the State of California Department of Transportation (CalTrans) Project Planning and Design Manual (CalTrans Design Manual) was utilized in this preliminary analysis. The Rational Method was used to calculate the peak flow value for each Drainage Area. The Rational Method is dependant upon the area of the Drainage Area, the precipitation intensity, and a runoff coefficient.

The Pre-Development runoff coefficient, or "C" value, for each Drainage Area was calculated as a weighted value for this preliminary analysis, and considers the varying land use and soil types in each Drainage Area, in accordance with Table 8-3 of the CalTrans Design Manual. The Proposed Development runoff coefficient considers the increased impervious area due to the proposed roads and homes, and modification to the land use based on the proposed development, in accordance with Table 8-4 of the CalTrans Design Manual. The assumptions applied to the Pre-Development and Post-Development preliminary analyses are further discussed below. Additional discussion regarding about the Rational Method can be found in the CalTrans Highway Design Manual.

The Intensity value was obtained from Bulletin No. 195: Rainfall Analysis for Drainage Design, Draft, February 2007, published by the California Department of Water Resources. For this simplified analysis, the intensity value corresponding to a 24-hour time of concentration (Tc) was used. To determine the actual impact to the Drainage Areas from the proposed development, the Tc for each drainage area should be

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calculated and utilized to calculate the peak discharge upon completion of the proposed development layout and grading.

5.2.2 Pre-Development Hydrology

The land in the project area is generally undeveloped, with some trails and unimproved roads. The terrain on the site generally slopes to the west. Topography within the site varies from nearly flat (1% to 5% slope) to steeply sloped (>30% slopes). Numerous drainage areas are formed by the topography.

Due to topography, the off-site land to the east contributes runoff to the site. Topographic information for these off-site areas was not available, and is not included in this preliminary analysis. Runoff in the general area of the proposed site flows towards El Toro Creek.

The weighted runoff coeffiencent for use in the Rational Method calculation was calculated for each Drainage Area based on the Pre-Development slope, soil type, and vegetation conditions. The Pre-Development ”C” values were determined in accordance with Table 8-3 of the CalTrans Design Manual, and are summarized below along with the peak flow for each Drainage Area.

TABLE 5-1
PRE-DEVELOPMENT DRAINAGE AREA PARAMETERS PEAK FLOW (CFS)

DRAINAGE AREA ID	AREA (Acres)	“C” VALUE	PEAK FLOW (CFS)		
			10-yr, 24 hr	50-yr, 24 hr	100-yr, 24 hr
DA-1	3.84	0.28	0.12	0.15	0.16
DA-2	12.14	0.30	0.40	0.51	0.55
DA-3	73.30	0.47	3.82	4.86	5.21
DA-4	97.69	0.41	4.45	5.66	6.06
DA-5	19.45	0.45	0.96	1.23	1.31

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TABLE 5-1 PRE-DEVELOPMENT DRAINAGE AREA PARAMETERS PEAK FLOW (CFS) (CONTINUED)					
DRAINAGE AREA ID	AREA (Acres)	"C" VALUE	PEAK FLOW (CFS)		
			10-yr, 24 hr	50-yr, 24 hr	100-yr, 24 hr
DA-6	54.46	0.49	2.95	3.75	4.02
DA-7	45.15	0.44	2.19	2.79	2.99
DA-8	82.13	0.53	4.75	6.04	6.47
DA-9	73.70	0.54	4.35	5.53	5.93
DA-10	2.04	0.42	0.09	0.12	0.13
DA-11	96.71	0.48	5.10	6.49	6.95
DA-12	14.06	0.35	0.54	0.69	0.74
DA-13	13.31	0.48	0.71	0.90	0.97
DA-14	134.65	0.50	7.36	9.37	10.04
DA-15	172.92	0.59	11.18	14.23	15.25
DA-16	7.23	0.52	0.41	0.52	0.56
DA-17	4.66	0.57	0.29	0.37	0.40
DA-18	36.39	0.54	2.14	2.73	2.92
DA-19	27.52	0.58	1.77	2.25	2.41
DA-20	7.15	0.55	0.43	0.55	0.59
DA-21	3.37	0.63	0.23	0.30	0.32

5.2.3 Post-Development Hydrology

The proposed site includes the construction of residential homes, roads, drainage structures, utilities, and screening berm. In order to treat the runoff from the proposed

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development, numerous water quality treatment and detention areas will be required. The quantity, type, size, and location of these areas will be determined during final design of the proposed development. Based on the topography, discharge from this site will be routed to the west, and will flow adjacent to Highway 68 and eventually into El Toro Creek.

As the final grading and site layout for the proposed facility have not been developed, this preliminary analysis assumed that the design points assigned to each Pre-Development drainage area would remain in the same location for the Post-Development analysis. The Post-Development condition was based on the preliminary site plan provided by PMC, and was modeled as change in the land use to residential lots and asphalt roads for the Drainage Areas. A revised weighted runoff coefficient was calculated for each Drainage Area, in accordance with Table 8-4 of the CalTrans Design Manual. The revised runoff coefficients and Post-Development peak flow for each Drainage Area are presented below.

TABLE 5-2
POST-DEVELOPMENT DRAINAGE AREA PARAMETERS

DRAINAGE AREA ID	AREA (Acres)	"C" VALUE	PEAK FLOW (CFS)		
			10-yr, 24 hr	50-yr, 24 hr	100-yr, 24 hr
DA-1	3.84	0.35	0.15	0.19	0.20
DA-2	12.14	0.33	0.45	0.57	0.61
DA-3	73.30	0.48	3.87	4.92	5.27
DA-4	97.69	0.49	5.32	6.77	7.25
DA-5	19.45	0.45	0.96	1.23	1.31
DA-6	54.46	0.49	2.95	3.75	4.02
DA-7	45.15	0.44	2.19	2.79	2.99
DA-8	82.13	0.53	4.75	6.04	6.47

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TABLE 5-2 POST-DEVELOPMENT DRAINAGE AREA PARAMETERS (CONTINUED)					
DRAINAGE AREA ID	AREA (Acres)	"C" VALUE	PEAK FLOW (CFS)		
			10-yr, 24 hr	50-yr, 24 hr	100-yr, 24 hr
DA-9	73.70	0.54	4.40	5.60	6.00
DA-10	2.04	0.42	0.90	0.12	0.13
DA-11	96.71	0.49	5.18	6.59	7.06
DA-12	14.06	0.36	0.55	0.70	0.75
DA-13	13.31	0.49	0.72	0.92	0.98
DA-14	134.65	0.50	7.40	9.42	10.09
DA-15	172.92	0.59	11.18	14.23	15.25
DA-16	7.23	0.52	0.41	0.52	0.56
DA-17	7.66	0.57	0.29	0.37	0.40
DA-18	36.39	0.54	2.18	2.77	2.97
DA-19	27.52	0.58	1.77	2.25	2.41
DA-20	7.15	0.55	0.43	0.55	0.59
DA-21	3.37	0.63	0.23	0.30	0.32

5.2.4 Preliminary Analysis Evaluation

Based on the calculations described above, the increase in peak flow discharged from each Drainage Area was calculated. This is the volume that will have to be captured and controlled to mitigate discharge from the project to be equal to the Pre-Development condition. These values are presented below.

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TABLE 5-4 DRAINAGE AREA EVALUATION			
DRAINAGE AREA ID	Change in Peak Flow (CFS)		
	10-yr, 24 hr	50-yr, 24 hr	100-yr, 24 hr
DA-1	0.03	0.04	0.04
DA-2	0.05	0.06	0.06
DA-3	0.05	0.06	0.06
DA-4	0.87	1.11	1.19
DA-5	0.00	0.00	0.00
DA-6	0.00	0.00	0.00
DA-7	0.00	0.00	0.00
DA-8	0.00	0.00	0.00
DA-9	0.06	0.07	0.08
DA-10	0.00	0.00	0.00
DA-11	0.08	0.10	0.11
DA-12	0.01	0.01	0.01
DA-13	0.01	0.02	0.02
DA-14	0.04	0.05	0.05
DA-15	0.00	0.00	0.00
DA-16	0.00	0.00	0.00
DA-17	0.00	0.00	0.00
DA-18	0.04	0.04	0.05
DA-19	0.00	0.00	0.00
DA-20	0.00	0.00	0.00
DA-21	0.00	0.00	0.00

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Due to the proposed development in DA-4, post-development runoff may increase significantly from pre-development runoff. Additional hydraulic and sediment control measures may be required in Drainage Area to control discharge to pre-development conditions.

As previously indicated, the Design Point from some of the Drainage Areas route discharge into an adjoining Drainage Area. The installation of additional BMP's in such Drainage Areas should be considered to minimize the size of the BMPs in the receiving Drainage Area. These BMPs may include wet basins, infiltration trenches and intermediate infiltration benches.

Based on the soil conditions in the project site, it is likely that infiltration basins could be used to capture and control the volume of runoff from the site. The topography of the site near Highway 68 provides sufficient area for the placement of infiltration basins and similar BMPs, based on the preliminary analysis.

5.3 BEST MANAGEMENT PRACTICES

BMPs should be installed during construction and as permanent features following the completion of construction. Erosion and sediment control measures should be designed to minimize disturbance by taking advantage of the existing landscape. Existing stream channels should be protected from disturbance and from the introduction of sediment-laden runoff generated elsewhere on-site. Where BMPs facilities are required, they should be designed to accommodate anticipated flows and minimize scour and deposition through energy controls. Drainage culverts should be located to minimize erosion potential at inlet and outlet structures. Excess outlet velocities should be controlled through energy dissipaters and/or rock riprap protection.

5.3.1 Construction BMPs

During construction activities, temporary BMPs should be employed for temporary soil stabilization and temporary sediment control. BMPs should be chosen based on rainfall

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occurrence and should be correlated to the occurrence of the rainy season, the presence of vegetation, soil type, and slopes within the construction area. The BMP of scheduling, which includes sequencing of construction activities, should be practiced when implementing BMPs used during the creation of active and non-active disturbed soil areas (DSAs).

BMPs applicable to the proposed activity during construction in active DSAs may include:

- Installation of straw mulch;
- Installation of geotextile or plastic mats and erosion control blankets;
- Earthen dikes/drainage swales and lined ditches;
- Outlet protection/velocity dissipation devices; and,
- Stream bank stabilization.

BMPs applicable for use in non-active DSAs include:

- Preservation of existing vegetation;
- Installation of hydraulic mulch;
- Hydroseeding;
- Installation of geotextile or plastic mats and erosion control blankets;
- Wood mulching; and,
- Stream bank stabilization.

BMPs applicable to temporary sediment control during construction activities may include:

- Installation of silt fences;
- Installation of sediment/silting basins;
- Installation of check dams;
- Installation of fiber rolls; and,
- Street sweeping.

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Street sweeping as a form of sediment control is applicable during the later stages of construction when more permanent features, such as paved roads, have been constructed. The sediment control measures described should also be used in conjunction with the soil stabilization methods described above. Specific details of the BMPs discussed above are included as Appendix F-2 of this report.

5.3.2 Permanent BMPs

Several permanent BMPs may be applicable for use in the proposed activity. The evaluation and design methodologies for these BMPs is described in Appendix A of the CalTrans Design Manual, and has been attached as Appendix F-3 of this report. Selected BMPs, and their potential application, are presented below. Additional BMPs may be determined during preparation of the SWPPP and final site design.

1. Vegetation- preservation of existing vegetation and planting of native species will allow for a natural vegetative filter (bio-filtration) and will reduce velocity.

2. Flared Culvert End Sections- typically used at the outlets of pipes, drains, culverts, and other channelizing devices to reduce velocity and prevent scour.

3. Check Dams- reduce velocity in swales and cause water to pond behind the dam, allowing sedimentation to occur.

5.4 OTHER CONSIDERATIONS

In addition to the foregoing erosion and drainage control suggestions, the following roadway and dust control mitigations should be considered. For road cuts, slopes should be as steep as practicable for the given soil conditions. Fill slopes should be compacted by mechanical methods to compact the fill the minimize the potential for wind erosion.

Measures that may be necessary to control dust include water trucks and/or temporary sprinkler systems. Air temperature, wind, and relative humidity should be

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considered in determining the frequency of on-site and access road dust control watering. Nearby vegetation should be monitored for dust accumulation as well.

5.4.1 Maintenance and Inspection

Consistent with BMP design and installation is the inspection and maintenance of the erosion and drainage control structures. These structures should be inspected in accordance with the SWPPP requirements. Any damaged or poorly performing components should be repaired immediately. Sediment and debris should be regularly removed from structures as necessary to keep them operating at their peak efficiencies. Culvert entrances, and trash racks should also be inspected and cleaned of debris, which may block flow.

Any graded areas should be inspected weekly during the rainy season and after any significant storm events to ensure that no significant erosion is taking place and that reestablishment of vegetation is progressing.

Additional erosion-control materials such as silt fencing, matting, riprap, and mulch should be kept at the project site during the rainy season for emergency use.

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6 ENVIRONMENTAL IMPACTS AND MITIGATION

6.1 SIGNIFICANCE CRITERIA

The following significance criteria for the proposed Ferrini Ranch Property Subdivision project setting were formulated based on the findings this feasibility-level investigation, *State CEQA Guidelines*, professional judgment, and knowledge of the project area.

Based on consideration of Appendix G of the State CEQA Guidelines, the project would be considered to have a significant adverse impact on geology, soils or seismicity if it would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

- Ground rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
- Strong seismic ground shaking.
- Seismic-related ground failure, including liquefaction.
- Landslides or debris flows.
- Substantial Soil Erosion of the loss of topsoil.
- Negative impact to surface water quantity or quality.
- Substantially deplete groundwater supplies such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level
- Otherwise substantially degrade water quality .
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

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- Create or contribute runoff water which would exceed the capacity of existing or planned storm-water drainage systems or provide substantial additional sources of polluted runoff.

The project would also be considered to have a significant impact if it would result in the loss of a unique geologic feature. A significant adverse impact could result if the project is located on strata or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse. These potentially significant impacts are addressed in the following Sections.

6.1.1 Impact: Exposure of people or property to building collapse caused by seismic shaking or ground rupture from an earthquake on active faults in the area

The County will require that development on the Ferrini Ranch property be in compliance with guidelines established by the UBC/CBC for Seismic Zone 4 with respect to seismic shaking. These requirements will include adherence to near-fault and other seismic-related criteria. Because such hazards shall be mitigated during site development this impact of seismic shaking and earthquake ground rupture are considered less than significant.

6.1.2 Impact: Exposure of people or property to slope-failure-related hazards such as landslides, earth and debris flows (mudflows), or other related ground failures

In areas of sloping terrain, relatively permanent alteration to the natural topography may occur. If improper grading or cut-and-fill occurs, or if development is attempted on steep slopes at the project site, it is likely that landslides, earth and debris flows, or other unstable soil or bedrock conditions could occur. Landslides and earth and debris flows typically occur as a result of natural conditions combined with land disturbing activities, which set up preconditions for such incidents. The County's Grading Ordinance is the single most important instrument for assuring that land disturbance

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associated with new development minimize these impacts. Proper administration of this ordinance, including frequent field inspections during grading, is required to provide such assurances. Therefore, the goals, policies, objectives and implementation actions and strategies contained in the County's Grading Ordinance and site-specific design-level geotechnical studies serve as effective mitigation measures for addressing slope-failure related hazards, and will result in a less-than-significant impact.

6.1.3 Impact: Accelerated erosion, resulting in a substantial reduction in on-site soil productivity, revegetation potential, or siltation/sedimentation of receiving waters

Under natural conditions, potential for soil erosion from channelized flow or sheet wash across the Ferrini Ranch property is classified as moderate to high. Erosion will be most severe where soil cover is removed and soil particles are disturbed. Erosion/siltation of waterways, and other unstable conditions may be caused by cut/fill and grading practices unsuitable to the site. In the absence of more detailed site-specific information, the County shall use the Natural Resources Conservation Service's Soil Survey of Monterey County in determining the suitability of soil for particular land uses. The County shall require the developer to prepare and implement erosion-control and landscape plans for the proposed Ferirni Ranch Subdivision development project. The plans shall be prepared by a registered civil engineer or certified professional in the fields of erosion and sediment control and shall be subject to approval of the public works director for the County. The erosion component of the plan must at least meet the requirements of Storm Water Pollution Prevention Plans (SWPPPs) required by the California State Water Resource Control Board.

Through site monitoring, the County shall ensure that all measures included in the developer's erosion-control and landscape plans are properly implemented. The County will designate areas with severe soil limitations by erosion, for open space or similar use if adequate measures cannot be taken to ensure the structural stability of these soils. This shall be designated at the project-specific level though a design-level geotechnical study. Because these policies and programs require the analysis of soil

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and slope conditions prior to development and are based on findings presented in the design-level geotechnical report, the implementation of measures to prevent erosion, and the exclusion of development in areas where adequate measures shall be taken to ensure the structural stability of soils and slopes, this impact is considered less than significant.

6.1.4 Impact to Surface Water Quantity or Quality

Appendix G of the CEQA Guidelines indicates that hydrology-related impacts can be considered significant if a project would:

- Violate Regional Water Quality Control Board water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems to control.
- Place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
- Place within a 100-year floodplain structures that would impede or redirect flood flows.

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- Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

Developments on watershed lands should be carefully evaluated for potential effects on surface water quality. The construction of projects in the County of Monterey will be subject to County Grading Ordinance requirements, which will provide mitigation measures to address erosion and the introduction of construction materials into surface waters. Runoff from development may also discharges pollutants from motor vehicles, such as petroleum hydrocarbons, glycol, and dissolved heavy metals. Regulations under Section 402(p) of the federal Clean Water Act are now in effect. They involve control of pollution in stormwater discharges. In California, the Section 402(p) National Pollutant Discharge Elimination System (NPDES) stormwater permitting program is administered by the Regional Water Quality Control Boards on behalf of the U.S. Environmental Protection Agency (EPA). A 402(p) permit is required for most new developments that disturb over five acres. Implementation of these standards will ensure a less-than-significant impact to surface water quality or Regional Water Quality Control Board standards and waste discharge requirements.

6.1.5 Impact: Substantial change in topography or ground surface relief features.

The County shall require that grading plans be submitted to the County's geotechnical reviewer. The grading plans shall be reviewed and approved by a Certified Engineering Geologist and Registered Geotechnical Engineer as conforming with the design-level geotechnical report and County grading requirements. Because grading shall be required by the County to meet County requirements adverse impact to topography shall be mitigated during site development, this impact is considered less than significant.

As a consequence of the proposed Ferrini Ranch Subdivision project implementation, no significant impacts with respect to be above described issues are anticipated if the

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development is designed and constructed in accordance with County requirements. The impacts analysis may change should modifications of the proposed project become inconsistent with County, State or other regulations.

6.1.6 Impact: Substantially deplete groundwater supplies such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level

From the perspective of a water-balance analysis, the development, as proposed, will derive its water from Cal Water's wells in the El Toro area and its waste water will be transported via California Utilities Service, Inc., sewer pipeline to the treatment facility on Reservation Road where the treated water will be discharged to the alluvial sediments of the Salinas Valley Groundwater Basin. The residential and commercial development of the Ferrini Ranch subdivision will have the affect of removing about 57 ac-ft/yr from the local groundwater system.

Unless other sources of water are used for the project, the inevitable conclusion is that any new homes developed in the El Toro area will increase the existing overdraft condition. "Overdraft pumping" is not considered to be an acceptable long-term, sustainable water source. The proposed project could have a significant effect on the environment, however, to allow the proposed development, the County may rule that the impact of overdraft be avoided or minimized to the extent practicable or the County may rule that the proposed development not show a negative impact to the environment.

6.1.7 Impact: Otherwise substantially degrade water quality.

Sewage from the proposed subdivision is to be piped to an offsite treatment facility so that nitrate-levels at the site should not be adversely affected by the development. According to project plans provided by PMC, more than two-thirds of the 870-acre ranch property will remain graze land after the subdivision development. From an animal husbandry perspective and assuming that the number of livestock will remain about the same or may decrease, there should be no increase of nitrate loading from

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activities on the property after development. Other than possible minor amounts of residential herbicides and pesticides used in residential landscaping (see Phase I Environmental Assessment), no further additional factors are expected to impact groundwater quality beneath the site resulting from residential development of the Ferrini Ranch.

As a consequence of the proposed Ferrini Ranch Subdivision project implementation, no significant impacts with respect to be above described issues are anticipated if the development is designed and constructed in accordance with County requirements. The impacts analysis may change should modifications of the proposed project become inconsistent with County, State or other regulations.

6.1.8 Impact: Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

The majority of the proposed Ferrini Ranch subdivision is on hillside and located outside of the 100- flood boundaries. A portion of the property, located at the southwest corner of the site near the intersection of Highway 68 and San Benancio Road, however, could be impacted by flooding along El Toro Creek. Flooding along the creek could impact the stability of proposed Lots 1 through 17 and should be evaluated during future design-level studies.

Although flooding could have a significant impact to certain areas of the project site, the County shall ensure that, through project oversight and permitting, mitigation of the hazard be accomplished by establishing setbacks or design changes in accordance with the Monterey County Floodplain Regulations. Because impact due to flooding can be mitigated, this impact is considered less than significant.

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6.1.9 Impact: Create or contribute runoff water which would exceed the capacity of existing or planned storm-water drainage systems or provide substantial additional sources of polluted runoff.

Of the 17 different soil types identified by the USDA on the Ferrini Ranch project site, 14 are rated for susceptibility to erosion. The County shall ensure that construction-related erosion-control guidelines in compliance with Section 16.12.090 of the Monterey County Erosion Control Ordinance are implemented to minimize on- and off-site transport of soil. In order to minimize impact on the detention basins located on the project site, operations should consider runoff capture and controlled release. Flow velocities should be controlled through use of vegetative buffers, sediment traps, berms, temporary detention ponds, and check dams, Project site traffic and grading operations should be minimized while it is raining.

After construction, permanent measures must be used for proper storm-water management. Post-construction BMPs can include structural controls such as inlet filters, oil/sediment separators and the use of porous paving materials, and design features such as grass swales, filter strips and detention/ retention ponds. BMPs should be installed during construction and as permanent features following the completion of construction.

As a consequence of the proposed Ferrini Ranch Subdivision project implementation, no significant impacts with respect to be above described issues are anticipated if the development is designed and constructed in accordance with County requirements. The impacts analysis may change should modifications of the proposed project become inconsistent with County, State or other regulations.

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7 LIMITATIONS

The information in this report is based on our field observations, review and evaluation of published papers and articles, reports, maps made available to us by PMC or contained in our library. It is possible that conditions could vary between or beyond observation points. The accuracy of the information presented in this report should not be implied beyond the limitations of the methods described. We have prepared this report in substantial accordance with the generally accepted professional procedures and guidelines as they exist today. No warranty is expressed or implied.

This report has been prepared for the exclusive use of PMC and Monterey County and its agents for purposes so stated, and within a reasonable time but not more than three years from its issuance. Land use, site and groundwater conditions, both on and off-site, or other factors may change over time, and additional investigative work may be required. Any party other than PMC or Monterey County who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an up-dated report be issued. Non-compliance with any of these requirements will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

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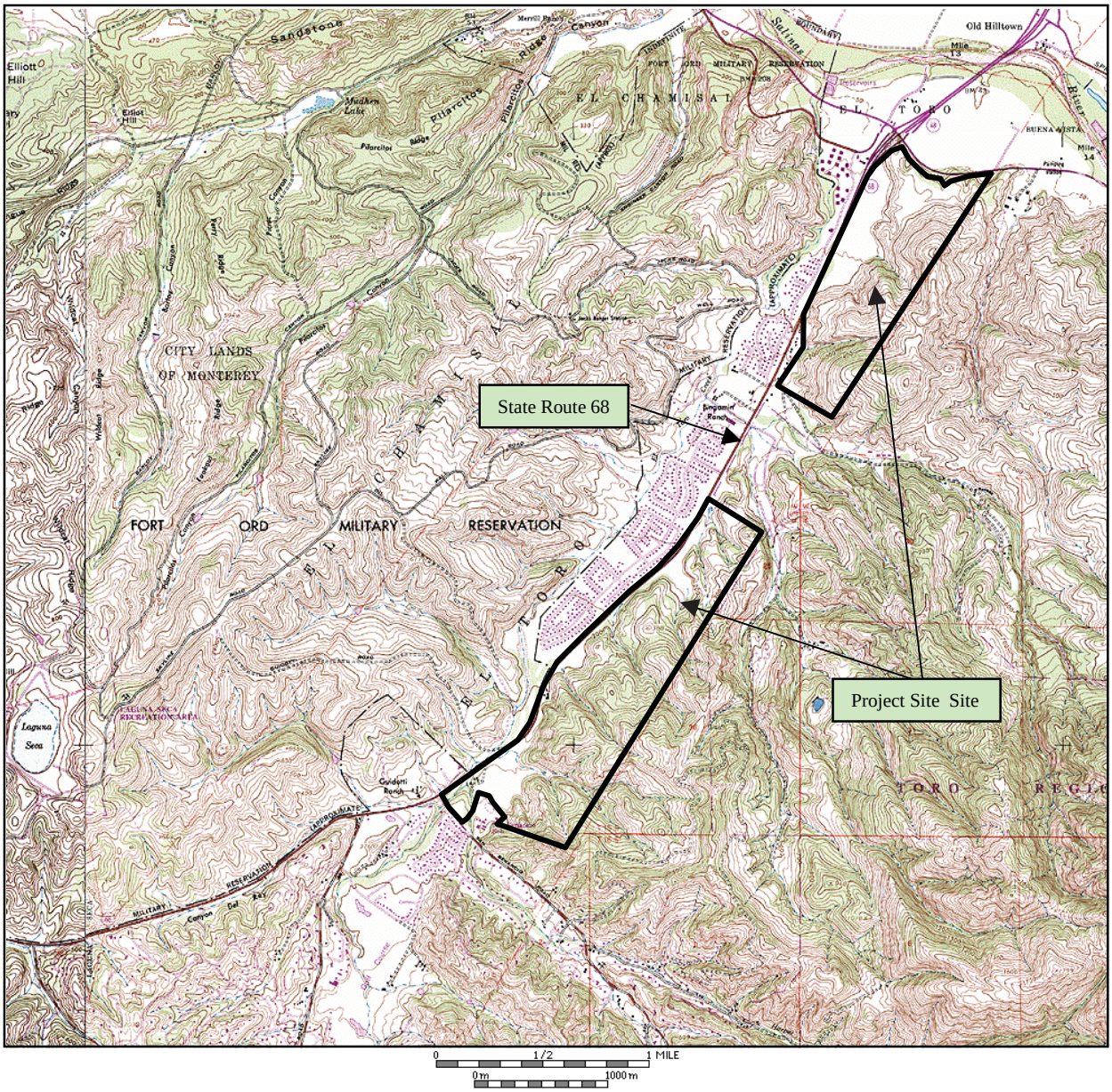
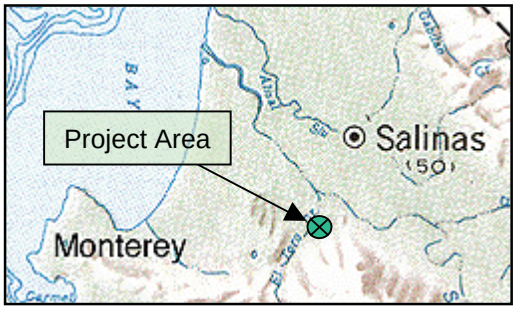
PLATES





Base source: U.S. Geological Survey 7½-minute Sprekles quadrangle

All locations are approximate

Original in color

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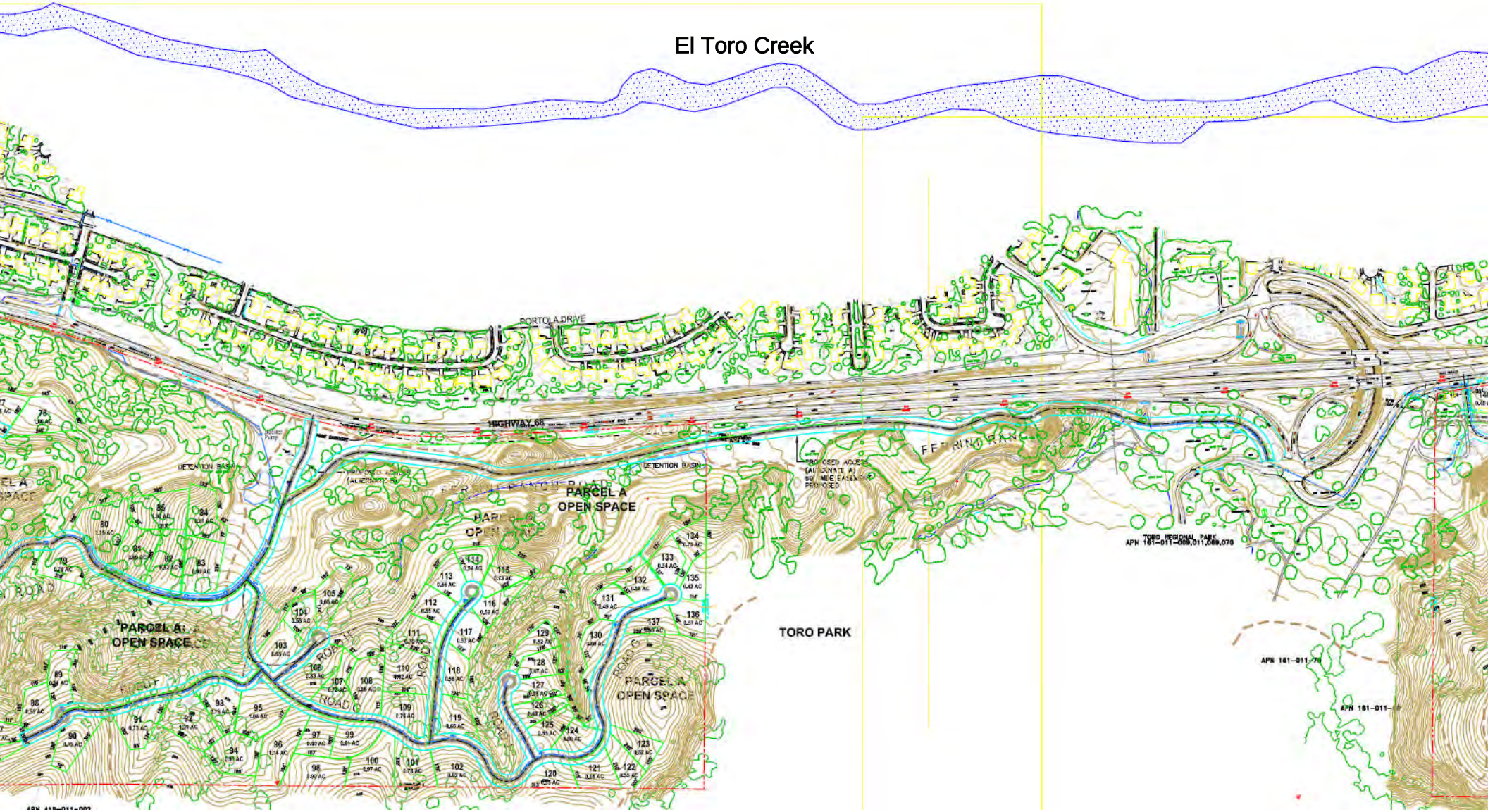

Source: Topographic Map of

Qls
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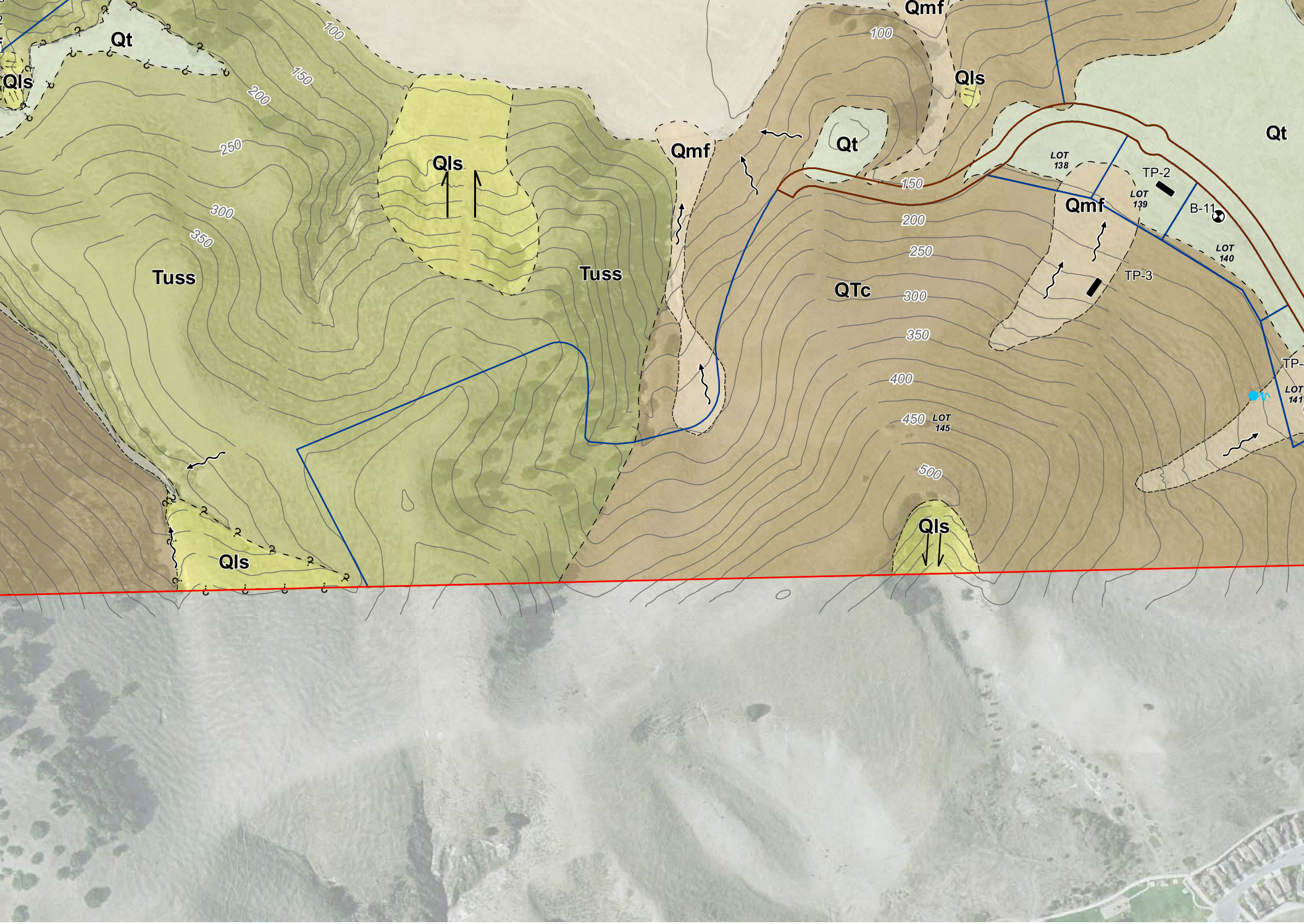
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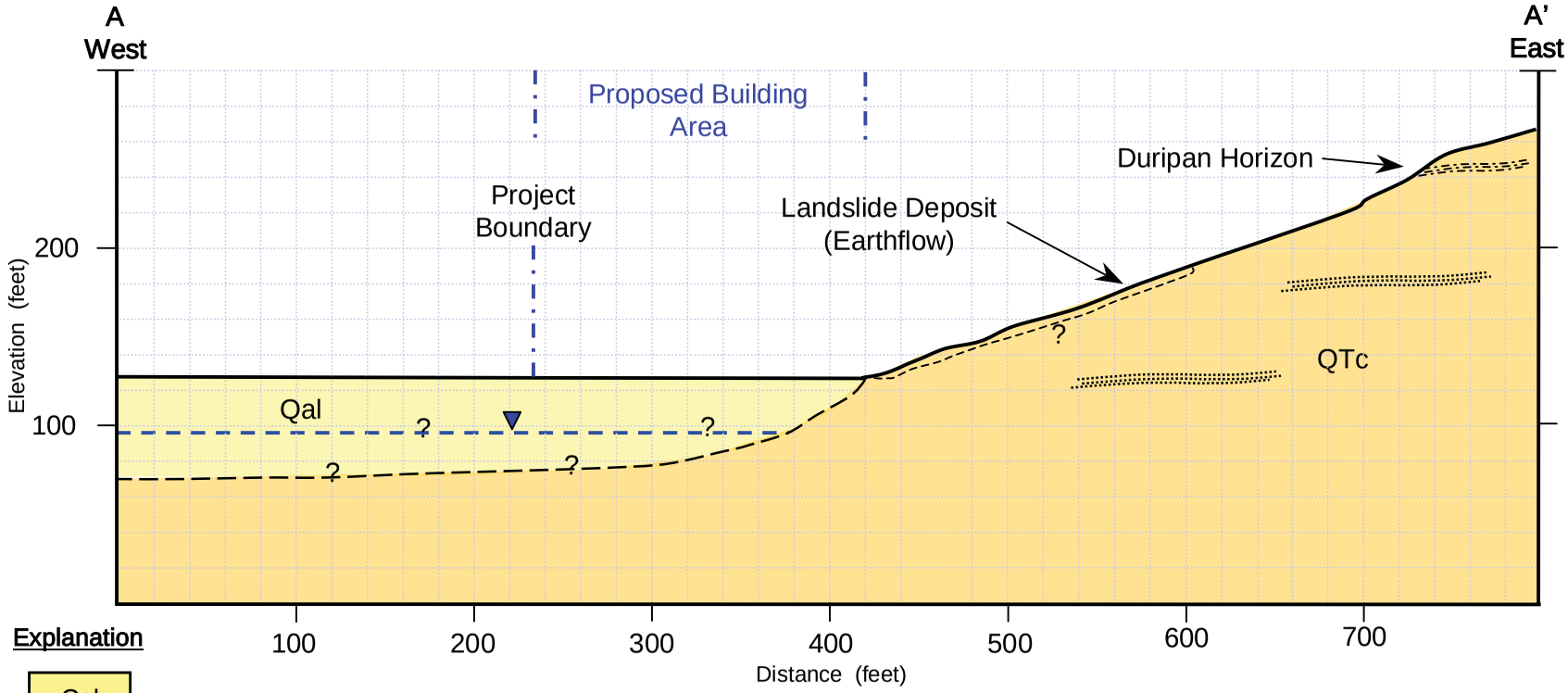

Explanation

Qal	Alluvium
QTc	Continental Deposits

Geologic Contact (approximate, queried where uncertain)

Groundwater (approximate)

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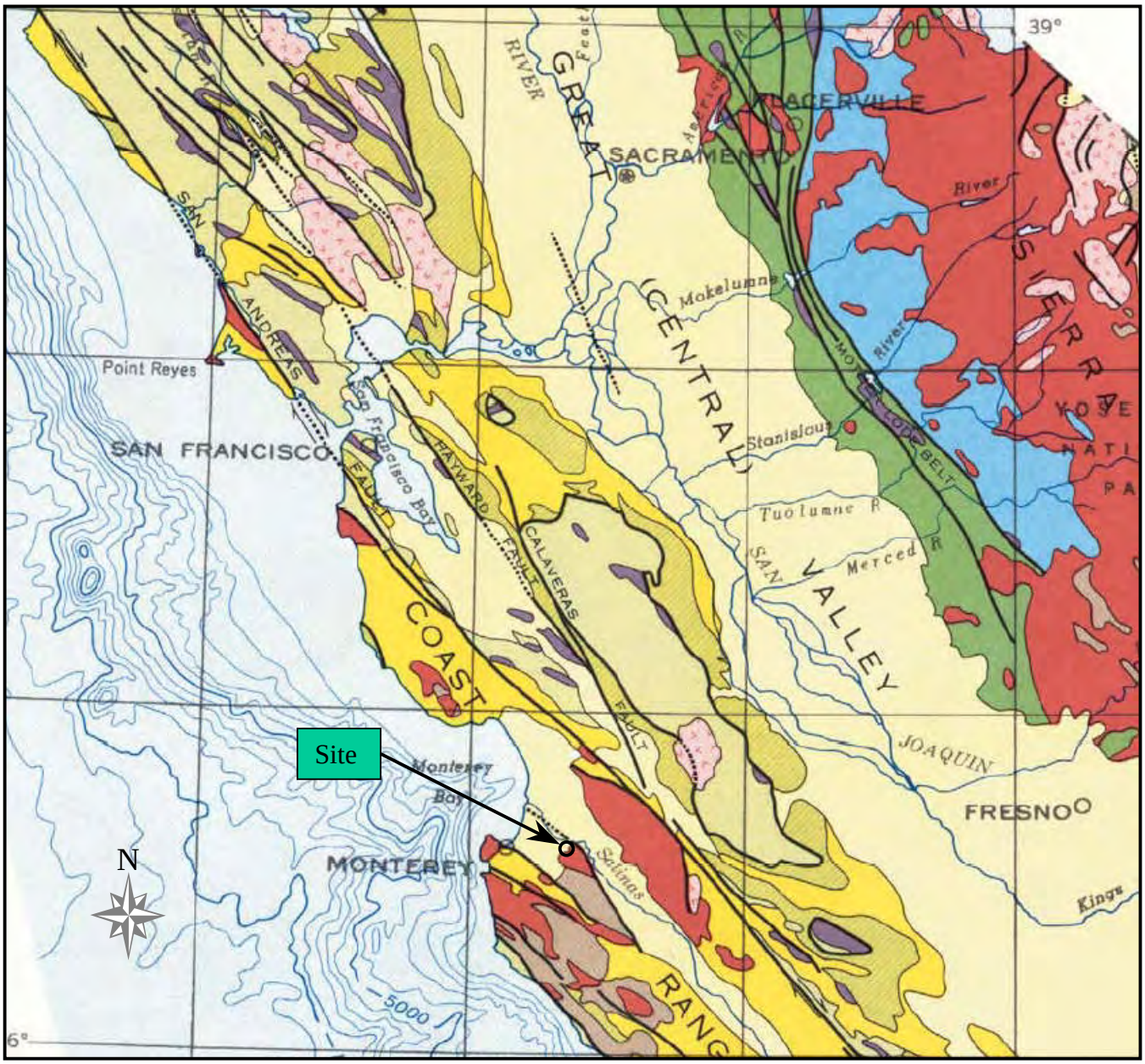

0 50

SCALE MILES

Map source: Reproduced with permission, California Geological Survey, 2002, Geologic Map of California, California Department of Conservation.

EXPLANATION
of units in SF Bay Area

- Cenozoic nonmarine
- Cenozoic marine
- Late Mesozoic shelf and slope
- Late Mesozoic of the Franciscan Formation
- Mesozoic Granitic rocks
- Mesozoic Ultramafic rocks
- Pre-Cenozoic rocks
- Fault, dotted where concealed, arrows indicate direction of movement

Original in color

DRAWN BY: D. Seymour		REGIONAL GEOLOGIC MAP	KLEINFELDER	PLATE
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CHECKED BY: m. cLARK		Ferrini Ranch Subdivision Monterey County, California	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	5
DATE: 09/20/06	APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt	FILE NAME:	

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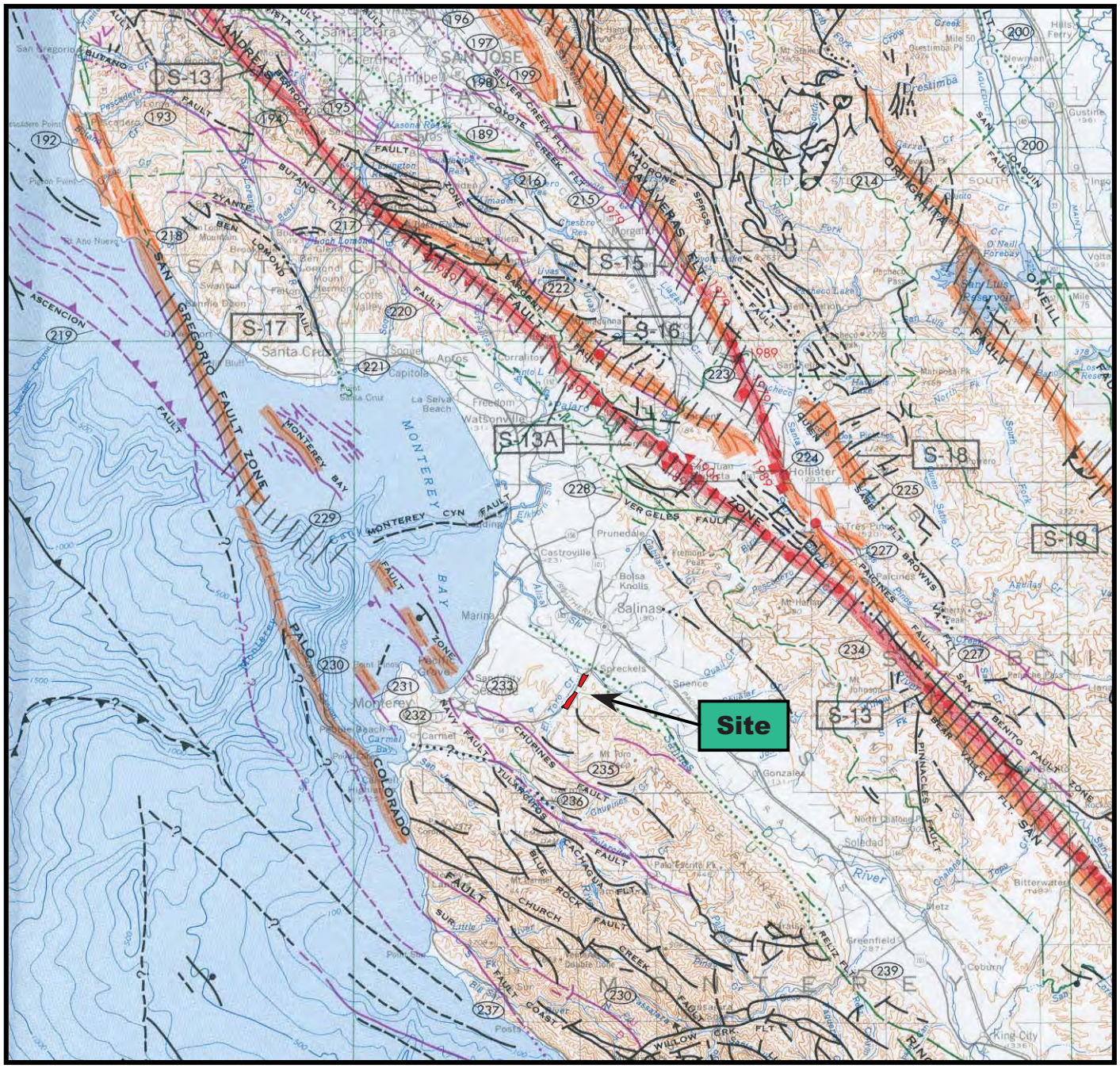

Scale (miles)

0 10 20 30 40

Original in Color

N

Reference
Jennings, C.W., 1994, Fault activity map of California and adjacent area, with locations and ages or Recent volcanic eruptions; California geologic data map series, map no. 6, Department of Conservation, Division of Mines and Geology

EXPLANATION

- Fault with historic movement
- Fault with within last 10,000 years
- Faults with movement older than 10,000 years or undifferentiated

Original in color

DRAWN BY: D. Seymour		REGIONAL FAULT MAP	KLEINFELDER	PLATE
REVISED BY:			365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	6
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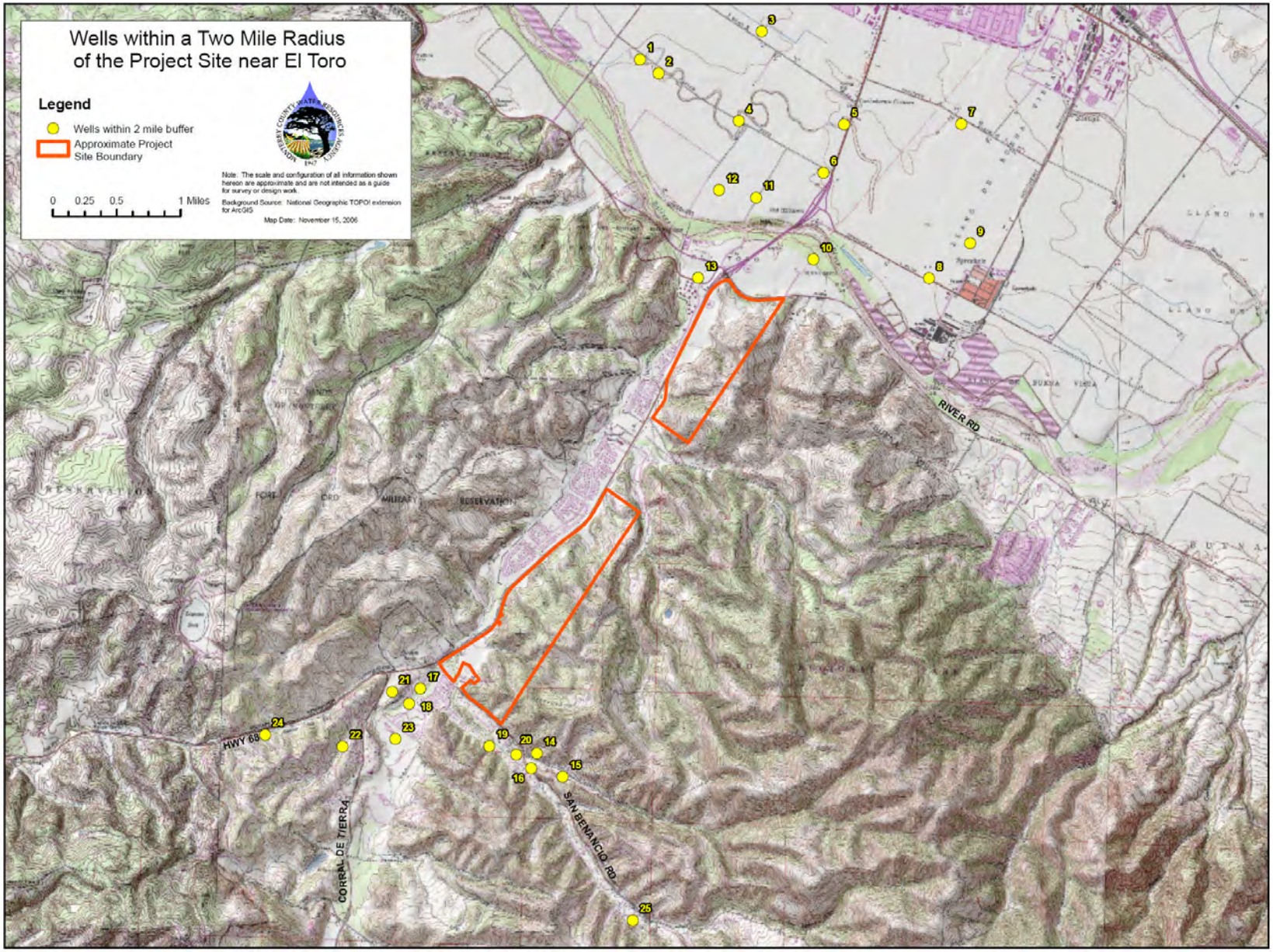

Source: Monterey County Water Resources Agency

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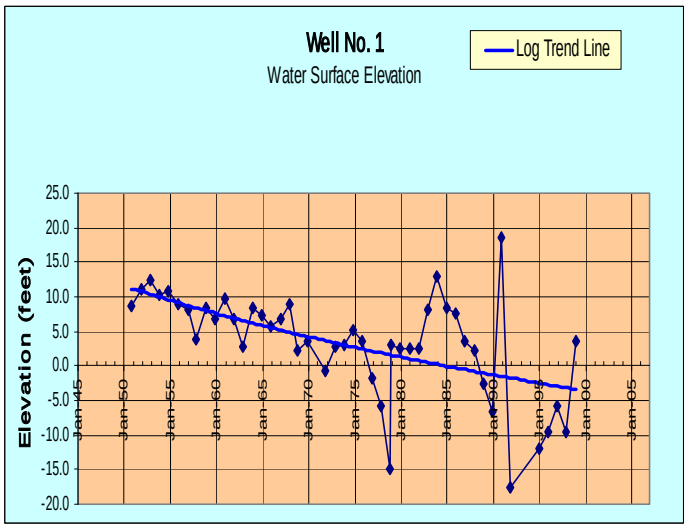

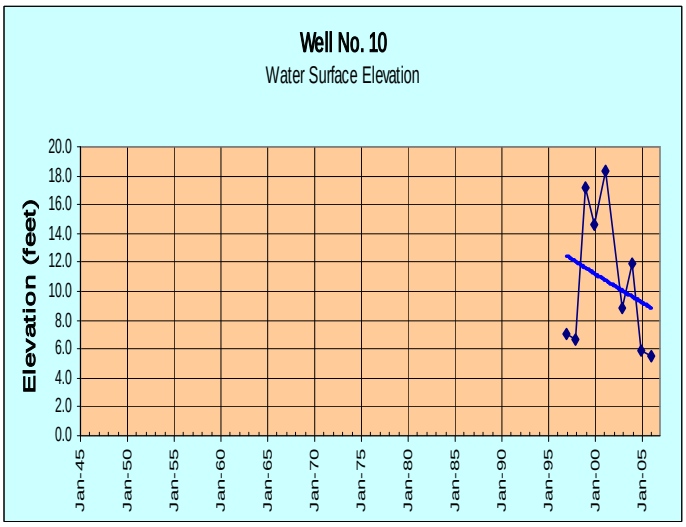

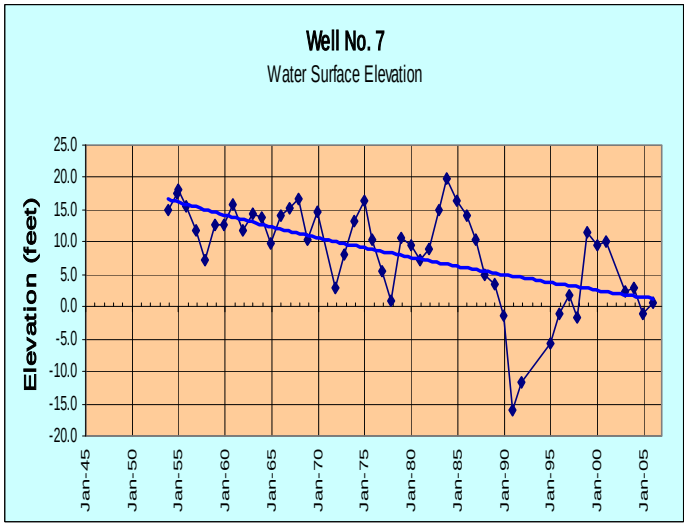

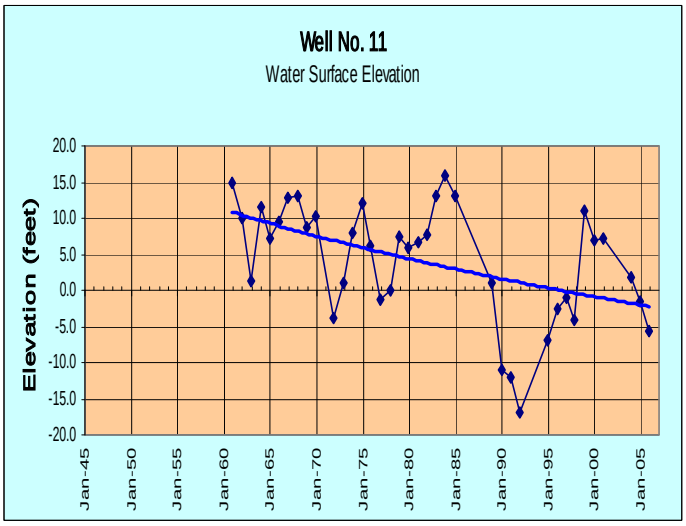

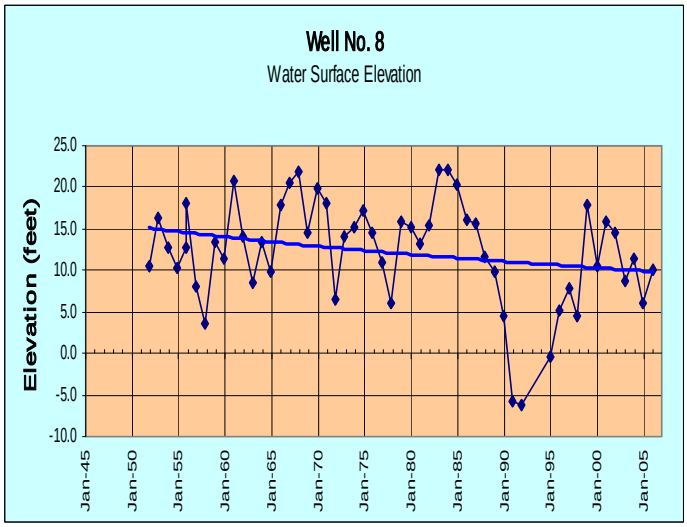

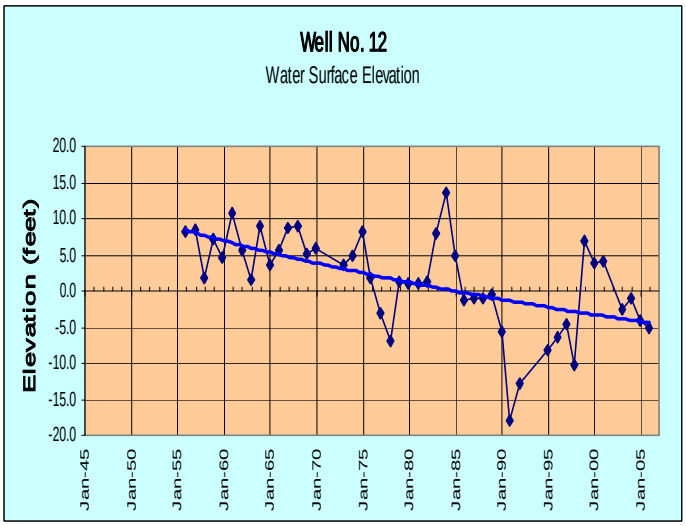

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CHECKED BY: m. cLARK		Ferrini Ranch Subdivision Monterey County, California	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	
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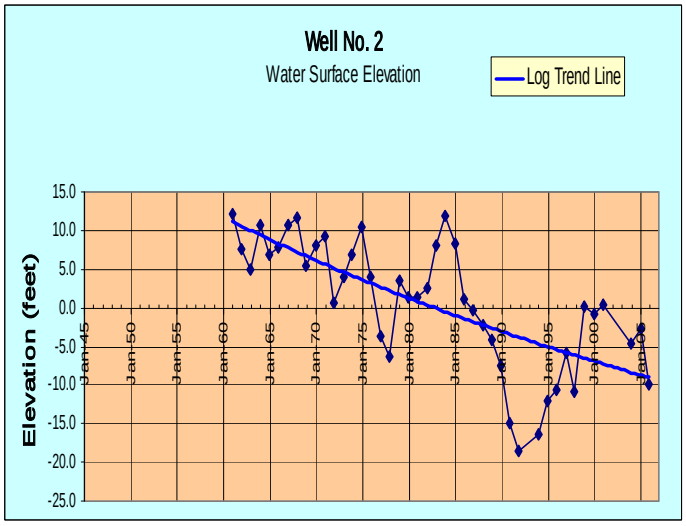

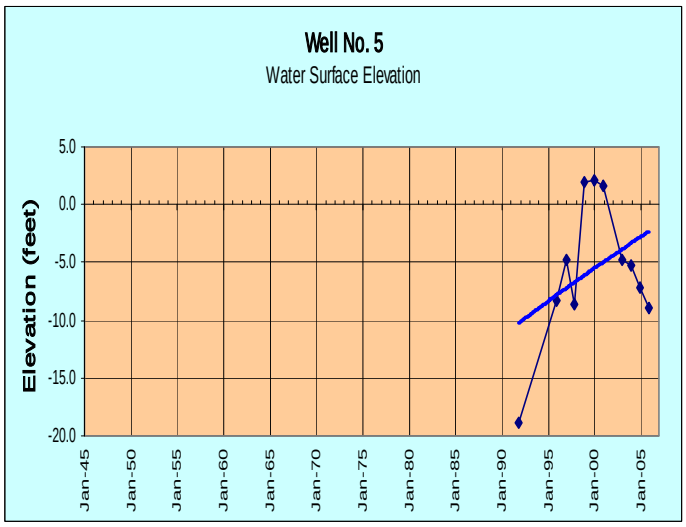

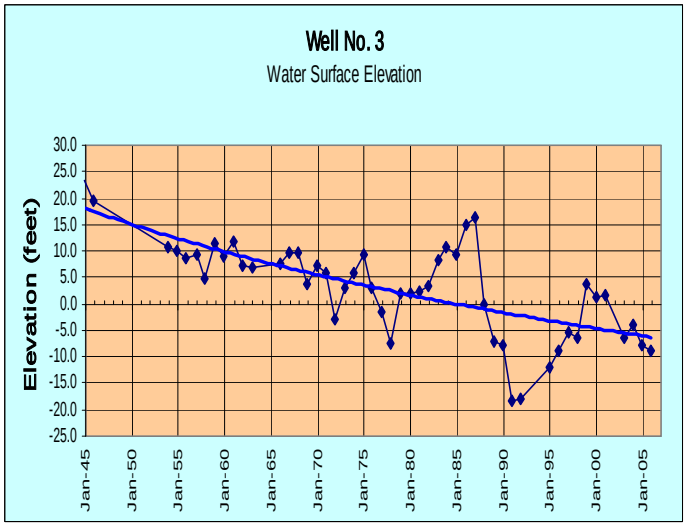

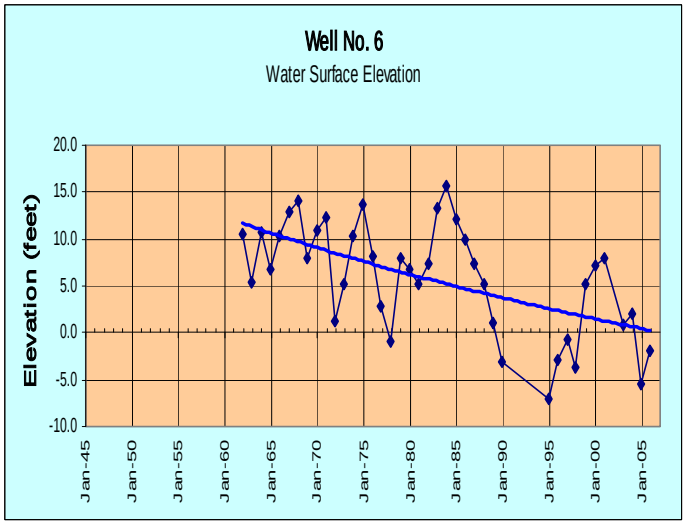

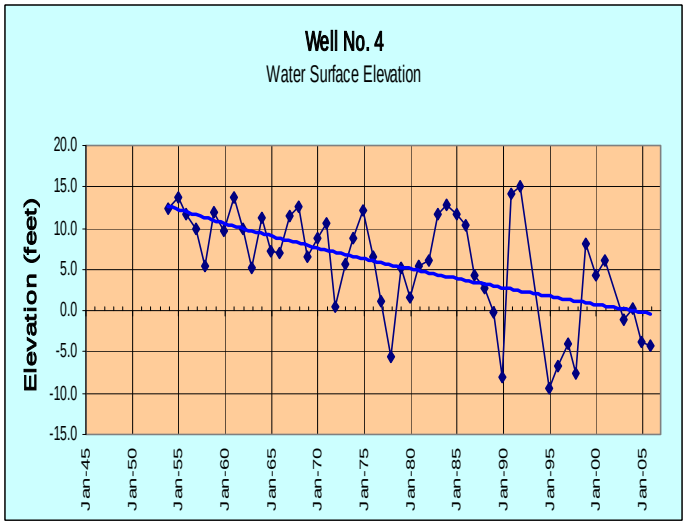

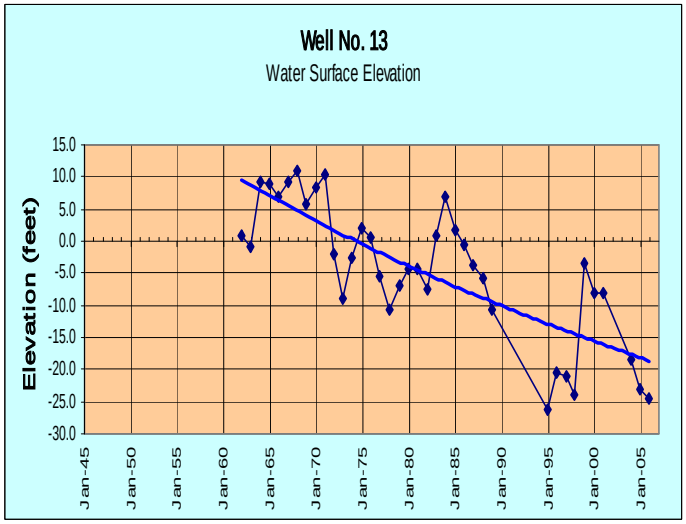

DRAWN BY: D. Seymour		Groundwater Trends Pressure Area 400-foot Aquifer	KLEINFELDER	PLATE
REVISED BY:				9
CHECKED BY: m. cLARK		Ferrini Ranch Subdivision Monterey County, California	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	
DATE: 09/20/06	APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt	FILE NAME:	

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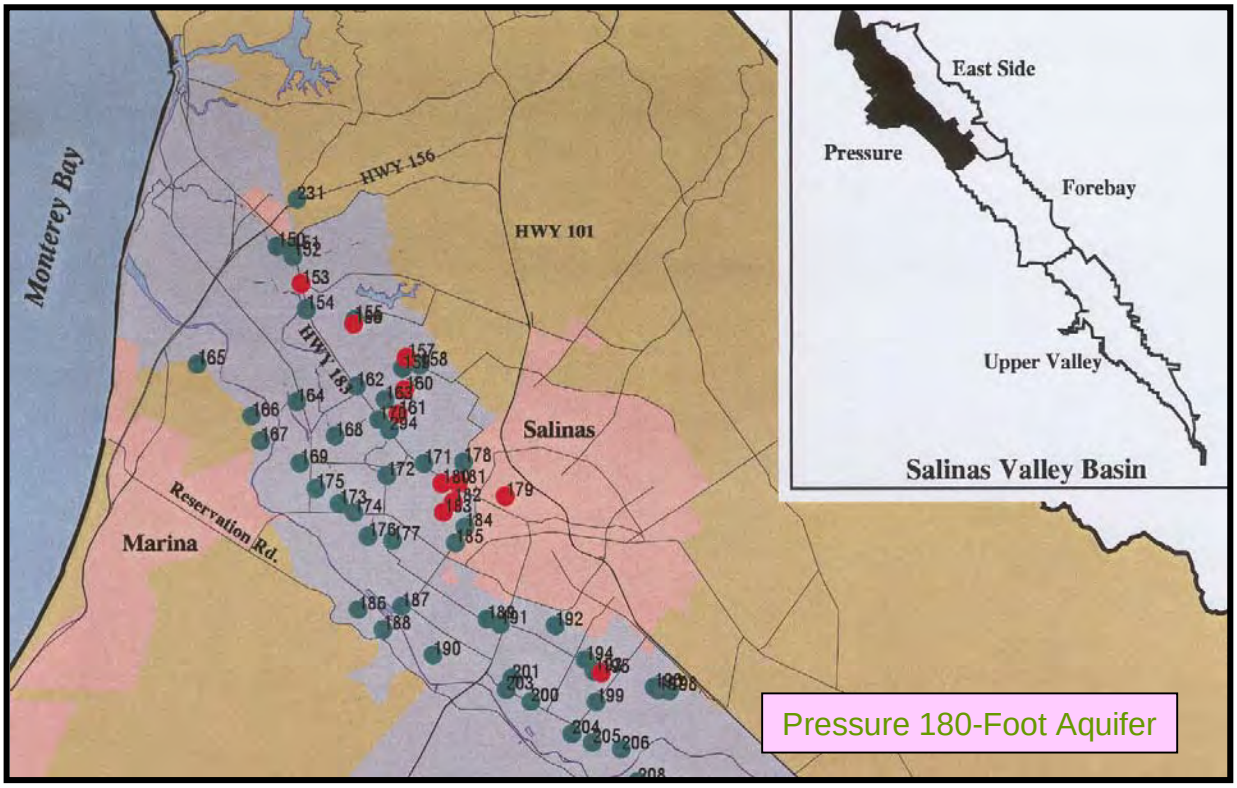
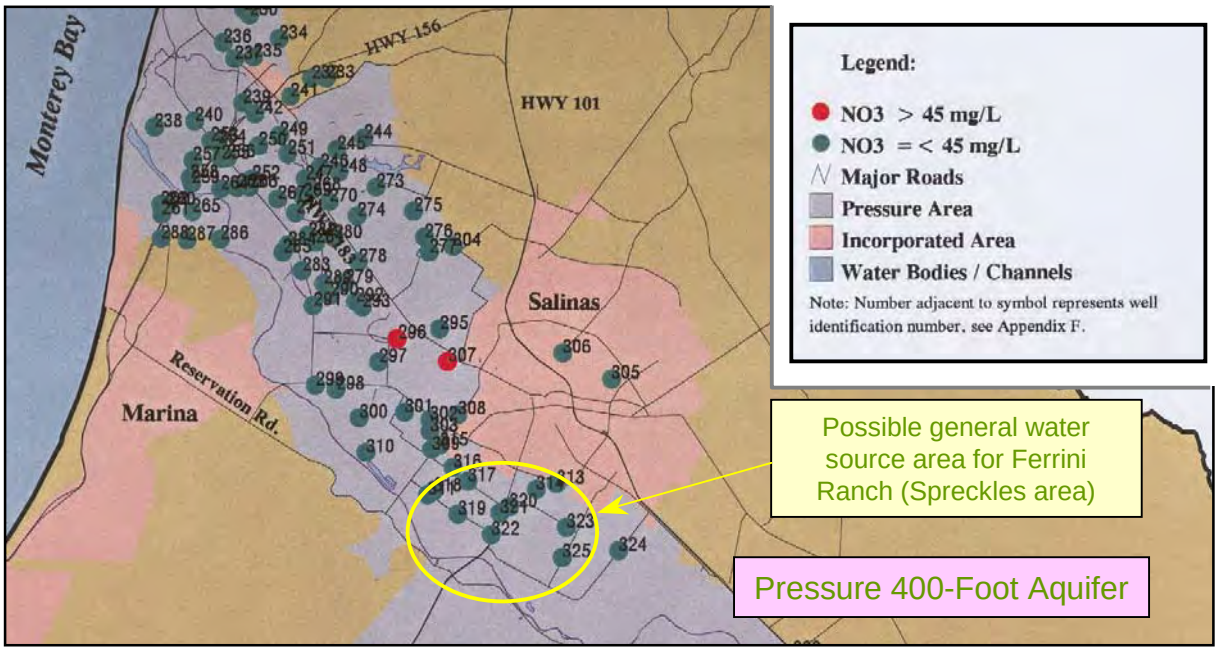
PLOTTED:2 January 2007





N

Map source: Monterey County Water Resources Agency, 2000, Water Resources Data Report, Water Year 1994-1995

1995 Nitrate Values, Pressure Area

Nitrate in Wells as NO_3

0 2 4 6 8
SCALE Miles

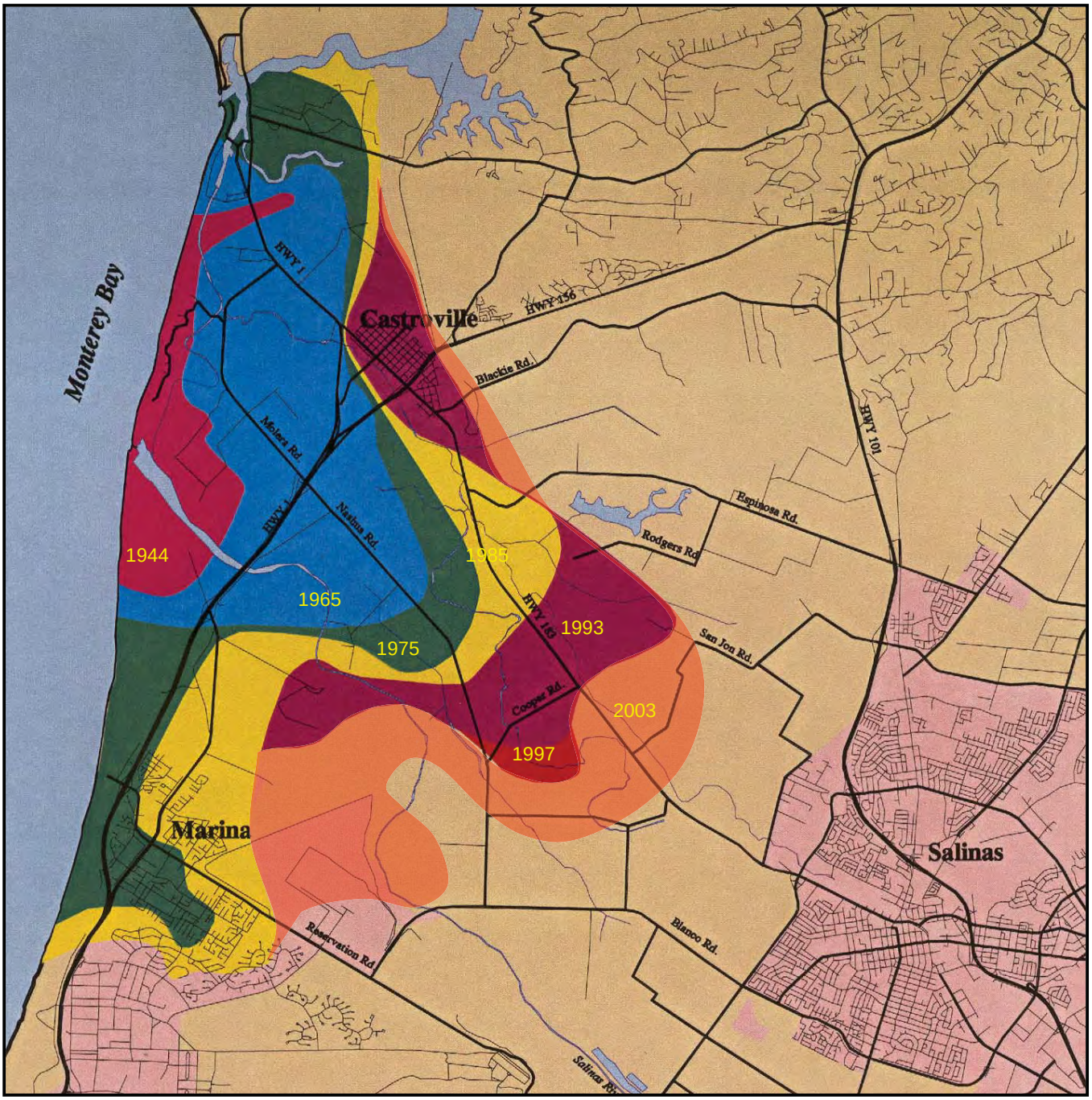
All locations are approximate

Original in color

DRAWN BY: D. Seymour		NITRATE VALUES, PRESSURE AREA	KLEINFELDER	PLATE
REVISED BY:				
CHECKED BY: m. cLARK		Ferrini Ranch Subdivision Monterey County, California	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	10
DATE: 09/20/06	APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt	FILE NAME:	

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:2 January 2007



Historic Seawater Intrusion Map

Pressure 180-foot Aquifer – 500 mg/L Chloride
MODIFIED AND UPDATED TO 2003

Map source: Monterey County Water Resources Agency, 2000, Water Resources Data Report, Water Year 1994-1995

0 1 2
SCALE Miles

N

All locations are approximate

Original in color

DRAWN BY: D. Seymour	HISTORIC SEAWATER INTRUSION MAP	KLEINFELDER	PLATE
REVISED BY:			
CHECKED BY: m. cLARK	Ferrini Ranch Subdivision Monterey County, California	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909	11
DATE: 09/20/06 / APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt / FILE NAME:		

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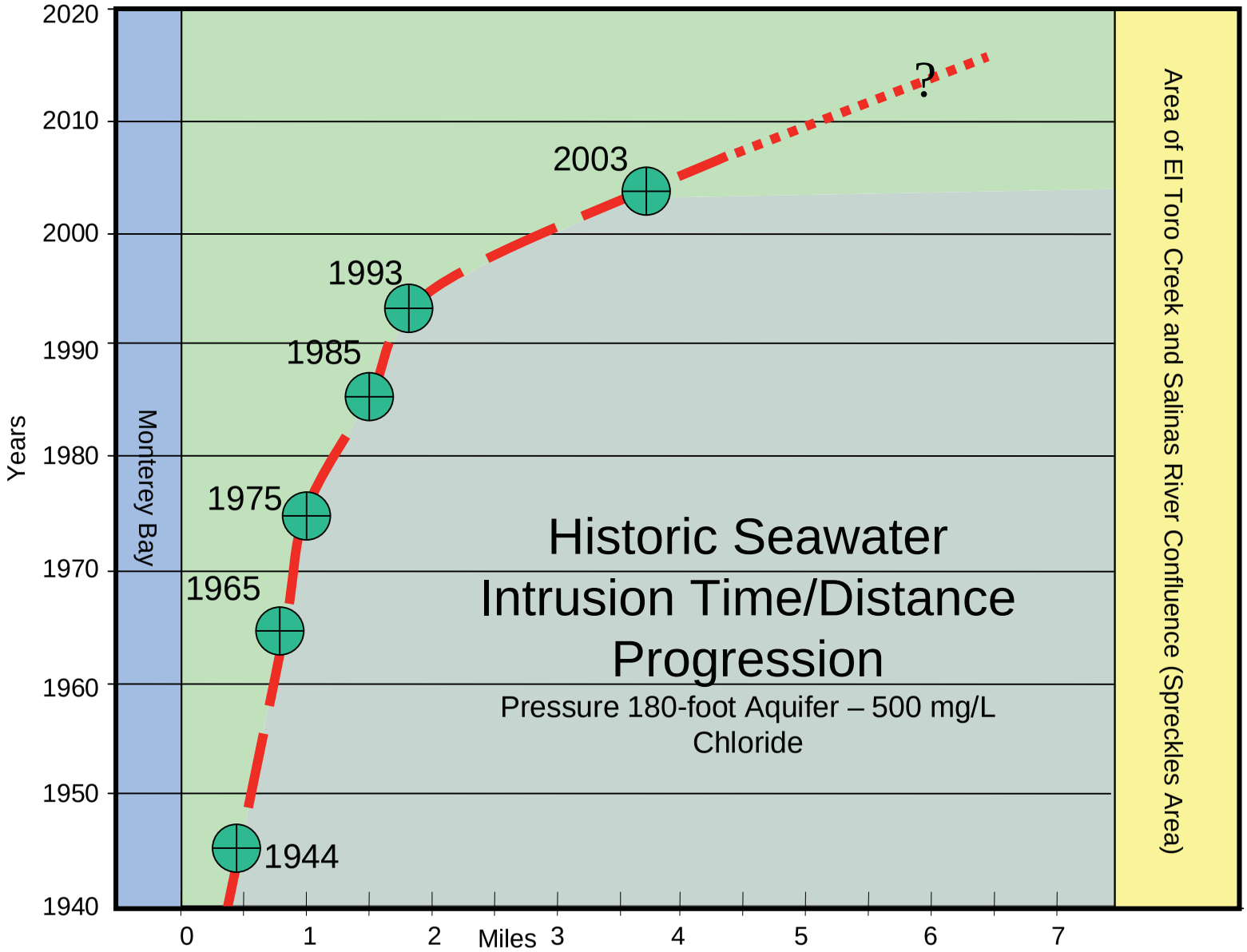
PLOTTED:2 January 2007



Original in color

DRAWN BY: D. Seymour	SEAWATER INTRUSION TIME/DISTANCE PLOT	KLEINFELDER	PLATE
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CHECKED BY: M. Clark	Ferrini Ranch Subdivision Monterey County, California		
DATE: 09/20/06 / APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt / FILE NAME:		

Library file: L:\2006\library\projects\74732**.ppt

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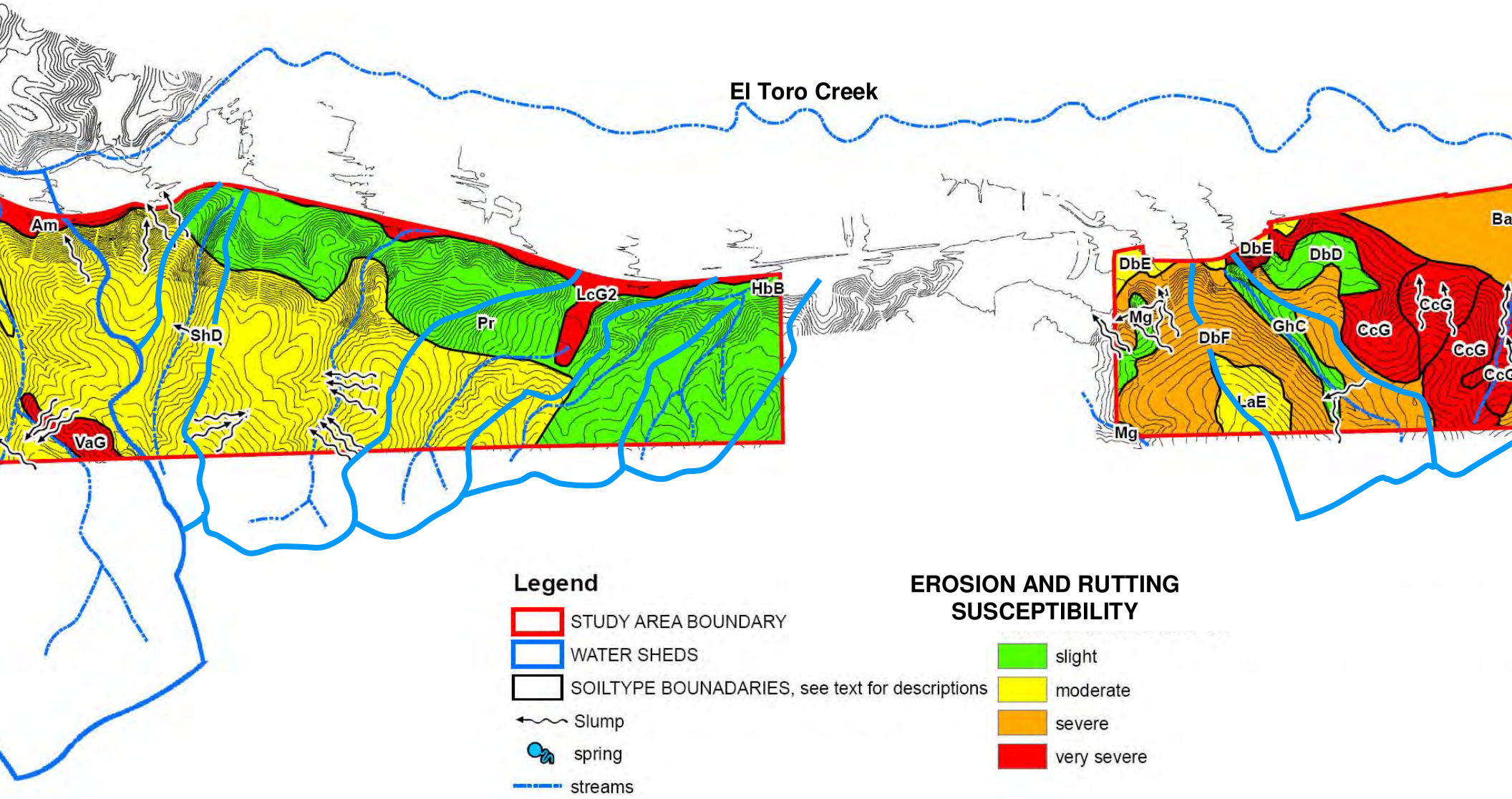
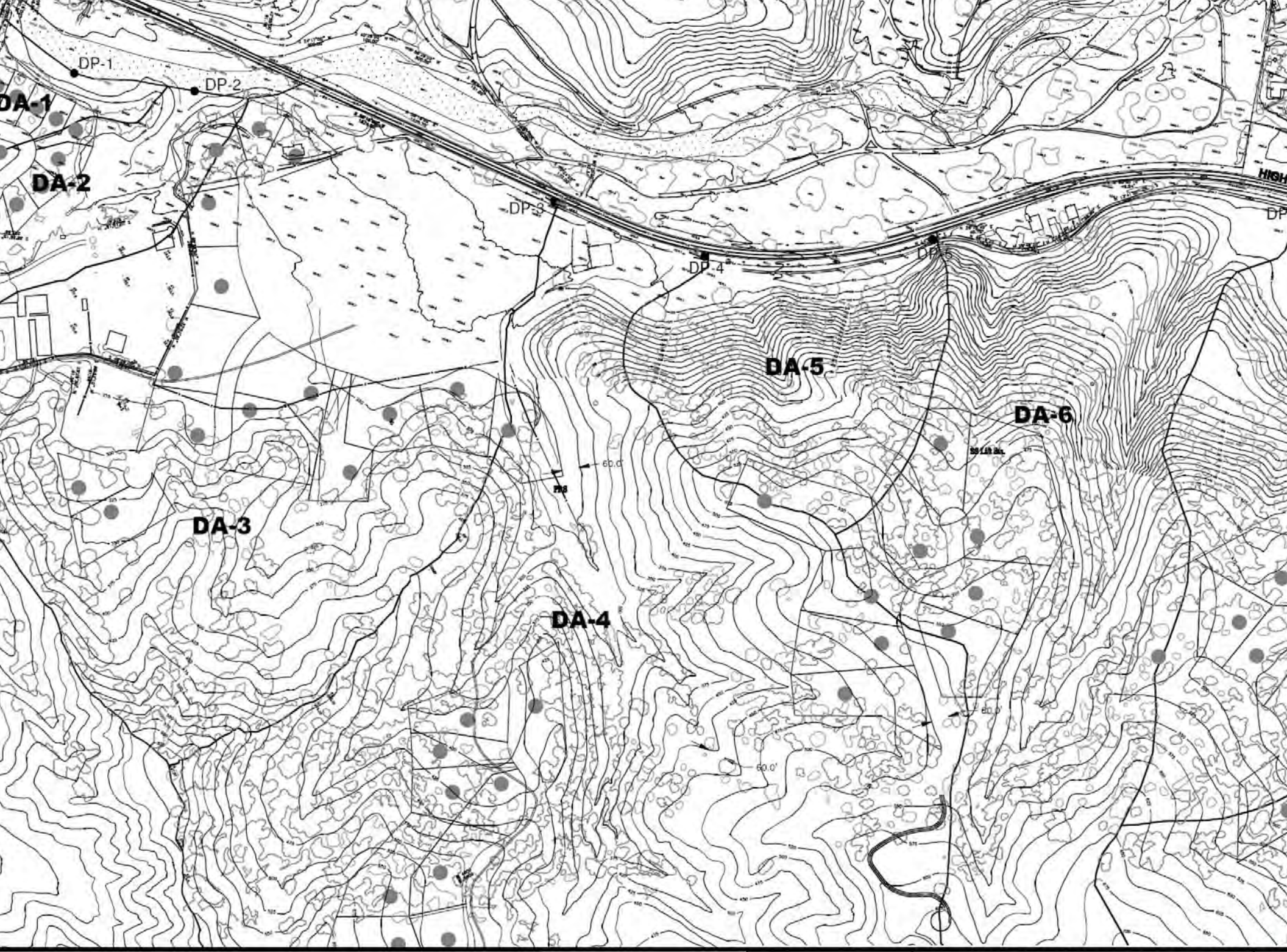


N

DRAWN BY: J. WALKER	EROSION AND DRAINAGE MAP	K L E



LEGEND

DRAINAGE AREA BOUNDARY

EXISTING INDEX CONTOUR (25 FEET)

DRAWN BY: JL

PRELIMINARY DRAINAGE AREA ANALYSIS
DRAINAGE AREA BOUNDARIES

K

GEND

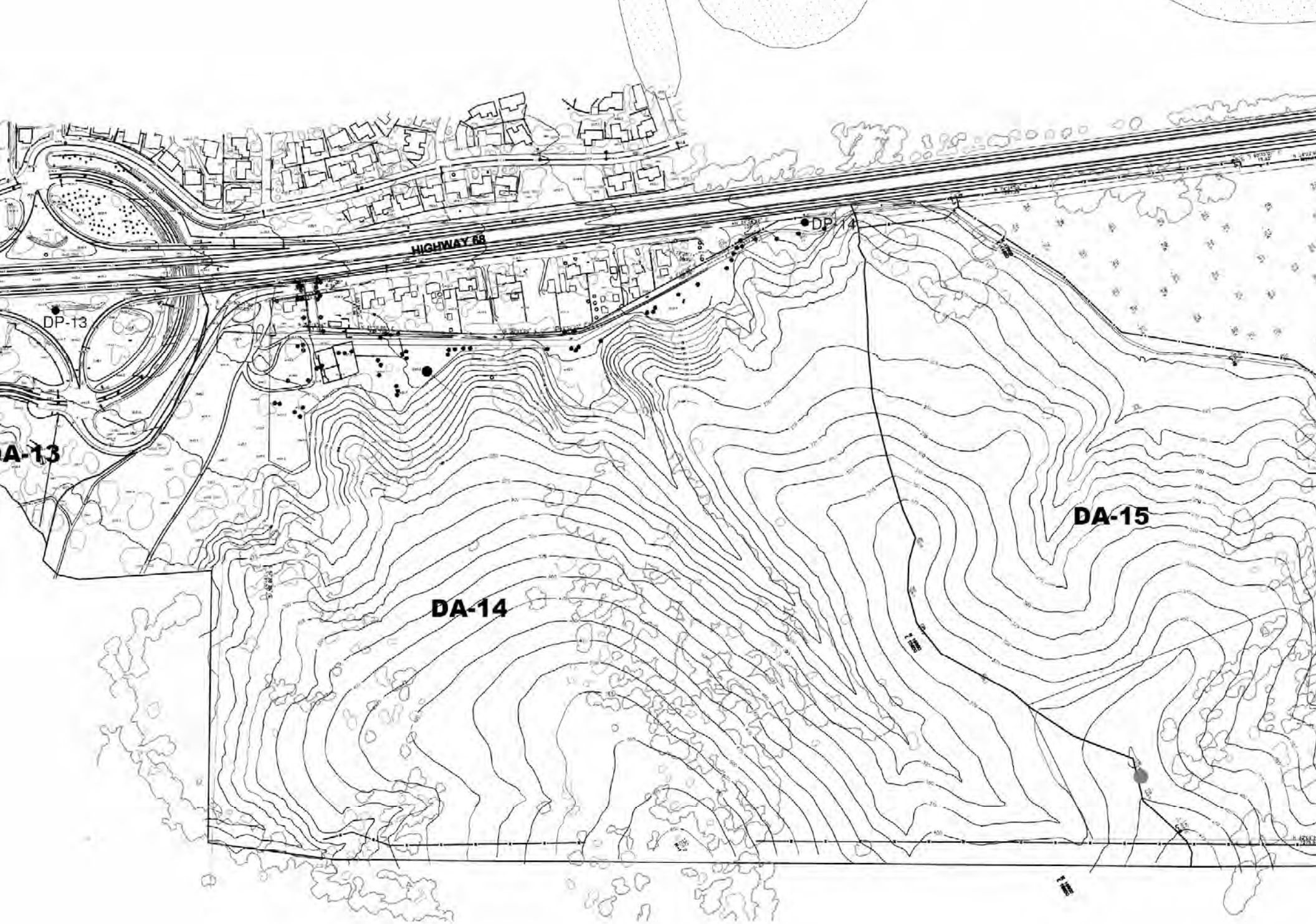
DRAINAGE AREA BOUNDARY

EXISTING INDEX CONTOUR (25 FEET)

DRAWN BY: JL

PRELIMINARY DRAINAGE AREA ANALYSIS
DRAINAGE AREA BOUNDARIES

K



EGEND

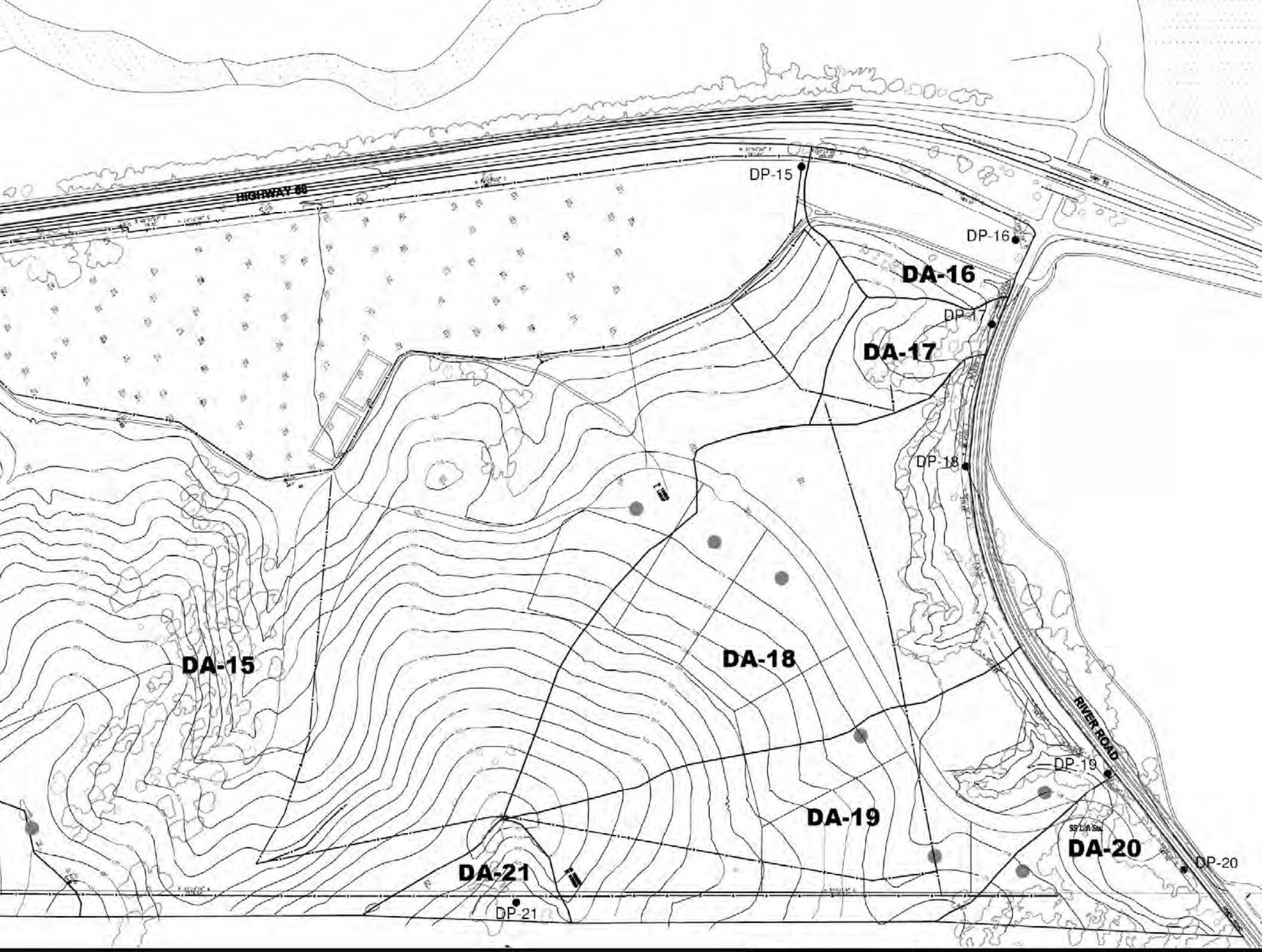
DRAINAGE AREA BOUNDARY

EXISTING INDEX CONTOUR (25 FEET)

DRAWN BY:	JL
REVISED BY:	JL

PRELIMINARY DRAINAGE AREA ANALYSIS
DRAINAGE AREA BOUNDARIES

K



LEGEND

DRAWN BY:

PRELIMINARY DRAINAGE AREA ANALYSIS
DRAINAGE AREA BOUNDARIES

APPENDIX A

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	ID	DESCRIPTION	MAJOR DIVISIONS		LTR	ID	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY	GW		Well-graded gravels or gravel with sand, little or no fines.	FINE GRAINED SOILS	SILTS AND CLAYS	ML		Inorganic silts and very fine sands, rock flour or clayey silts with slight plasticity.
		GP		Poorly-graded gravels or gravel with sand, little or no fines.			CL		Inorganic lean clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		GM		Silty gravels, silty gravel with sand mixture.			OL		Organic silts and organic silt-clays of low plasticity.
		GC		Clayey gravels, clayey gravel with sand mixture		SILTS AND CLAYS	MH		Inorganic elastic silts, micaceous or diatomaceous or silty soils.
	SAND AND SANDY	SW		Well-graded sands or gravelly sands, little or no fines.			CH		Inorganic fat clays (high plasticity).
		SP		Poorly-graded sands or gravelly sands, little or no fines.			OH		Organic clays of medium high to high plasticity.
		SM		Silty sand.	HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils.
		SC		Clayey sand.					

Standard Penetration Split Spoon Sampler 2.0 inch O.D., 1.4 inch I.D.

Modified California Sampler 2.5 inch O.D., 2.0 inch I.D.

Bulk Sample

California Sampler, 3.0 inch O.D., 2.5 inch I.D.

Shelby Tube 3.0 inch O.D.

0745, 5/31 — Approximate water level first observed in boring. Time recorded in reference to a 24 hour clock.

0800, 5/31 — Approximate water level observed in boring following drilling

PEN — Pocket Penetrometer reading, in tsf

TV:Su — Torvane shear strength, in ksf

LL	LIQUID LIMIT	TX	TRIAXIAL SHEAR
PI	PLASTICITY INDEX	CONSOL	CONSOLIDATION
%-#200	SIEVE ANALYSIS (#200 SCREEN)	R-Value	RESISTANCE VALUE
DS	DIRECT SHEAR	SE	SAND EQUIVALENT
C	COHESION (PSF)	EI	EXPANSION INDEX
PHI	FRICTION ANGLE	FS	FREE SWELL (U.S.B.R.)

Notes: Blow counts represent the number of blows a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18 inch penetration, unless otherwise noted.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

KLEINFELDER

PROJECT NO. **74732-Geotech1**

BORING AND TEST PIT LOG LEGEND

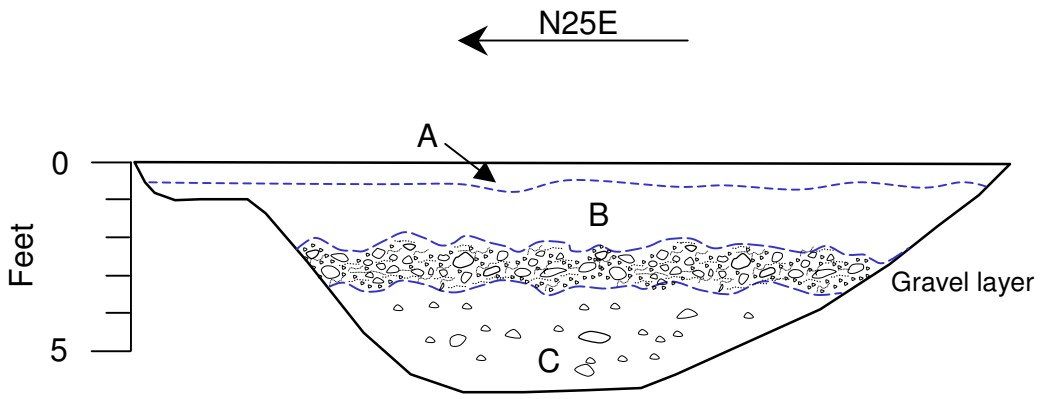
FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

A-1

12/12/2006 9:28:31 AM

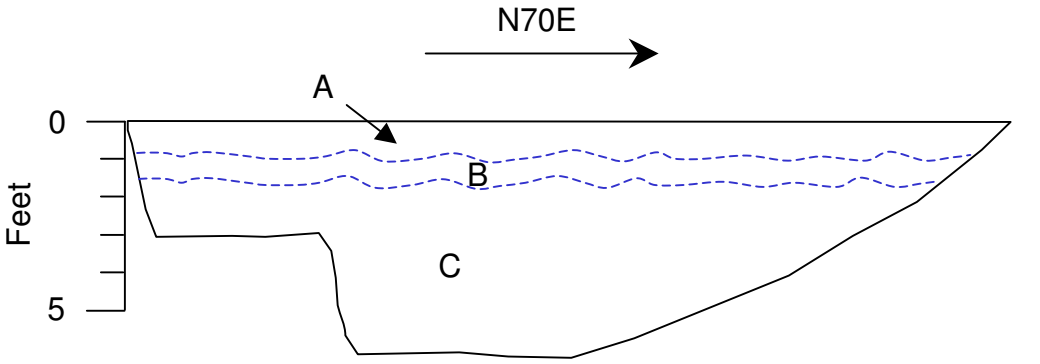
TP-1



Scale – 1:1 (Horizontal to Vertical)

A – Silty Sand (SM), dark yellowish brown, moist, medium dense, blocky soil structure, wavy lower contact, fine-grained sand (topsoil).
B – Well-graded Sand with gravel (SW), pale yellow to light yellowish brown, slightly moist, medium dense to dense, fine- to coarse-grained sand, fine to coarse gravel, wavy dark brown banding (Qof).
C – Well-graded Gravel with sand (GW), yellowish brown to dark yellowish brown, moist, dense, medium- to coarse-grained arkosic sand, fine to coarse subrounded gravel, upper layer about 20% cobbles, about 80% of gravel and cobbles composed of quartz monzonite and other granitic rocks, about 20% shale fragments (Qof).

TP-2



Scale – 1:1 (Horizontal to Vertical)

A – Silty Clay (CL), very dark grayish brown, moist, soft to medium stiff.
B – Silty Clay (CL), pale brown, dry, medium stiff to stiff,carbonate horizon, no carbonate nodules, wavy upper and lower contacts
C – Sandy Clay with silt(CL), brown to dark brown, moist, stiff, fine- to coarse-grained sand, some clay lined ped faces (Qt).

DRAWN BY: D. Seymour		**TEST PIT LOGS TP-1 and TP-2**	KLEINFELDER	**PLATE**
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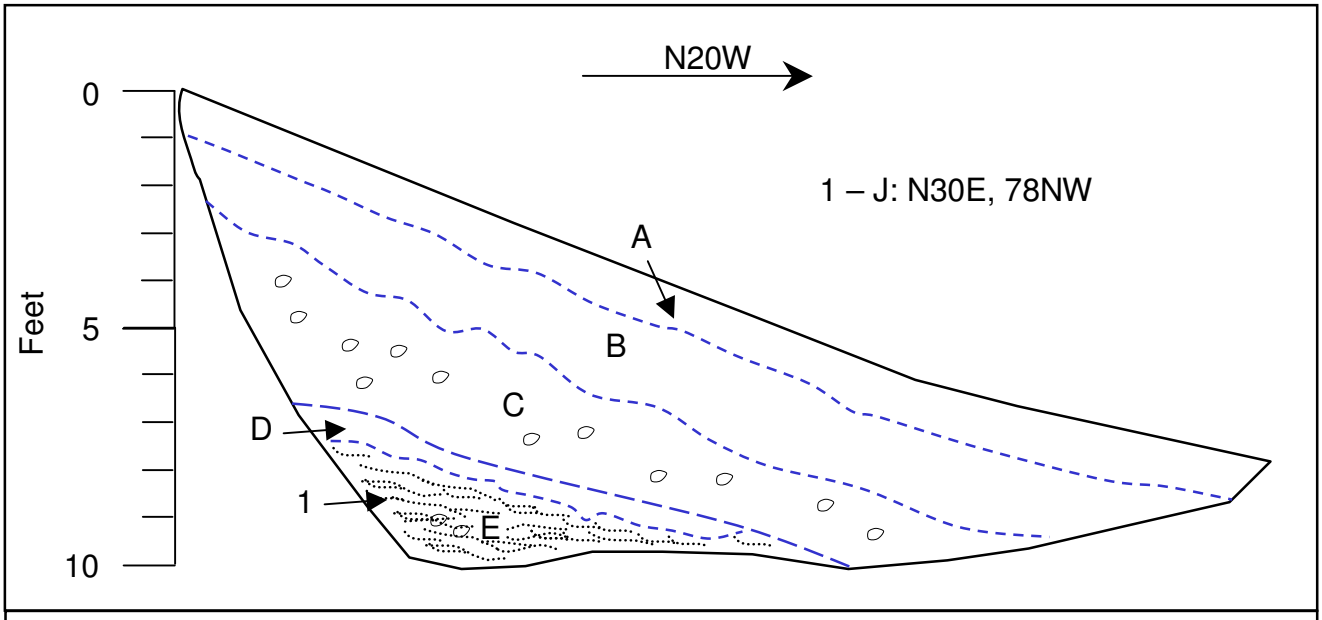
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision** **Monterey County, California**		
DATE: Dec. 2006	APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt	FILE NAME:	

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

TP-3



A – Sandy Clay/Clayey Sand (CL/SC), very dark brown to black, moist, soft/loose, fine-grained sand, numerous roots.
B – Sandy Silt (ML), dark grayish brown to very dark grayish brown, dry, soft to medium stiff, porous with open pores from 0.1 to 0.25 inch, occasional coarse gravel composed of rounded shale clasts, wavy upper and lower contacts (earth flow deposit).
C – Silty Sand with Gravel (SM), pale brown, dry, loose to medium dense, porous with pores up to 0.25 inch, fine- to coarse-grained sand, fine to coarse gravel with cobbles up to 4 inches, gravel and cobbles composed of mostly subrounded to round shale clasts, abrupt lower contact (earth/debris flow deposit).
D – Sandy Clay (CL), dark yellowish brown, moist, very stiff, fine- to coarse-grained sand, oxidized sand layer above underlying bedrock varying from 0.5 to 4 inches thick.
E – Sandstone, very pale orange, dry, moderately to highly weathered, moderately fractured, fine-grained sand, pockets of rounded gravel composed of mostly shale (QTc).

Scale – 1:1 (Horizontal to Vertical)

<u>Explanation</u>

B – Bedding attitude
J – Joint attitude

DRAWN BY: D. Seymour	**TEST PIT LOGS**	KLEINFELDER	**PLATE**
REVISED BY:	**TP-3**		
CHECKED BY: M. Clark	**Ferrini Ranch Subdivision**	365 Victor Street, Suite L	A-3
DATE: Dec. 2006 / APPROVED BY: M. Clark	**Monterey County, California**	Salinas, California 93907	
	PROJECT NO: 74732/Rpt / FILE NAME:	Ph. (831) 755-7900 Fax. (831) 755-7909	
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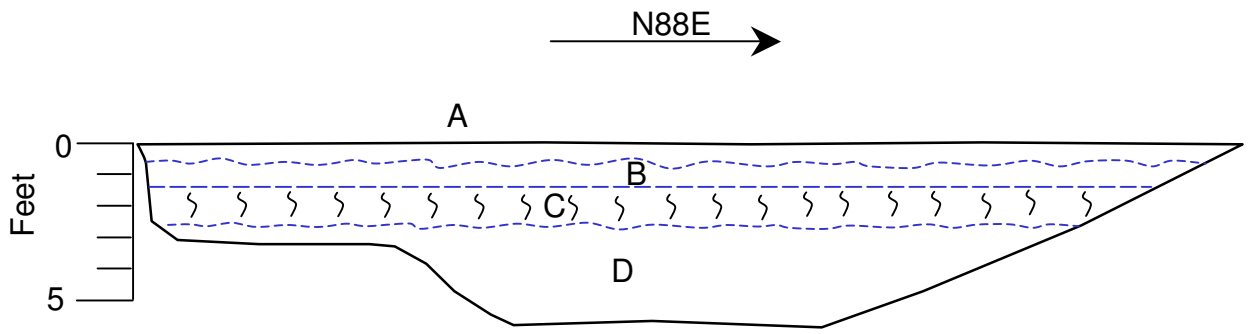
PLOTTED:12 December 2006

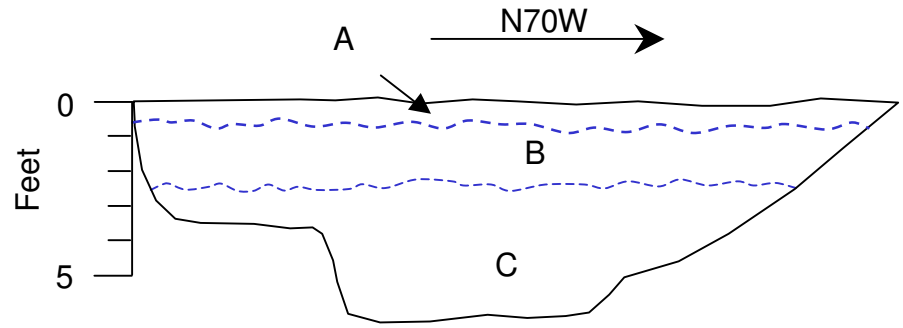
TP-4



Scale – 1:1 (Horizontal to Vertical)

A – Silty Clay (CL), very dark brown to black, moist, soft, numerous roots, wetted zone from recent rains (topsoil/mud flow deposit).
B – Sandy Silt (ML), grayish brown, dry, medium stiff, porous with pores up to 0.1-inch diameter, some carbonate cement, upper contact gradational, lower contact abrupt (mud flow deposit-Qmf).
C – Sandy Clay (CL), very dark gray to black, slightly moist, stiff to very stiff, fine- to coarse-grained sand, trace of fine gravel composed of mostly shale, blocky soil structure, lower contact gradational.
D – Sandy Clay with gravel (CL), mottled brown and light olive brown, moist , stiff to very stiff, fine- to coarse-grained sand, gine gravel composed of subrounded to rounded granitic rocks and shale clasts (Terrace Deposit-Qt).

TP-5



Scale – 1:1 (Horizontal to Vertical)

A – Silty Clay (CL), very dark brown to black, moist, soft, numerous roots, wetted zone from recent rains (topsoil/mud flow deposit).
B – Silty Sand/Sandy Silt (SM/ML), pale brown to brown, dry, medium stiff,fine-grained sand, porous with pores up to 1/16-inch, lower contact gradational, carbonate cement.
C – Sandy Clay with gravel (CL), very dark grayish brown, moist, medium stiff to stiff, fine-grained sand pores up to 1/16-inch, fine gravel (Terrace Deposit – Qt).

DRAWN BY: D. Seymour	**TEST PIT LOGS TP-4 and TP-5**	KLEINFELDER	**PLATE**
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CHECKED BY: M. Clark	**Ferrini Ranch Subdivision** **Monterey County, California**		
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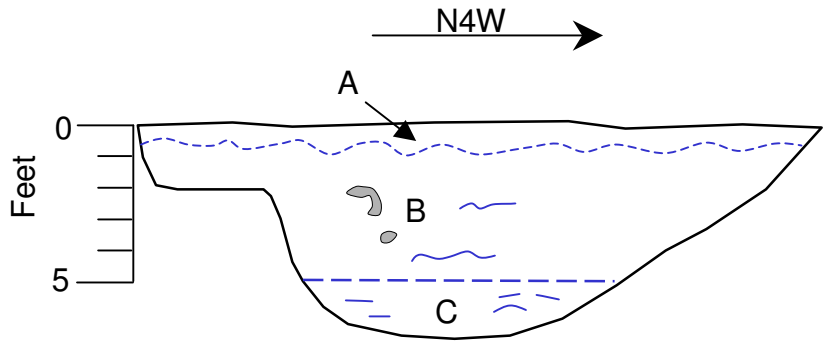
Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

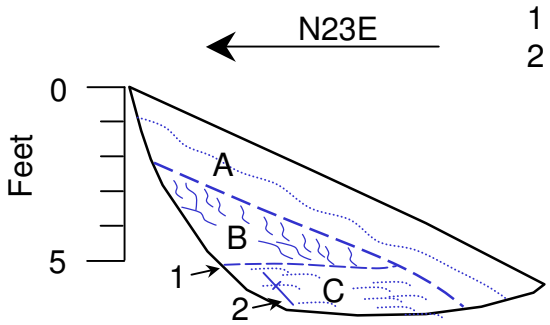
TP-6



Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), dark brown, moist, soft, fine-grained sand, numerous roots, wetted zone from recent rains 7 to 10 inches thick, lower contact gradational (topsoil/mud flow deposit).
B – Sandy Silt (ML), mottled light brownish gray to dark brownish gray, dry, soft to medium stiff, fine- to medium-grained sand, occasional krotovina, sporadic thin soil bands, lower contact planar and abrupt (mud flow deposit-Qmf).
C – Silty Sand/Sandy Silt (SM/ML), mottled brown to dark brown, moist, medium dense/stiff, 1-inch thick layer of dark brown silty sand along contact (alluvium – Qal).

TP-7



1 – B: N65E, 3 to 4SE
2 – J: N38W, 85SW

Explanation

B – Bedding attitude
J – Joint attitude

Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), very dark grayish brown, moist, soft, numerous roots, wetted zone from recent rains, wavy contact to dry zone that is light brownish gray to pale brown, porous, wavy and abrupt contact with underlying highly weathered bedrock (colluvium/mud flow deposit).
B – Bedrock – upper 10 to 12 inches is Silty Clay (CL), yellowish brown to dark yellowish brown, moist stiff, Blocky soil structure, grades to highly to moderately weathered Siltstone, intensely fractured (QTc)
C – Sandstone, pale yellow, dry, moderately weathered, moderately fractured, massive, contact with siltstone near horizontal and abrupt.

DRAWN BY: D. Seymour	**TEST PIT LOGS TP-6 and TP-7**	KLEINFELDER	**PLATE**
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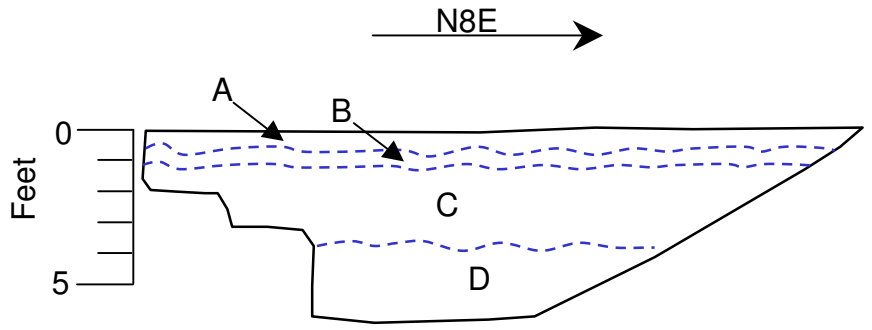
PLOTTED:12 December 2006

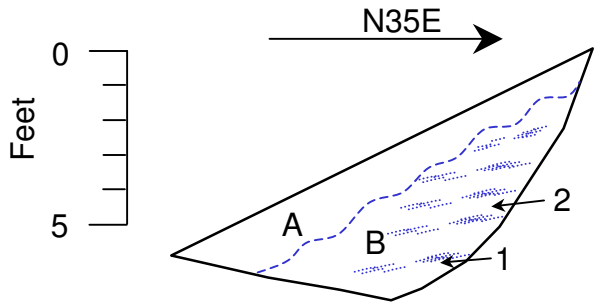
TP-8



Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), dark brown, moist, soft, fine-grained sand, numerous roots, wetted zone from recent rains 7 to 10 inches thick, lower contact gradational.
B – Sandy Silt (ML), light brownish gray, dry, soft, fine-grained sand, porous with pores up to 1/8-inch diameter, lower contact gradational (alluvium-Qal).
C –Silt with sand (ML), very dark grayish brown to very dark brown, moist, soft, very porous with pores up to ¼-inch diameter, trace of fine subrounded gravel composed of sandstone and siltstone clasts (Qal).
D – Sandy Silt (ML), very dark gray to black, very moist to wet, soft, fine- to medium-grained sand, Distinct reduction in pores and pore size, becomes wet at approximately 5 feet (Qal).

TP-9



1 – B: N44E, 42NW
2 – B: N20E, 46NW

Explanation

B – Bedding attitude
J – Joint attitude

Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), dark brown, moist, soft, fine-grained sand, numerous roots (topsoil)
B – Bedrock – Silty Sandstone, light yellowish brown, dry, moderately weathered, moderately fractured, fracture spacing 1- to 3-ft, oxide staining along fractures, appears massive with stringers of limonite staining, fine-grained sand, micaceous.

DRAWN BY: D. Seymour		**TEST PIT LOGS TP-8 and TP-9**	KLEINFELDER	**PLATE**
REVISED BY:				A-6
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision Monterey County, California**	365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909 www.Kleinfelder.com	
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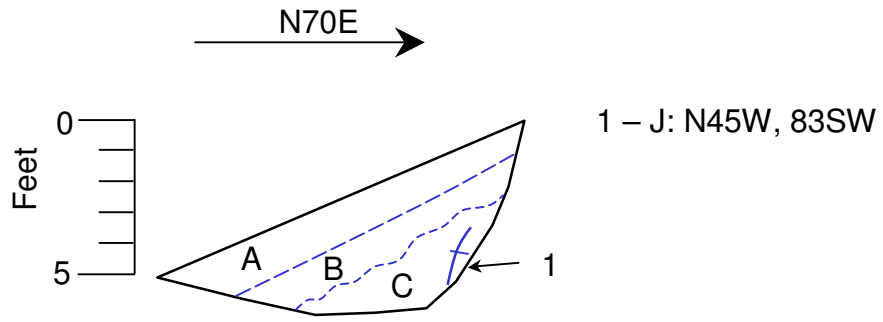
Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

TP-10



Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), very dark grayish brown, moist, soft, numerous roots, wetted zone from recent rains, wavy contact to dry zone that is light brownish gray to pale brown, porous, wavy and abrupt contact with underlying highly weathered bedrock (colluvium/mud flow deposit).
B – Silty Clay (CL), yellowish brown to dark yellowish brown, moist stiff,
Blocky soil structure, grades to highly to moderately weathered Siltstone, intensely fractured (QTc)
C –Bedrock – Silty Sandstone, light yellowish brown, dry, highly to moderately weathered, intensely fractured, appears massive, soft, fractures lined with dark oxides and clay.

Explanation

B – Bedding attitude
J – Joint attitude

DRAWN BY: D. Seymour	**TEST PIT LOGS**	KLEINFELDER	**PLATE**
REVISED BY:	**TP-10**		A-7
CHECKED BY: M. Clark	**Ferrini Ranch Subdivision**	365 Victor Street, Suite L	
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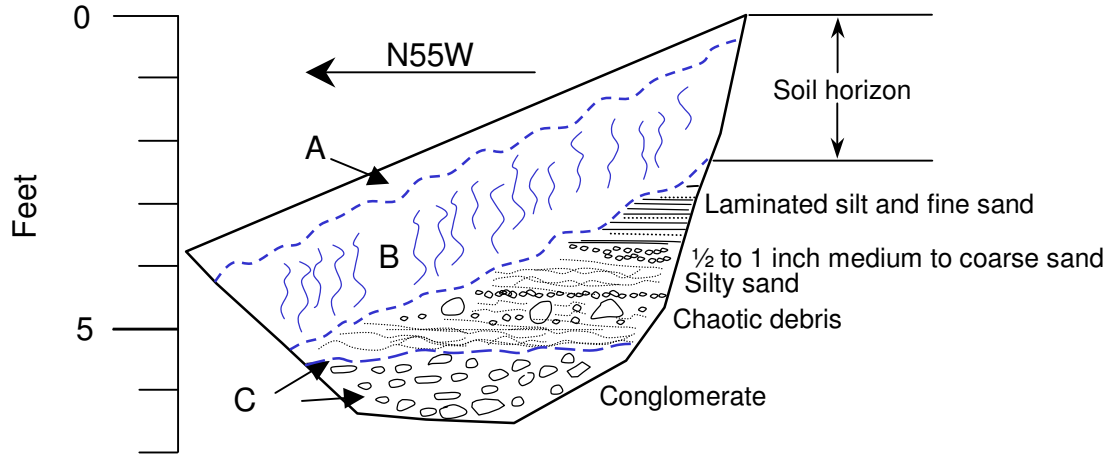
TP-11



Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt (ML), very dark gray to black, moist, soft, numerous roots (topsoil).
B – Sandy Clay (CL), pale brown to dark brown, dry, stiff to very stiff, massive soil structure, remnant laminea, gradational upper and lower contacts (B horizon).
C – Bedrock – various units: Silt (ML) and Sand (SM), mottled very pale brown and yellowish brown, dry, stiff/dense, laminated sequence of fine-grained sand and silt with occasional lens of fine- to coarse-grained sand and fine gravel.

Silty Sand (SM), light yellowish brown, slightly moist, dense, fine- to medium-grained sand, micaceous, wavy lower contact.

Chaotic Mixture of claystone and sandstone rip-up clasts with fine- to coarse-grained sand, lower contact is wavy with a 4 to 12-inch thick layer of silty sand below.

Conglomerate, sandy gravel, fine- to coarse-grained sand, fine to coarse subrounded to rounded gravel, Occasional cobbles up to 8 inches, gravel composed of mostly quartz monzonite and similar granitic rocks (QTc).

DRAWN BY: D. Seymour		**TEST PIT LOGS**	KLEINFELDER	**PLATE**
REVISED BY:		**TP-11**		
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision**	365 Victor Street, Suite L	A-8
DATE: Dec. 2006	APPROVED BY: M. Clark	**Monterey County, California**	Salinas, California 93907	
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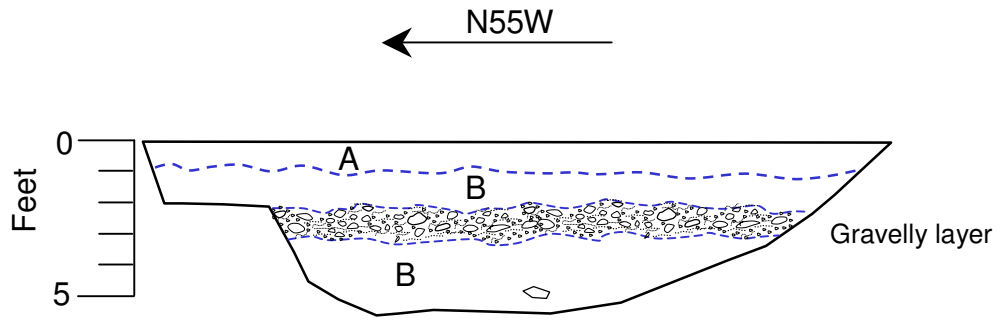
PLOTTED:12 December 2006

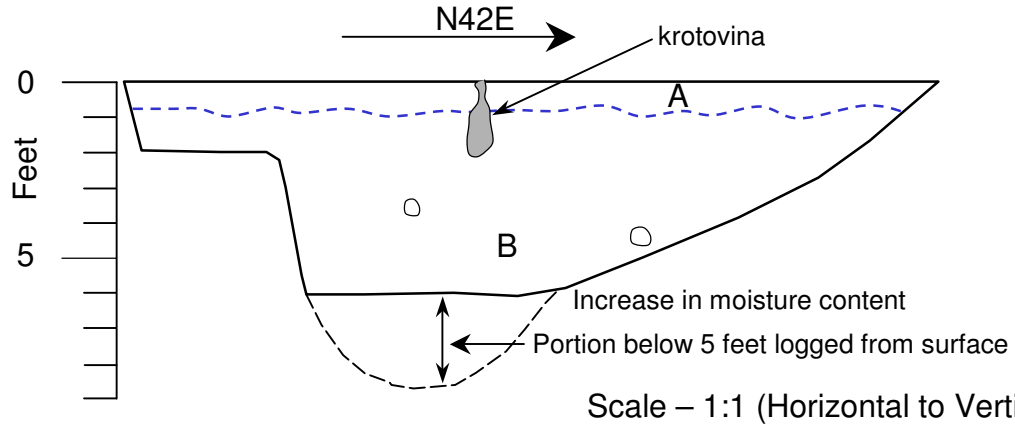
TP-12



Scale – 1:1 (Horizontal to Vertical)

A – Sandy Silt/Silty Sand (ML/SM), very dark grayish brown to very dark brown, moist, soft/loose, numerous roots, wetted zone from recent rains, gradational lower contact (topsoil).
B – Sandy Silt/Silty Sand with gravel (ML/SM), mottled yellowish brown and dark yellowish brown, dry to slightly moist, fine- to coarse-grained sand, angular to subrounded fine gravel composed mostly of granitic rock, gravel content about 15 to 30 percent, moisture and fines contents increase below gravelly layer (Qal).

TP-13



Scale – 1:1 (Horizontal to Vertical)

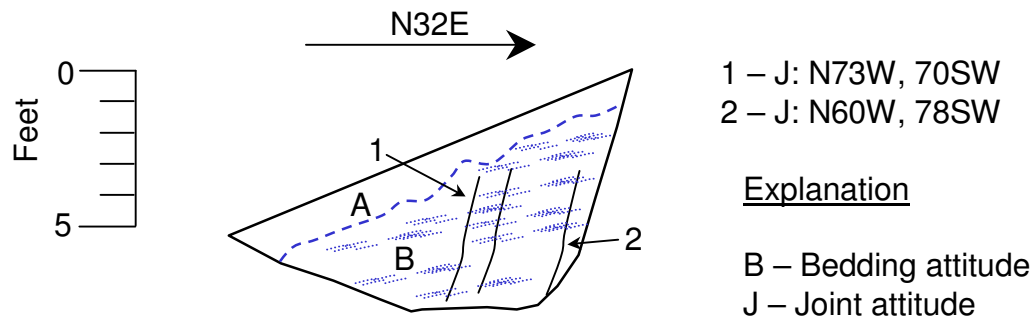
A – Silty Sand/Sandy Silt with gravel (SM/ML), brown to dark yellowish brown, moist, loose/soft, fine- to coarse-grained sand, fine angular gravel about 15 to 20 percent (topsoil).
B – Silty Sand with gravel (SM), brown, dry, medium dense, fine- to coarse-grained sand with fine angular gravel, gravel composed of quartz monzonite and similar granitic rocks, gravel about 20 to 30 percent (Qal).

DRAWN BY: D. Seymour		**TEST PIT LOGS TP-12 and TP-13**	KLEINFELDER	**PLATE**
REVISED BY:			365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909 www.Kleinfelder.com	A-9
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision** **Monterey County, California**		
DATE: Dec. 2006	APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt	FILE NAME:	

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

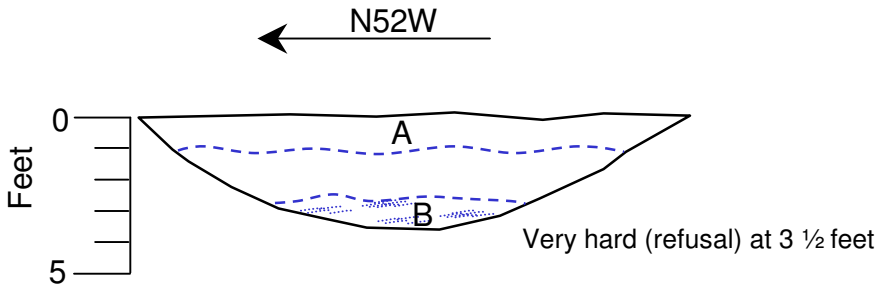
TP-14



Scale – 1:1 (Horizontal to Vertical)

A – Silty Sand (SM), dark grayish brown, moist, loose, fine-grained sand, numerous roots in upper few inches, varies from about 6 to 12 inches in thickness (topsoil).
B – Bedrock – Silty Sandstone, pale yellow, moist, moderately weathered, moderately fractured, fracture spacing 6 to 24 inches, joints lined with clay and steeply inclined, wavy near-horizontal brown bands about 1/16 inches in thickness, lighter colored sand lens vary from about 1/8 to ½ inches thick, fine-grained sand, trace of coarse-grained sand (Tsm).

TP-15



Scale – 1:1 (Horizontal to Vertical)

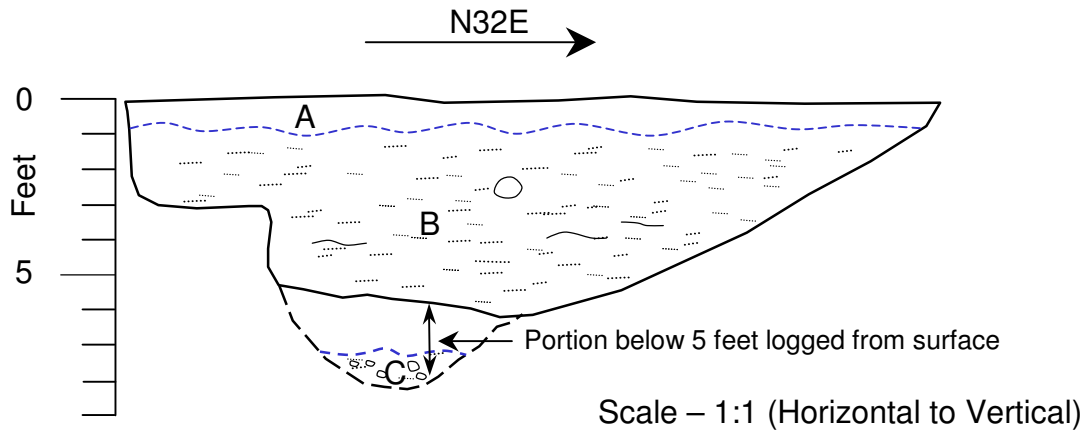
A – Silty Sand with gravel (SM), brown, dry, medium dense, fine gravel, lower gradation contact.
B – Clayey Sand/Sandy Clay (SC/CL), dark grayish brown to very dark grayish brown, moist, dense to very dense, fine- to coarse-grained sand, some fine gravel, coarse sand and gravel composed of angular quartz and feldspar (mapped as landslide debris – Qls).

DRAWN BY: D. Seymour	**TEST PIT LOGS TP-14 and TP-15**	KLEINFELDER	**PLATE**
REVISED BY:		365 Victor Street, Suite L Salinas, California 93907 Ph. (831) 755-7900 Fax. (831) 755-7909 www.Kleinfelder.com	A-10
CHECKED BY: M. Clark	**Ferrini Ranch Subdivision** **Monterey County, California**		
DATE: Dec. 2006 / APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt / FILE NAME:		

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

TP-16



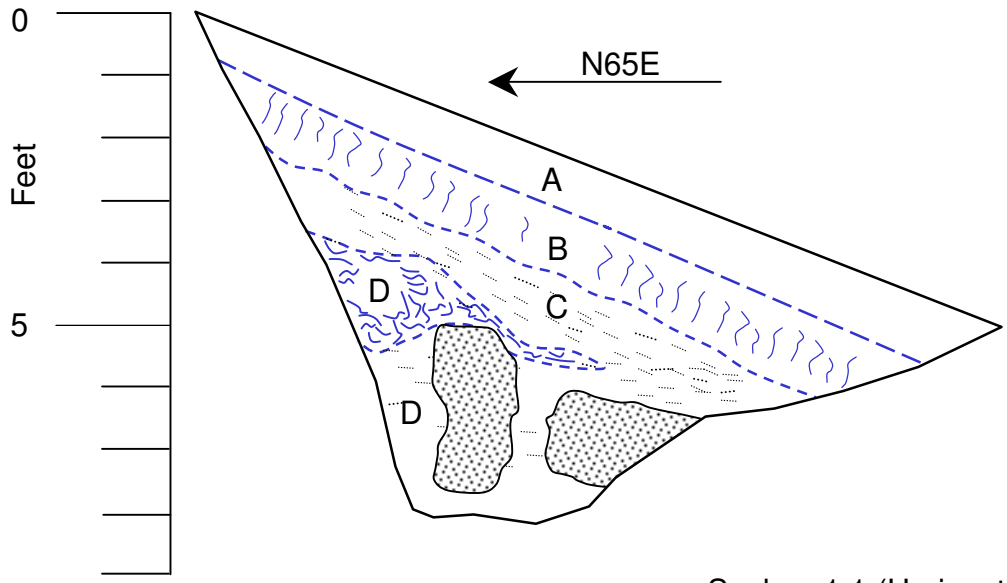
A – Silty Sand/Sandy Silt (SM/ML), dark brown, moist, soft, numerous roots, about 8 to 10 inches thick (topsoil).
B – Silty Sand with gravel (SM), brown to dark brown, dry to slightly moist, medium dense to dense, fine- to coarse-grained sand and fine gravel, gravel about 10 to 15 percent, pores up to 1/8 inch (possible terrace deposit – Qt or QTc).
C – Well-graded Sand with gravel (SW), brown, moist, dense, fine- to coarse-grained sand, fine gravel (QTc).

DRAWN BY: D. Seymour		**TEST PIT LOGS**	KLEINFELDER	**PLATE**
REVISED BY:		**TP-16**		A-11
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision**	365 Victor Street, Suite L	
DATE: Dec. 2006	APPROVED BY: M. Clark	**Monterey County, California**	Salinas, California 93907	
		PROJECT NO: 74732/Rpt	FILE NAME:	Ph. (831) 755-7900 Fax. (831) 755-7909 www.Kleinfelder.com

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

TP-17



Scale – 1:1 (Horizontal to Vertical)

A – Silty Sand (SM), grayish brown, moist, loose, fine-grained sand, abundant roots in upper few inches, lower contact abrupt, wavy (earth flow deposit – Qmf).
B – Sandy Clay (CL), very dark brown, moist, medium stiff, fine- to coarse-grained sand, argillic soil horizon, clay lined ped faces, blocky soil structure, occasional granitic cobbles, gradational lower contact (B horizon).
C – Silty Sand (SM), yellowish brown, moist, medium dense, appears to be highly weathered sandstone.
D – Landslide Debris (?) – Deposit of sandstone boulders and blocks of highly sheared claystone in a matrix of silty sand that is similar to Unit C. Sandstone boulders are composed of white, fine-grained sand with wavy olive gray laminae, locally very hard and difficult to excavate, may be derived from Santa Margarita Sandstone. Sheared claystone is olive gray with numerous polished surfaces. (ancient landslide debris – Qls).

DRAWN BY: D. Seymour		**TEST PIT LOGS**	KLEINFELDER	**PLATE**
REVISED BY:		**TP-17**		
CHECKED BY: M. Clark		**Ferrini Ranch Subdivision**	365 Victor Street, Suite L	A-12
DATE: Dec. 2006	APPROVED BY: M. Clark	**Monterey County, California**	Salinas, California 93907	
		PROJECT NO: 74732/Rpt	FILE NAME:	Ph. (831) 755-7900 Fax. (831) 755-7909 www.Kleinfelder.com

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

PLOTTED:12 December 2006

APPENDIX B

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	ID	DESCRIPTION	MAJOR DIVISIONS		LTR	ID	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY	GW		Well-graded gravels or gravel with sand, little or no fines.	FINE GRAINED SOILS	SILTS AND CLAYS	ML		Inorganic silts and very fine sands, rock flour or clayey silts with slight plasticity.
		GP		Poorly-graded gravels or gravel with sand, little or no fines.			CL		Inorganic lean clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		GM		Silty gravels, silty gravel with sand mixture.			OL		Organic silts and organic silt-clays of low plasticity.
		GC		Clayey gravels, clayey gravel with sand mixture		SILTS AND CLAYS	MH		Inorganic elastic silts, micaceous or diatomaceous or silty soils.
	SAND AND SANDY	SW		Well-graded sands or gravelly sands, little or no fines.			CH		Inorganic fat clays (high plasticity).
		SP		Poorly-graded sands or gravelly sands, little or no fines.			OH		Organic clays of medium high to high plasticity.
		SM		Silty sand.	HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils.
		SC		Clayey sand.					

Standard Penetration Split Spoon Sampler 2.0 inch O.D., 1.4 inch I.D.

Modified California Sampler 2.5 inch O.D., 2.0 inch I.D.

Bulk Sample

California Sampler, 3.0 inch O.D., 2.5 inch I.D.

Shelby Tube 3.0 inch O.D.

0745, 5/31 — Approximate water level first observed in boring. Time recorded in reference to a 24 hour clock.

0800, 5/31 — Approximate water level observed in boring following drilling

PEN — Pocket Penetrometer reading, in tsf

TV:Su — Torvane shear strength, in ksf

LL	LIQUID LIMIT	TX	TRIAXIAL SHEAR
PI	PLASTICITY INDEX	CONSOL	CONSOLIDATION
%-#200	SIEVE ANALYSIS (#200 SCREEN)	R-Value	RESISTANCE VALUE
DS	DIRECT SHEAR	SE	SAND EQUIVALENT
C	COHESION (PSF)	EI	EXPANSION INDEX
PHI	FRICTION ANGLE	FS	FREE SWELL (U.S.B.R.)

Notes: Blow counts represent the number of blows a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18 inch penetration, unless otherwise noted.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

KLEINFELDER

PROJECT NO. **74732-Geotech1**

BORING AND TEST PIT LOG LEGEND

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-1

12/12/2006 9:28:31 AM

Date Completed:	**11/6/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**50.0 ft**	*Notes:*	

Surface Elevation: **Estimated 268 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		32	93	2.9				**SILTY SAND (SM)** - brown tan, dry to moist, medium dense, fine grained sand (Alluvium)
5		20						
10		31						- dense - hard drilling at approximate;y 11 feet below ground surface
15		31						**SILTY SAND with GRAVEL (SM)** tan, moist, dense, medium grained sand, fine to medium gravel
20		16						**WELL-GRADED SAND with SILT (SW-SM)** tan, moist, medium dense, medium to coarse grained sand, silty sand in shoe
25		21		18.5		Passing -#200=33% 10:26 11/6/2006 10:16 11/6/2006		**CLAYEY SAND (SC)** - dark gray, wet, medium dense, fine grained sand, micaceous
30						Passing -#200=17%		**CLAYEY SAND (SC)** - wet

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 1

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-2

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:33 AM

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		16						**CLAYEY SAND (SC)** - continued
35		27		21.7		Passing -#200=57%		**SANDY CLAY (CL)**
40		27/6"						**WELL-GRADED SAND (SW)** - gray, wet, dense, medium to coarse grained sand, clay lenses to 1-inch thick, flowing sands
45		27						- medium dense
50		45						- dense
								Boring terminated at approximately 50 feet below ground surface. Boring backfilled with spoils.
55								
60								

KLEINFELDER

PROJECT NO. **74732-Geotech1**

LOG OF BORING NO. B- 1

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-2
(cont'd)

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:33 AM

Date Completed:	**11/6/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**25.0 ft**	*Notes:*	

Surface Elevation: **Estimated 260 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		19	94	1.3				**SILTY SAND (SM)** - gray, dry to moist, medium dense, fine grained sand (Alluvium) - tan
5		23						
10		23						
15		25						**POORLY GRADED SAND (SP)** yellow-brown, moist, medium dense, fine grained sand
20		19						**POORLY GRADED SAND with SILT (SP-SM)** brown, moist, medium dense, fine grained sand - hard drilling at approximately 22 feet below ground surface
25		20						Boring terminated at approximately 25 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. 74732-Geotech1

LOG OF BORING NO. B- 2

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-3

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:33 AM

Date Completed:	**11/6/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**49.0 ft**	*Notes:*	

Surface Elevation: **Estimated 245 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		10	99	5.0				**SILTY SAND (SM)** - gray, moist, loose, fine grained sand (Alluvium)
5		21						- dark brown - medium dense
10		17						**CLAYEY SAND (SC)** - orange-brown, moist, medium dense, fine grained sand
15		35						**POORLY GRADED SAND with SILT (SP-SM)** red-brown, moist, dense, fine grained sand, micaceous
20		13				Passing -#200=55%		**SANDY SILT/SILTY SAND (ML)** gray, wet, medium dense, fine grained sand
25		34		15.4		Passing -#200=8%		**WELL GRADED SAND with SILT (SW-SM) - dense**
30						LL=31; PI=25		**SANDY SILT to SILTY SAND (ML/SM)** gray, wet, very stiff/dense, fine grained sand

13:41 11/6/2006

13:21 11/6/2006

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 3

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-4

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12/12/2006 9:25:34 AM

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		40						**SANDY SILT to SILTY SAND (ML/SM)** - continued
35		40						
40		34						**SILTY SAND (SM)** - gray, wet, dense, fine grained sand
45		50/5.5"						**CLAYEY SAND (SC)** - tan, wet, very dense, fine grained sand
50		50/5"						**WELL-GRADED SAND with GRAVEL (SW)** - tan-brown, wet, very dense
								Boring terminated at approximately 49 feet below ground surface.
								Boring backfilled with spoils.
55								
60								

KLEINFELDER

PROJECT NO. **74732-Geotech1**

LOG OF BORING NO. B- 3

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-4
(cont'd)

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12/12/2006 9:25:34 AM

Date Completed:	**11/6/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**25.0 ft**	*Notes:*	

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: **Estimated 256 feet (MSL)** *Coordinates:* **Latitude:** **Longitude:**
		15	104	1.9				**SILTY SAND (SM)**- gray, moist, medium dense, fine grained sand (Alluvium)
5		13						
								POORLY GRADED SAND (SP)- orange-brown, moist, medium dense, medium grained sand
10		11						**SILTY SAND (SM)**- brown, moist, medium dense, fine grained sand
15		22						
						LL=43; PI=16		**SANDY CLAY (CL)**-brown, damp, soft, fine grained sand
20		5						
		14:40 11/6/2006						
25		25						- no recovery
								Boring terminated at approximately 25 feet below ground surface. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 4

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-5

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:34 AM

Date Completed:	**11/6/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**24.0 ft**	*Notes:*	

Surface Elevation: **Estimated 255 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		10	99	2.7				**SILTY SAND (SM)** - gray, dry to moist, loose, fine grained sand (Alluvium)
5		49						**POORLY GRADED SAND with SILT (SP-SM)** - tan, moist, dense, fine grained sand - dark brown
10		36						
15		46						
20		50/6"						**WEATHERED SHALE** - tan, moist, as very dense sand, highly weathered, soft rock
		50/6"						- no recovery
25								Boring terminated at approximately 24 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. 74732-Geotech1

LOG OF BORING NO. B- 5

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-6

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12/12/2006 9:25:34 AM

Date Completed:	**11/7/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**19.0 ft**	*Notes:*	

Surface Elevation: **Estimated 210 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
			94	4.1				**SILTY SAND (SM)**- tan-brown, moist, medium dense, fine grained sand (Landslide Debris)
		21						
5		26						
								- very dense
10		50/5.5"						
15		50/5.5"						
		50/6"						
20								Boring terminated at approximately 19 feet below ground surface. No free water encountered. Boring backfilled with spoils.
25								
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 6

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-7

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:35 AM

Date Completed:	**11/7/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**24.0 ft**	*Notes:*	

Surface Elevation: **Estimated 182 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		27	99	2.3				**SILTY SAND (SM)**- gray, moist, medium dense, fine grained sand (Landslide Debris)
5		68						**CLAYEY SAND (SC)**- gray, moist, very dense, fine grained sand
10		54				LL=61; PI=23		**SANDY CLAY (CH)**- tan, moist, very stiff, fine grained sand (Weathered Siltstone)
15		50/6"						
20		54						**SILTY SAND (SM)**- tan, moist, very dense, fine grained sand
		50/4.5"						
25								Boring terminated at approximately 24 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 7

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-8

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12/12/2006 9:25:35 AM

Date Completed:	**11/7/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**35.0 ft**	*Notes:*	

Surface Elevation: **Estimated 146 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		15	86	1.9				**SILTY SAND (SM)** - gray, moist, medium dense, fine grained sand (Alluvium)
5		5						- loose
10		10						- loose, medium dense
								- hard drilling at approximately 12.5 feet below ground surface
15		50						**WELL-GRADED SAND with GRAVEL (SW)** - orange-brown, moist, very dense, fine to coarse grained sand, fine gravel
20		24						**SILTY SAND (SM)** - brown, moist, medium dense, fine grained sand
25		30						- very moist, medium dense to dense, coarse grained sand
								SILTY SAND (SM) - continued
30								- very moist, dense

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 8

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-9

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:35 AM

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		41						
		50/6"						
35								Boring terminated at approximately 35 feet below ground surface. No free water encountered. Boring backfilled with spoils.
40								
45								
50								
55								
60								

KLEINFELDER

PROJECT NO. **74732-Geotech1**

LOG OF BORING NO. B- 8

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-9
(cont'd)

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12/12/2006 9:25:36 AM

Date Completed:	**11/7/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**R. Hasseler**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**20.0 ft**	*Notes:*	

Surface Elevation: **Estimated 133 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		16	90	6.3				**SILTY SAND (SM)** - gray, moist, medium dense, fine grained sand (Alluvium)
5		54						- dark brown, very dense
10		42						- dense
15		57						- very dense
20		35						**CLAYEY SAND (SC)** - tan, moist, dense, fine grained sand
25								Boring terminated at approximately 20 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B- 9

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-10

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:36 AM

Date Completed:	11/7/06	Drilling method:	8" Hollow Stem Auger
Logged By:	R. Hasseler	Hammer Wt:	140 lbs., 30" drop
Total Depth:	40.0 ft	Notes:	

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: **Estimated 98 feet (MSL)** *Coordinates:* **Latitude:** **Longitude:**
		10	81	6.9				**SILTY SAND (SM)** - gray, moist, loose, fine grained sand, micaceous (Alluvium)
5		9						
10		17						**WELL-GRADED SAND (SW)** - tan, moist, medium dense, medium to coarse grained sand
15		11						**CLAYEY SAND (SC)** - dark brown, very moist, fine grained sand
20		17						
25		10		12.4		Passing -#200=45%		- loose, medium dense
		14:38 11/7/06						
30						Passing -#200=47%		**SILTY SAND (SM)** - gray-brown, moist, dense, fine grained sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

LOG OF BORING NO. B-10

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-11

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:36 AM

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		7						**SILTY SAND (SM)**- gray-brown, wet, dense, fine grained sand
								- moist
35		35						
40		70						- very dense
								Boring terminated at approximately 40 feet below ground surface.
								Groundwater encountered at 28 feet.
								Boring backfilled with spoils.
45								
50								
55								
60								

KLEINFELDER

PROJECT NO. **74732-Geotech1**

LOG OF BORING NO. B-10

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-11
(cont'd)

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:36 AM

Date Completed:	**11/8/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**W. Blackard**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**24.5 ft**	*Notes:*	

Surface Elevation: **Estimated 165 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		20	105	11.3				**SILTY SAND (SM)**- gray, moist, medium dense, fine grained sand (Terrace Deposit)
5		39						- dense
10		37				LL=44; PI=17		**LEAN CLAY (CL)**- brown to very dark brown, moist, very stiff
15		39						
20		23						- very stiff
		50/6"						**CLAYEY SAND (SC)**- brown, dry, very dense
25								Boring terminated at approximately 24.5 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B-11

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-12

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:37 AM

Date Completed:	**11/8/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**W. Blackard**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**24.0 ft**	*Notes:*	

Depth,ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: **Estimated 145 feet (MSL)** *Coordinates:* **Latitude:** **Longitude:**
		37	104	3.0				**SILTY SAND (SM)**- light brown to brown, dry, dense, fine grained sand (Terrace Deposit)
5		30					2.5	- very dense
10		46				LL=23; PI=17		**SANDY LEAN CLAY (CL)**- olive-brown, moist, very stiff
15		36						**CLAYEY SAND (SC)**- brown, moist, dense, fine grained sand
20		38						
		50/6"						
25								Boring terminated at approximately 24 feet below ground surface. No free water encountered. Boring backfilled with spoils.
30								

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B-12

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-13

C:\DOCUMENTS AND SETTINGS\PKHOSHKBAR\DESKTOP\74732.GPJ

12/12/2006 9:25:37 AM

Date Completed:	**11/8/06**	*Drilling method:*	**8" Hollow Stem Auger**
Logged By:	**W. Blackard**	*Hammer Wt:*	**140 lbs., 30" drop**
Total Depth:	**25.0 ft**	*Notes:*	

Surface Elevation: **Estimated 150 feet (MSL)**
Coordinates: **Latitude:** **Longitude:**

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
		53	113	9.8				**SILTY SAND (SM)** - light brown, dry, dense, fine grained sand (Terrace Deposit)
5		46						- dark brown, fine to medium grained sand
10		35						**POORLY GRADED SAND (SP)** brown, dry, dense, fine grained sand
15		38				LL=41; PI=16	2.4	**SANDY LEAN CLAY (CL)** olive-brown, moist, very stiff, micaceous
20		39					2.3	- fine grained sand
25		53						**POORLY GRADED SAND (SP)** red-brown, dry, very dense, fine gravel
30								Boring terminated at approximately 25 feet below ground surface. No free water encountered. Boring backfilled with spoils.

KLEINFELDER

PROJECT NO. *74732-Geotech1*

LOG OF BORING NO. B-13

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

B-14

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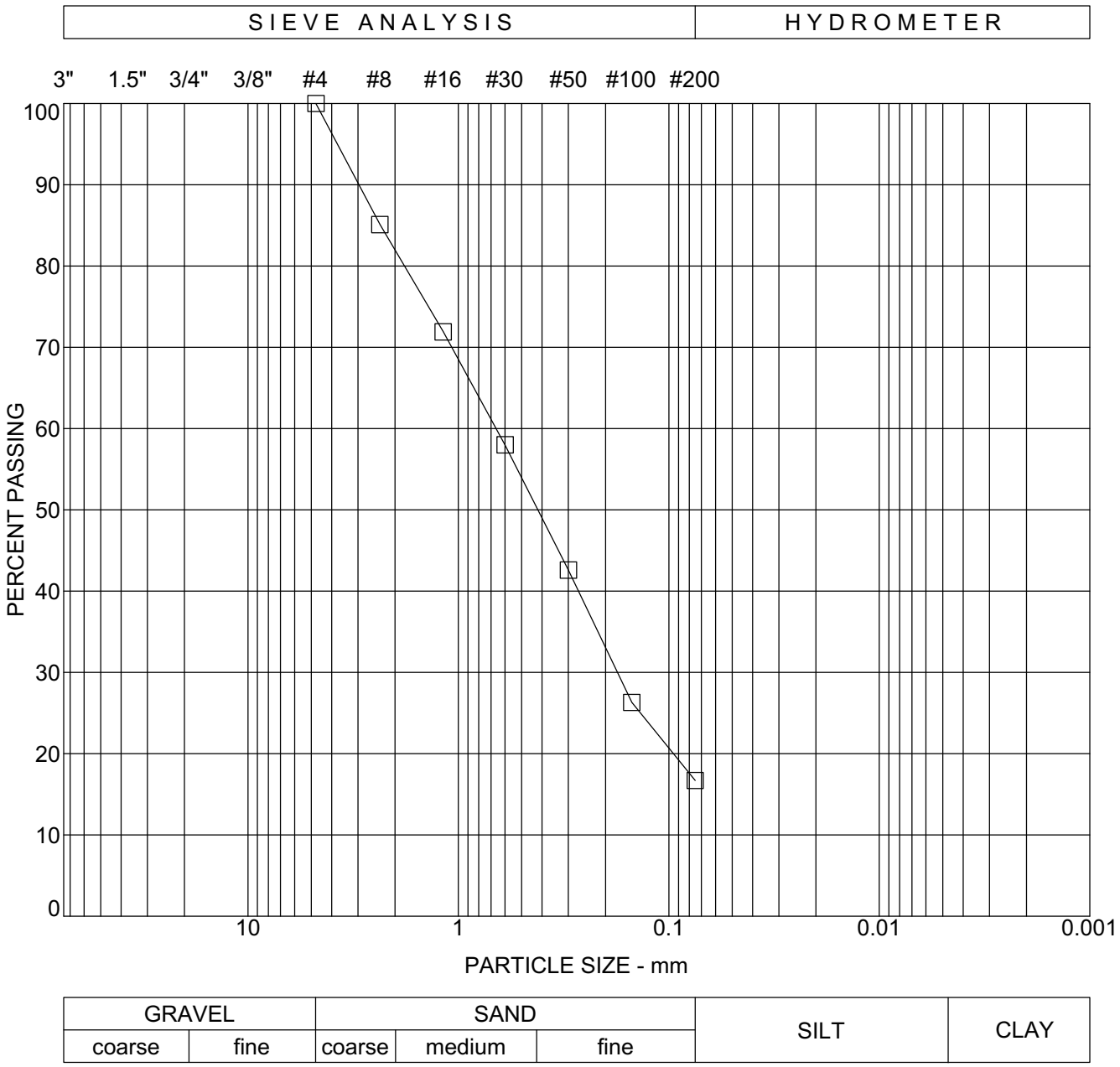
APPENDIX C



SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	B- 1	28.5	Dark Gray Clayey Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-1

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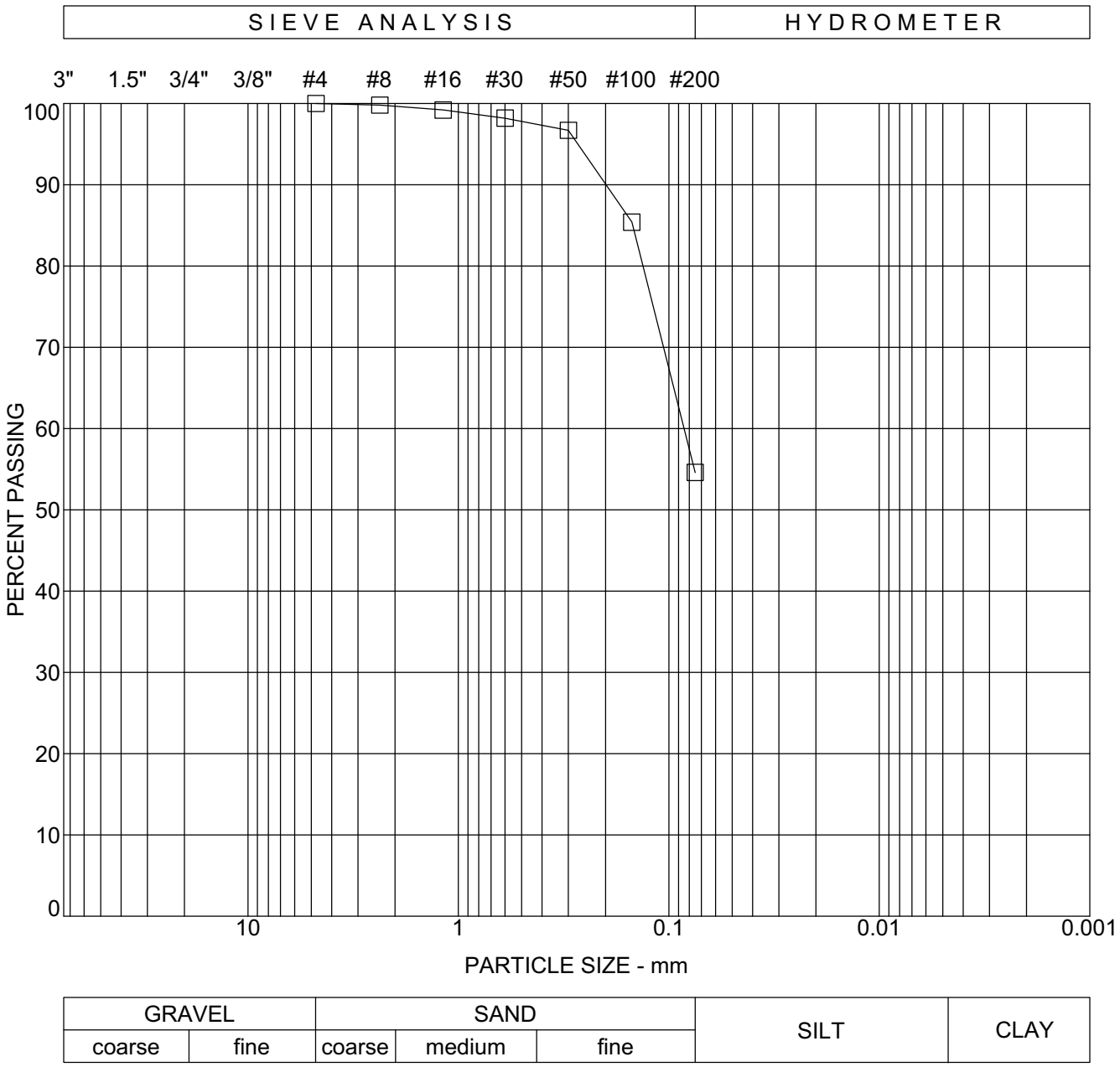

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	B- 3	18.5	Gray Sandy Silt/ Silty Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-2

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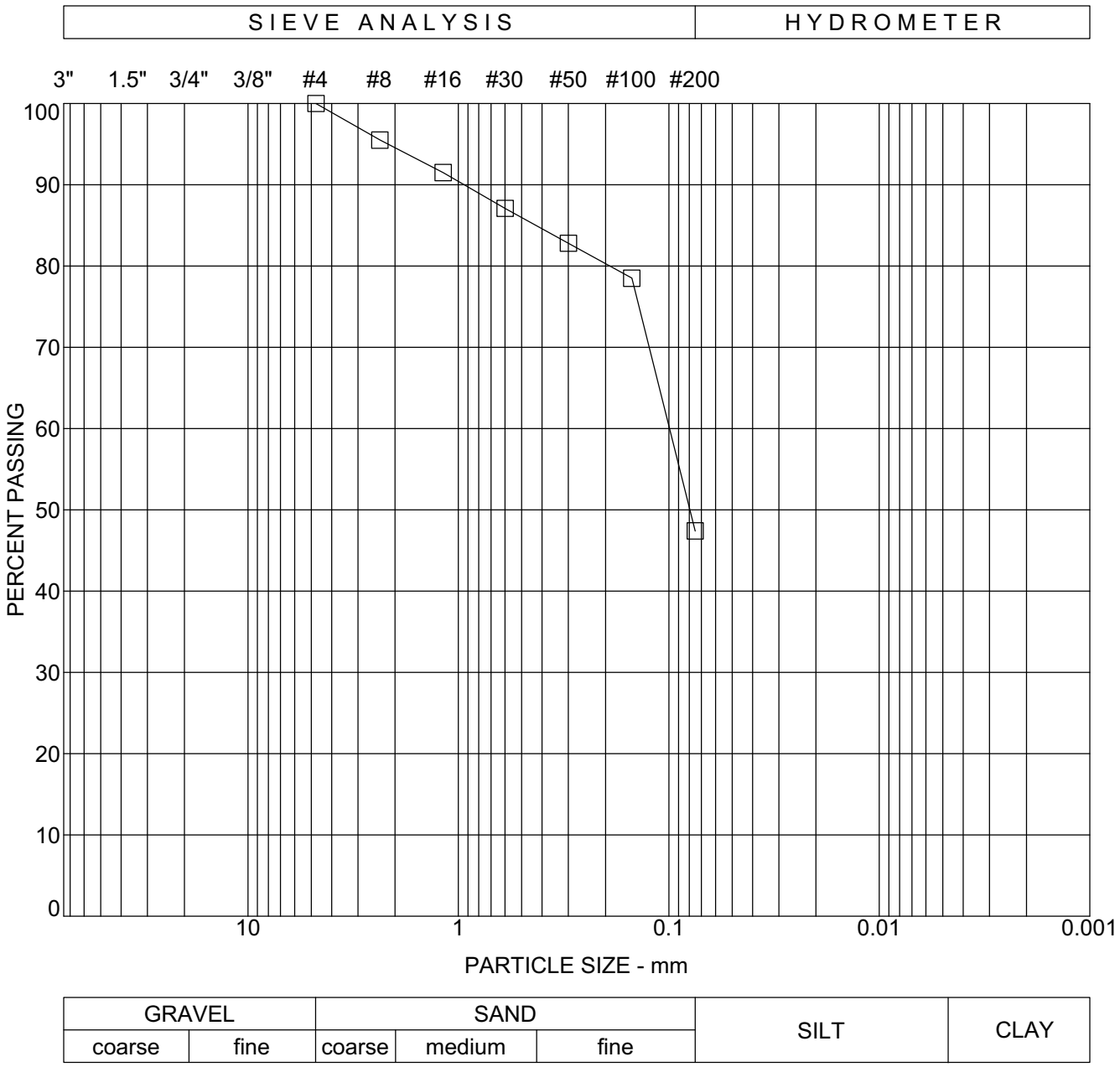

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	B-10	28.5	Dark Brown Silty Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-3

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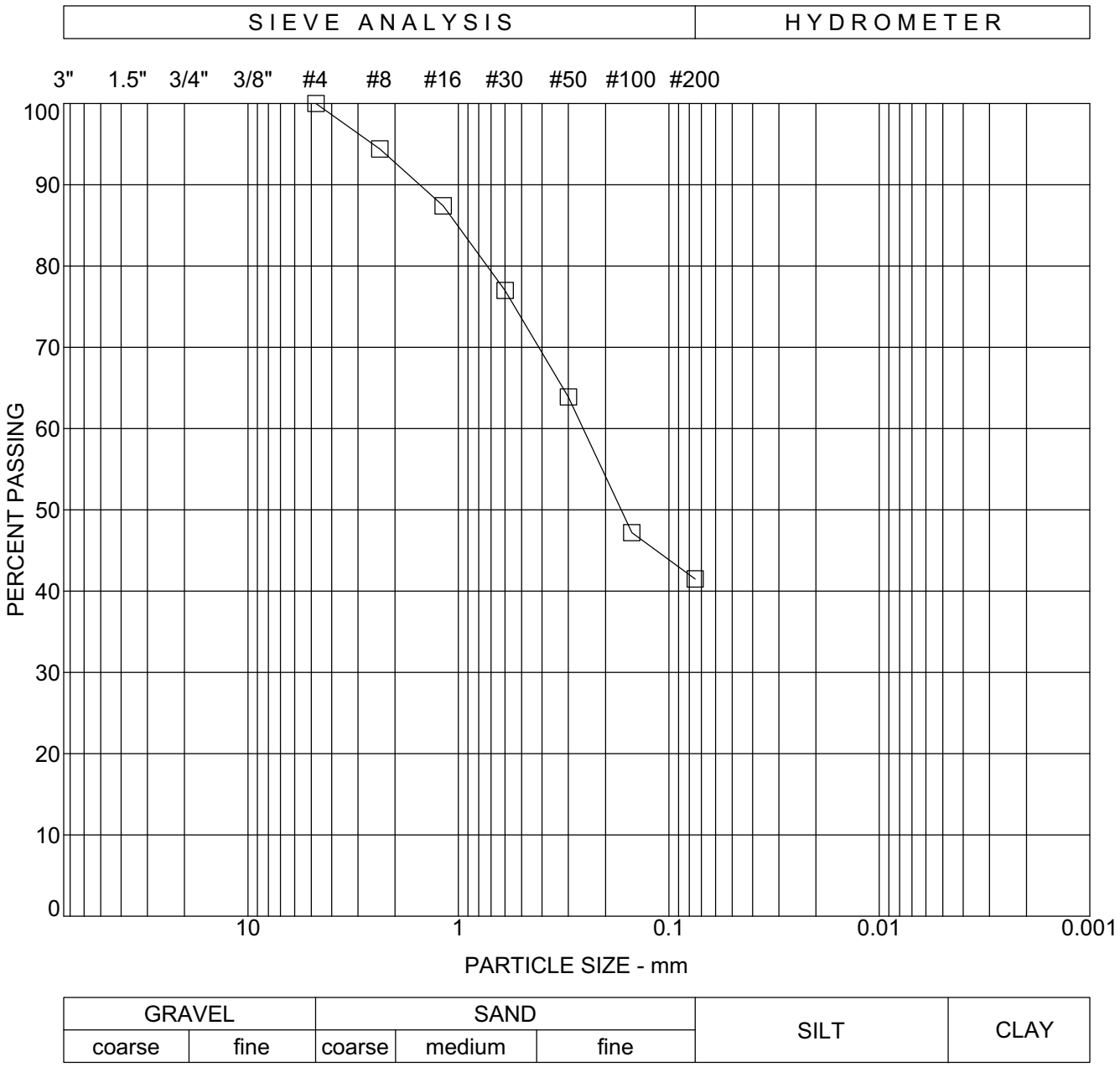

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	TP-5	2.0	Dark Brown Silty Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-4

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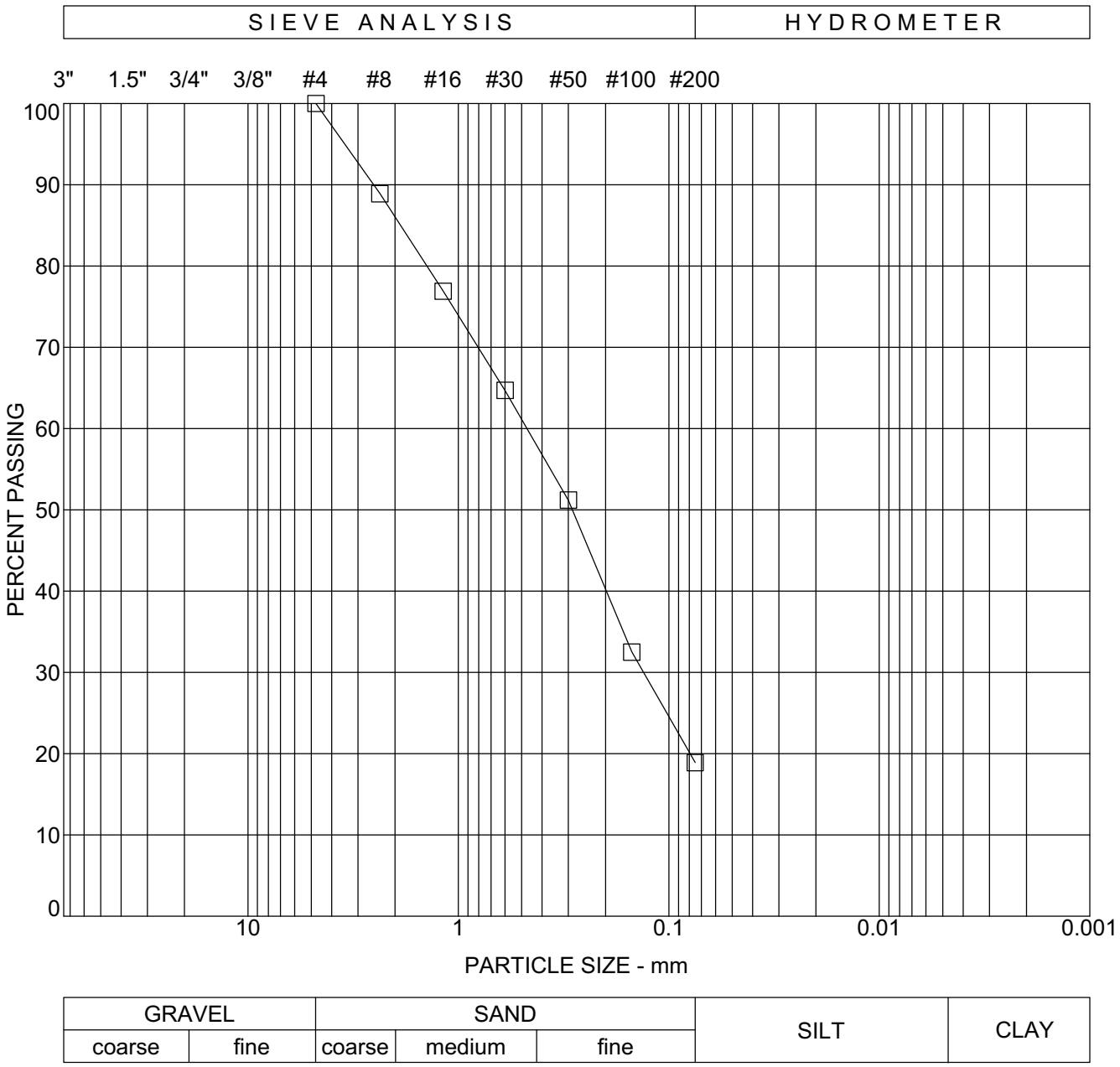

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	TP-13	3.0	Dark Brown Silty Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-5

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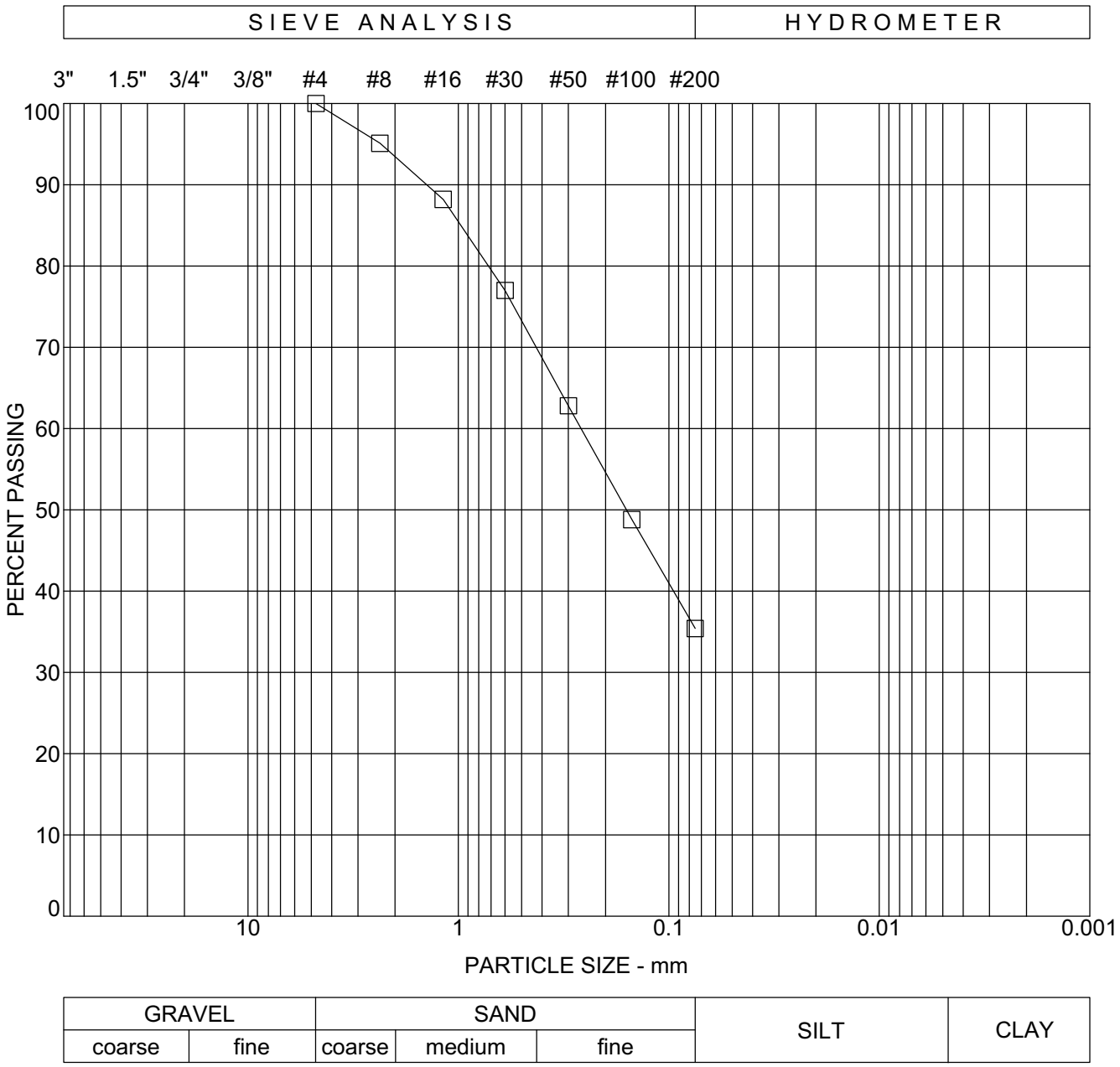

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION
□	TP-16	3.0	Brown Silty Sand

KLEINFELDER

PROJECT NO. 74732-Geotech1

GRAIN SIZE DISTRIBUTION

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-6

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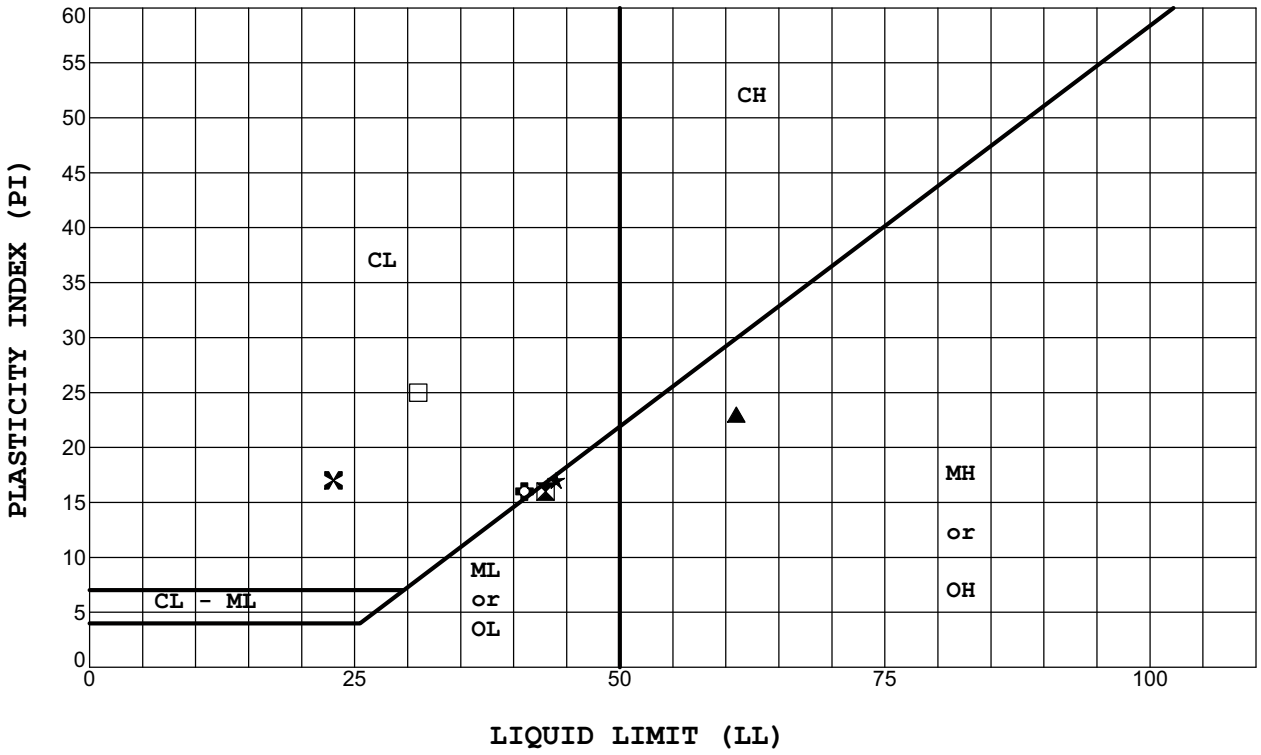

Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	B- 3	28.5	31	6	25	Olive Brown Sandy Silt
⊠	B- 4	18.5	43	27	16	Brown Sandy Clay
▲	B- 7	8.5	61	38	23	Olive Fat Clay
★	B-11	8.5	44	27	17	Brown to Dark Brown Sandy Lean Clay
✕	B-12	8.5	23	6	17	Olive-Brown Lean Clay
✿	B-13	13.5	41	25	16	Olive-Brown Sandy Lean Clay

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

KLEINFELDER

PROJECT NO. **74732-Geotech1**

PLASTICITY CHART

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-7

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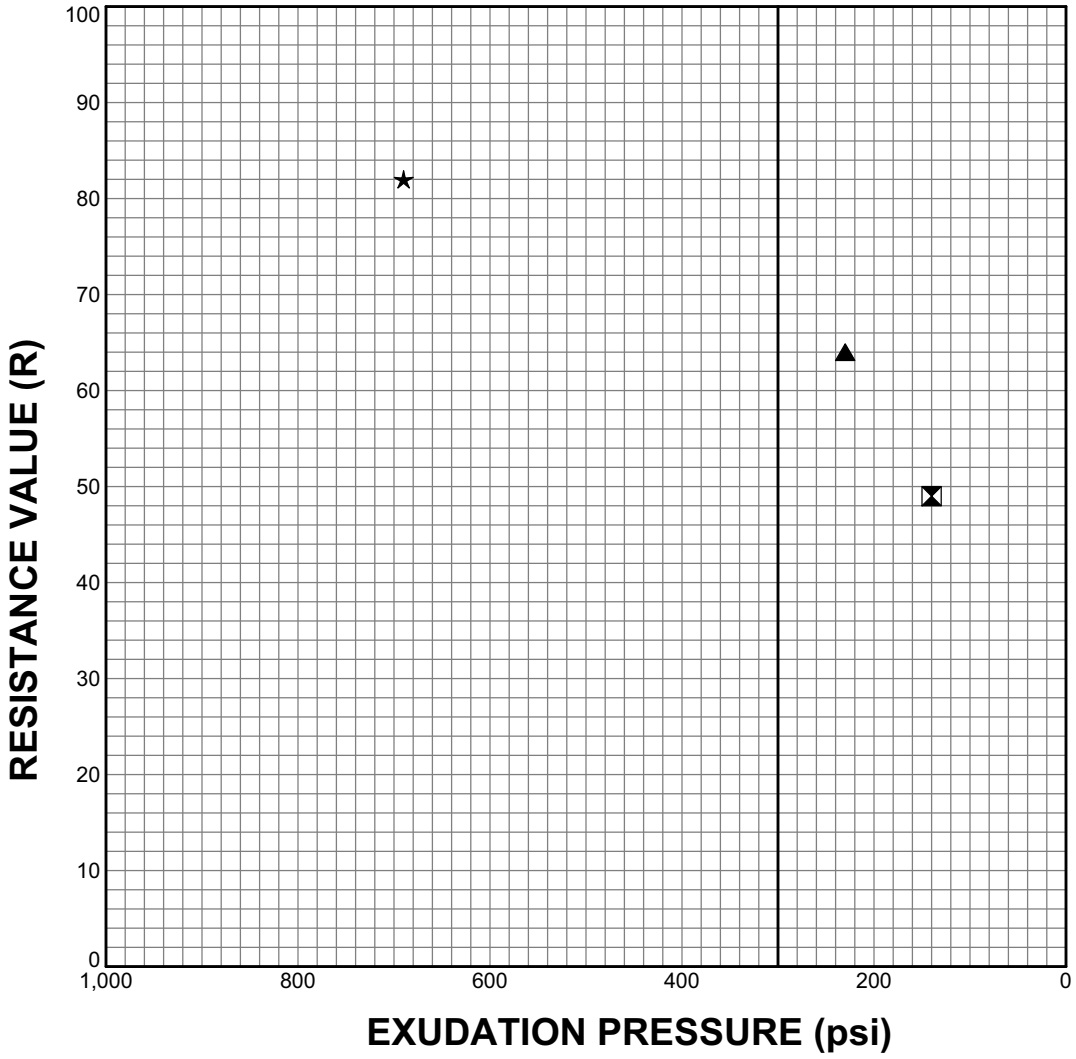

SPECIMEN NO.	⧗	▲	★
MOISTURE CONTENT (%)	10.5	9.2	8.0
DRY DENSITY (PCF)	124.5	125.8	125.3
EXUDATION PRESSURE (PSI)	140	230	690
EXPANSION PRESSURE (PSF)	0	0	0
RESISTANCE VALUE (R)	49	64	82

Date Received: 11/17/2006

SAMPLE SOURCE	CLASSIFICATION	SAND EQUIVALENT	EXPANSION PRESSURE	R-VALUE
(B- 4)	Brown Silty Sand	---	0 psf	**69**

ASTM D 2844, Cal Test 301

KLEINFELDER

PROJECT NO. 74732-Geotech1

RESISTANCE VALUE TEST DATA

FERRINI RANCH
MONTEREY COUNTY, CALIFORNIA

PLATE

C-8

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12/12/2006 9:34:33 AM

APPENDIX D

California State Certified Laboratory No.2153

C E R C O
analytical, inc.

7 December, 2006

Job No.0611175
Cust. No.10781

3942-A Valley Avenue
Pleasanton, CA 94566-4715
925.462.2771 • Fax: 925.462.2775
www.cercoanalytical.com

Mr. Parham Khoshkbari
Kleinfelder
2011 North Capitol Ave
San Jose, CA 95132

Subject: Project No.: 74732-GEOTech(1)
Project Name: Ferrini Ranch
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Khoshkbari:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on November 17, 2006. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, Samples No.002, No.003 and No.004 are classified as "moderately corrosive" and Sample No.001 is classified as "negligibly corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations reflect none detected with a detection limit of 15 mg/kg.

The sulfate ion concentrations reflect none detected with a detection limit of 15 mg/kg.

The pH of the soils range from 6.7 to 7.4 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials range from 390 to 420-mV. Sample No.004 is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions, and the remaining samples are indicative of aerobic soil conditions.

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

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

Very truly yours,
CERCO ANALYTICAL, INC.

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

JDH/jdl
Enclosure

RECEIVED
DEC 11 2006
KLEINFELDER SAN JOSE, CA

California State Certified Laboratory No.2153

C E R C O
analytical, inc.
3942-A Valley Avenue
Pleasanton, CA 94566-4715
925.462.2771 • Fax: 925.462.2775
www.cercoanalytical.com

Client: Kleinfelder
Client's Project No.: 74732-GEOtech(1)
Client's Project Name: Ferrini Ranch
Date Sampled: 17-Nov-06
Date Received: 17-Nov-06
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 7-Dec-2006

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
0611175-001	5 - 2	410	7.4	-	50,000	-	N.D.	N.D.
0611175-002	7 - 2	400	6.8	-	7,500	-	N.D.	N.D.
0611175-003	9 - 2	420	6.7	-	3,900	-	N.D.	N.D.
0611175-004	11 - 2	390	7.0	-	3,200	-	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	1-Dec-2006	1-Dec-2006	-	30-Nov-2006	-	5-Dec-2006	5-Dec-2006

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

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

APPENDIX E

CALIFORNIA WATER SERVICE COMPANY
254 COMMISSION STREET • SALINAS, CA 93901-3737
(831) 757-3644 • FAX (831) 757-0497

SALINAS DISTRICT

November 23, 2004

Whitson Engineers
Attn: Richard Weber
9699 Blue Larkspur Lane, Suite # 105
Monterey, CA 93940

Re: Ferrini Ranch

Dear Mr. Weber,

California Water Service Company (Cal Water) has reviewed the request for water availability for the Ferrini Ranch subdivision. Cal Water will provide service for domestic use and fire protection pending approval of the service area map by the Public Utilities Commission. In order to provide service, main extensions may be required. Water facilities needed to serve this subdivision will be installed in accordance with the main extension rules of the California Public Utilities Commission and in accordance with applicable county ordinances.

We meet all State and Public Utilities Commission regulations pertaining to water quality and quantity. There is no expiration on our willingness to serve.

We will supply only such domestic water at such pressure as may be available as a result of our operation of the system.

If we can be of further assistance, please contact either Pam Stricklind or me at this office.

Sincerely,

Michael L. Jones
MJones@CalWater.Com

Cc: Tom Smegal
Linda Przybla
Sal Pineda
Ed Harr
File

Primary Drinking Water Standards								
RADIOLOGICAL	**Year Range**	**Reporting Units**	**MCL (SMCL)**	**PHG (MCLG)**	**Violation**	**Result Range**	**Average**	**Source of Substance**
Gross Alpha Particle Activity	2004	pCi/L	15	(0)	No	ND - 6.9	3	Erosion of natural deposits
Uranium	2004	pCi/L	20	0.5	No	3.46 - 5.76	4.73	Erosion of natural deposits
INORGANIC CHEMICALS	**Year Range**	**Reporting Units**	**MCL (SMCL)**	**PHG (MCLG)**	**Violation**	**Result Range**	**Average**	**Source of Substance**
Arsenic	2005	ppb	50	n/a	No	1.3 - 1.4	1.34	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes
Fluoride	2005	ppm	2	1	No	0.29	0.29	Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories
Nitrate	2005	ppm	45	45	No	ND - 2.1	1.9	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
Chromium	2005	ppb	50	(100)	No	7.8 - 7.9	7.9	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits
DISINFECTION BY-PRODUCTS	**Year Range**	**Reporting Units**	**MCL (SMCL)**	**PHG (MCLG)**	**Violation**	**Result Range**	**Highest Running Annual Average**	**Source of Substance**
Total Trihalomethane (TTHM)	2005	ppb	80	n/a	No	2.3	2.3	By-product of drinking water chlorination
DISINFECTANT	**Year Range**	**Reporting Units**	**MRDL**	**PHG (MCLG)**	**Violation**	**Result Range**	**Highest Running Annual Average**	**Source of Substance**
Chlorine	2005	ppm	n/a	[4]	No	0.28 - 0.6	0.43	Drinking water disinfectant added for treatment
OTHER REGULATED SUBSTANCES	**Year Range**	**Reporting Units**	**AL**	**PHG (MCLG)**	**Violation**	**Level Detected (90th percentile)**	**# Samples Exceeding AL**	**Source of Substance**
Copper	2005	ppm	1.3	0.17	No	0.34	0 of 10	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Lead	2005	ppm	0.015	0.002	No	ND	0 of 10	Internal corrosion of household plumbing systems; discharges from industrial manufacturers; erosion of natural deposits
Secondary Drinking Water Standards and Unregulated Compounds								
INORGANIC CHEMICALS	**Year Range**	**Reporting Units**	**MCL (SMCL)**	**PHG (MCLG)**	**Violation**	**Result Range**	**Average**	**Source of Substance**
Alkalinity	2005	ppm	n/a	n/a	No	200 - 228	214	Erosion of natural deposits
Calcium	2005	ppm	n/a	n/a	No	77 - 112	95	Erosion of natural deposits
Chloride	2005	ppm	500 (500)	n/a	No	43 - 45	44	Runoff/leaching from natural deposits; seawater influence
Color	2005	UNITS	15 (15)	n/a	No	ND - 1	0.67	Naturally occurring organic materials
Hardness	2005	ppm	n/a	n/a	No	279 - 406	343	Erosion of natural deposits
Magnesium	2005	ppm	n/a	n/a	No	21 - 29	25	Erosion of natural deposits
Ph	2005	STD U	n/a	n/a	No	7.5	7.5	Inherent characteristic of water
Potassium	2005	ppm	n/a	n/a	No	3	3	Erosion of natural deposits
Sodium	2005	ppm	n/a	n/a	No	28 - 38	33	Erosion of natural deposits; seawater influence
Specific Conductance (E.C.)	2005	micromhos	1600 (1600)	n/a	No	682 - 858	770	Substances that form natural deposits; seawater influence
Sulfate	2005	ppm	500 (500)	n/a	No	99 - 169	134	Leaching from natural deposits; industrial wastes
Total Dissolved Solids	2005	ppm	1000	n/a	No	432 - 554	493	Runoff/leaching from natural deposits; seawater influence
Turbidity	2005	NTU	5 (5)	n/a	No	0.15 - 0.2	0.18	Soil runoff
Vanadium	2005	ppb	AL=50	n/a	No	6.5 - 6.8	6.6	Erosion of natural deposits; manufacturing of alloys and steel

mmhos/cm = measure of specific conductance
pCi/L = picoCuries per liter (measure of radioactivity)
ppm = parts per million (milligrams per liter)
NTU = nephelometric turbidity unit
ppb = parts per billion (micrograms per liter)
SMCL = secondary maximum contaminant level
ND = none detected
n/a = not applicable

Report Source: Cal Water, Salinas District

DRAWN BY: D. Seymour	2005 WATER-QUALITY REPORT for the SPRECKLES AREA	KLEINFELDER
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DATE: 09/20/06 APPROVED BY: M. Clark	PROJECT NO: 74732/Rpt FILE NAME:	

PLATE

E-2

Library file: L:\2006\library\projects\74732\Test Pit Logs.ppt

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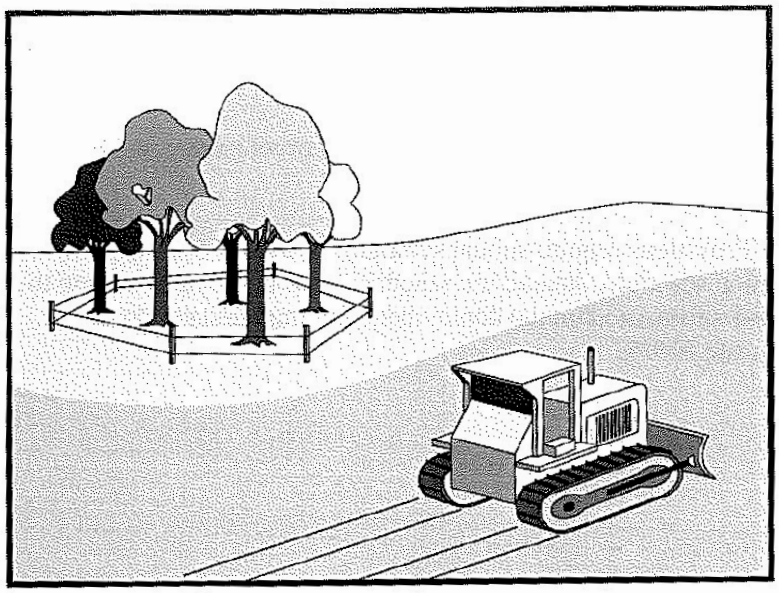
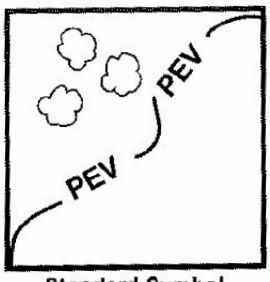
APPENDIX F

Preservation of Existing Vegetation

SS-2





Standard Symbol

BMP Objectives

Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits.

Appropriate Applications

- Preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date. Specifications for preservation of existing vegetation can be found in Standard Specifications, Section 7-1.11.
- On a year-round basis, temporary fencing shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas.
- Clearing and grubbing operations should be staged to preserve existing vegetation.

Limitations

Protection of existing vegetation requires planning, and may limit the area available for construction activities.

Standards and Specifications

Timing

- Preservation of existing vegetation shall be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas identified on the plans to be preserved, especially on areas designated as Environmentally Sensitive Areas (ESAs).
- Preservation of existing vegetation shall conform to scheduling requirements set forth in the special provisions.

Design and Layout

- Mark areas to be preserved with temporary fencing made of orange polypropylene that is stabilized against ultraviolet light. The temporary fencing shall be at least 1 meter (3.2. ft) tall and shall have openings not larger than 50 mm by 50 mm (2 in by 2 in).

A.1 REQUIRED MINIMUM DESIGN ELEMENTS FOR STORM WATER CONTROL

The PE must consider, and as appropriate, incorporate certain Design Pollution Prevention Best Management Practices (BMPs) into a project to minimize impacts to water quality. These BMPs were developed in response to the three following design objectives:

- *Prevent Downstream Erosion:* Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion;
- *Stabilize Disturbed Soil Areas:* Disturbed soil areas will be appropriately stabilized to prevent erosion after construction; and
- *Maximize Vegetated Surfaces Consistent with Existing Caltrans Policies:* Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

The Design Pollution Prevention BMPs listed in Table A-1 and described in the following sections are designed to accomplish these objectives.

Table A-1: Design Pollution Prevention BMPS

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
Ditches, Berms, Dikes and Swales
Overside Drains
Flared Culvert End Sections
Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
Vegetated Surfaces
Hard Surfaces

A.2 CONSIDERATION OF DOWNSTREAM EFFECTS RELATED TO POTENTIALLY INCREASED FLOW

Description:

Changes in the velocity or volume of runoff, the sediment load or other hydraulic changes from stream encroachments, crossings or realignment may affect downstream channel stability.

Caltrans will evaluate the effects on downstream channel stability and the applicability of the mitigation measures described under Implementation for this BMP.

Appropriate Applications:

During the design of both new and reconstructed facilities, Caltrans may include new road surfaces or additional surface paving to enhance the operational safety and functionality of the facility. The designer must also consider the effect of collecting and concentrating flows in roadside ditches, storm drain systems, or the effect of re-directing flows to treatment BMPs. Diversions or overflows from large storm events in these instances may create concentrated discharges in areas that have not historically received these flows.

Implementation:

If these changes result in an increased potential for downstream effects in channels, Caltrans will consider the following:

- Modifications to channel lining materials (both natural and man-made), including vegetation, geotextile mats, rock and riprap;
- Energy dissipation devices at culvert outlets;
- Smoothing the transition between culvert outlets/headwalls/wingwalls and channels to reduce turbulence and scour; and
- Incorporating detention facilities into designs to reduce peak discharges.

Caltrans will implement appropriate measures to ensure that runoff from Caltrans facilities will not significantly increase downstream effects.

A.3 PRESERVATION OF EXISTING VEGETATION

Description:

Preservation of existing vegetation involves the identification and protection of desirable vegetation that provides erosion and sediment control benefits.

Appropriate Applications:

Caltrans will preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date.

Implementation:

The following general steps should be taken to preserve existing vegetation:

- Identify and delineate in contract documents all vegetation to be retained;
- Delineate the areas to be preserved in the field prior to the start of soil-disturbing activities;

- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling; and
- When removing vegetation, consider impacts (increased exposure or wind damage) to the adjacent vegetation that will be preserved.

A.4 CONCENTRATED FLOW CONVEYANCE SYSTEMS

Concentrated flow conveyance systems consist of permanent design measures that are used alone or in combination to intercept and divert surface flows, and convey and discharge concentrated flows with a minimum of soil erosion. Concentrated flow conveyance systems may be used both within Caltrans rights-of-way (on-site) and downstream outside Caltrans rights-of-way.

Ditches, Berms, Dikes and Swales

Description:

These are permanent devices typically used to intercept and direct surface runoff to an overside (or slope) drain or stabilized watercourse.

Appropriate Applications:

Ditches, berms, dikes and swales are typically implemented:

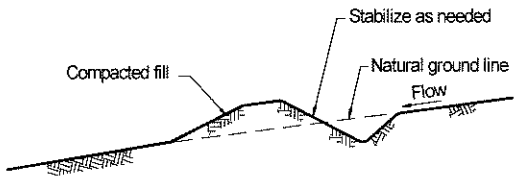
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside drains, stabilized watercourses, and storm water drainage system inlets (catch basins), pipes and channels;
- To intercept runoff from paved surfaces; or
- Along roadways and facilities subject to flooding.

Implementation:

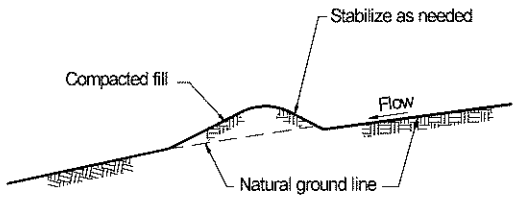
- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Chapter 813, Topic 836 and Chapter 860);
- Select design flow and safety factors based on careful evaluation of risks due to erosion, overtopping, flow backups or washout;
- Consider outlet protection where localized scour is anticipated;
- Examine the site for run-on from off-site sources;
- Consider order of work provisions to install and utilize permanent dikes, swales and ditches early in the construction process;

- Conveyances must be lined when velocities exceed allowable limits for soil. Consider use of Rock Slope Protection (RSP), engineering fabric, vegetation, asphalt concrete or concrete;
- Riprap should not be used where there is a high probability that traction sand or abrasives may enter the channel; and
- Ditches, berms, dikes and swales are shown in Figure A-1.

Figure A-1: Ditches, Berms, Dikes and Swales



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale
Note: Actual layout determined by design.

Overside Drains

Description:

Overside drains are pipes, downdrains, flumes or asphalt concrete overside drains used to protect slopes against erosion by collecting surface runoff from the roadbed, the tops of cuts or from benches in cut or fill slopes, and conveying it down the slope to a stabilized drainage ditch or area.

Appropriate Applications:

Overside drains are typically used at sites where slopes may be eroded by surface runoff.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design manual (see Topic 834.4);
- Pipe downdrains are metal pipes adaptable to any slope. They are recommended where side slopes are 1:4 or steeper;
- Flume downdrains are rectangular corrugated metal flumes with a tapered entrance. They are best adapted for low flow rates on slopes that are 1:2 or flatter;
- Pipe and flume downdrains shall be securely anchored to the slope;
- Paved spillways are recommended on side slopes flatter than 1:4. On steeper slopes, a more positive type of overside drain (such as a pipe downdrain) should be used; and
- Drainage from benches in cut and fill slopes should be removed at intervals ranging from 100 to 150 meters.

An overside drain is shown in the Standard Plans, July 1999, Figure D87D, page 118.

Flared Culvert End Sections

Description:

These are devices typically placed at inlets and outlets of pipes and channels to improve the hydraulic operation, retain the embankment near pipe conveyances, and to help prevent scour and minimize erosion at these inlets and outlets.

Appropriate Applications:

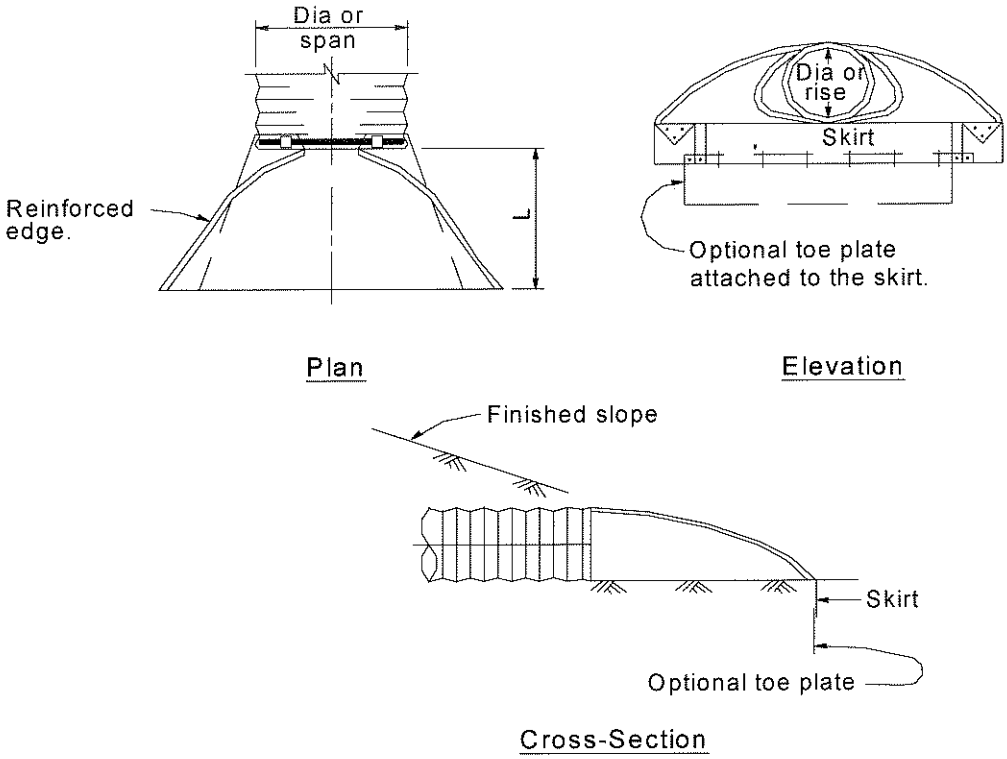
Use flared culvert end sections at outlets and inlets of slope drains and culverts.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Topic 827); and
- Use with other outlet protection/velocity dissipation devices as appropriate.

A flared culvert end section is shown in Figure A-2 (see Standard Plans, July 1999, Figures D94A and D94B, Pages 126 and 127).

Figure A-2: Flared Culvert End Section



Note: Actual layout determined by design.

Outlet Protection/Velocity Dissipation Devices

Description:

These devices are typically placed at pipe outlets to prevent scour and reduce the outlet velocity and/or energy of exiting storm water flows.

Appropriate Applications:

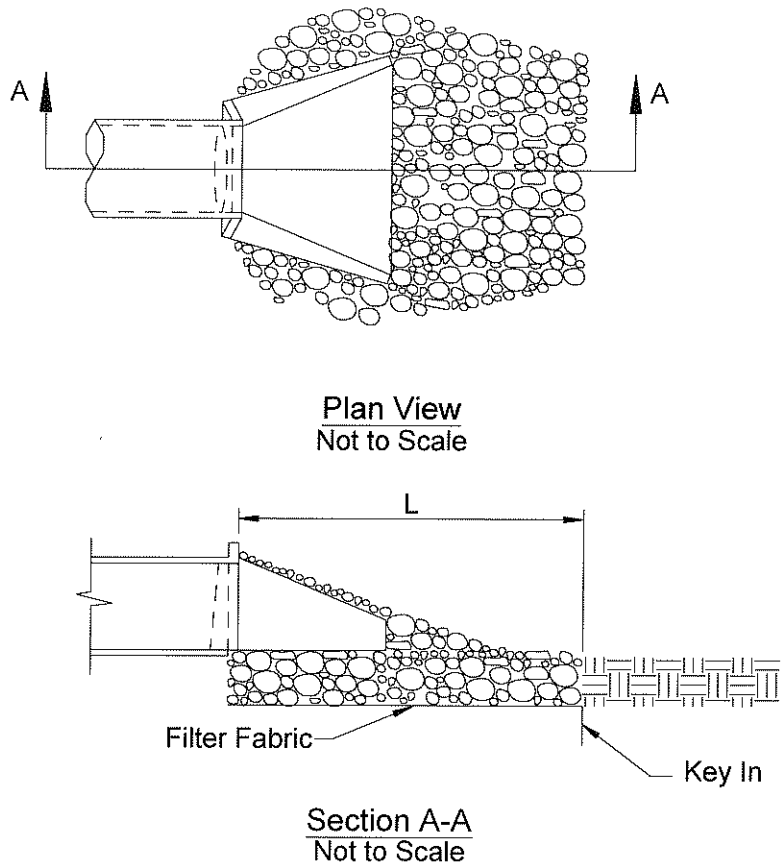
These devices are typically used at the outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design manual (see Topic 827 and Chapter 870);
- Install riprap, grouted riprap, or concrete apron at selected outlet;
- Apron length (L) is related to outlet flow rate and tailwater level; and
- For proper operation of apron, align apron with receiving stream and keep straight throughout its length.

An outlet protection/velocity dissipation device is shown in Figure A-3.

Figure A-3: Outlet Protection/Velocity Dissipation Device



A.5 SLOPE/SURFACE PROTECTION SYSTEMS

Surface protection consists of a selection of permanent design measures that are used alone or in combination to minimize erosion from completed, disturbed surfaces. Vegetated surfaces may offer several advantages to paved surfaces, including lower runoff volumes and slower runoff velocities, increased times of concentration and lower cost. However, where site or slope-specific conditions would prevent adequate establishment and maintenance of a vegetative cover, hard surfacing should be considered.

Vegetated Surfaces

Description:

> A vegetated surface is a permanent perennial vegetative cover on areas that have been disturbed. The purpose of a vegetated surface is to prevent erosion and remove pollutants in storm water and non-storm water runoff.

Appropriate Applications:

Vegetated surfaces should be established on areas of disturbed soil after construction related activities in that area are completed, and after the slope has been prepared. Vegetated surfaces should only be considered for areas that can support the selected vegetation long-term. Consult the District's Landscape Architect regarding vegetated surfaces and appropriate applications.

Implementation:

The following steps are typically implemented by the Landscape Architect:

- The site should first be evaluated to select the appropriate vegetation and planting strategy. The site evaluation should consider soil type and condition; site topography; climate and season; types of appropriate native and adapted vegetation suited to the site; and maintenance;
- Vegetated surfaces shall be designed to minimize overland and concentrated flow depths and velocities, and maximize contact time between water and vegetated surfaces. This will enhance infiltration and pollutant removal opportunities; and
- When determined feasible, strip and stockpile topsoil (duff) and removed vegetation during construction. Use stockpiled materials in the surface preparation prior to seeding operations.

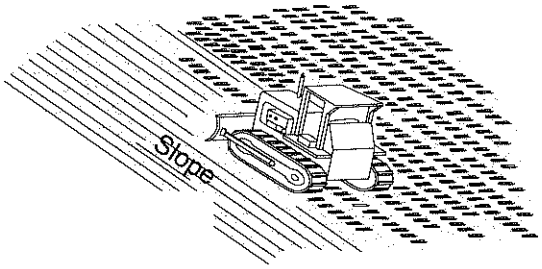
Long-term maintenance of these vegetated surfaces is discussed in Section 2 of the Guidelines.

Slope Roughening/Terracing/Rounding/Stepping:

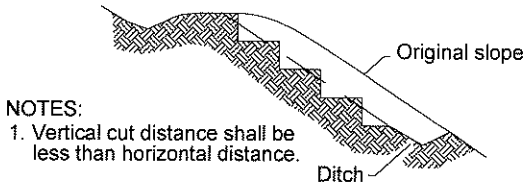
- Roughening and terracing are techniques for creating furrows, terraces, serrations, stair-steps or track-marks on the soil surface to increase the effectiveness of temporary and permanent soil stabilization practices. Slope rounding is a design technique to minimize the formation of concentrated flows; and
- Use on embankment or cut slopes, prior to the application of temporary soil stabilization or permanent seeding.

Slope roughening, terracing, rounding, and stepping, should be implemented as shown in Figure A-4.

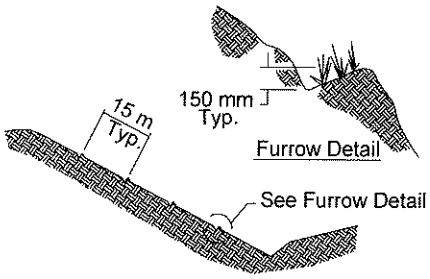
Figure A-4: Slope Roughening, Terracing, Rounding and Stepping



Tracking

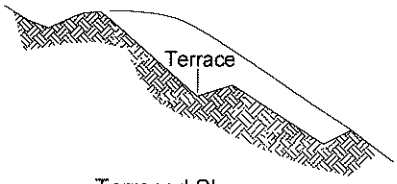


Stepped Slope
Not to Scale

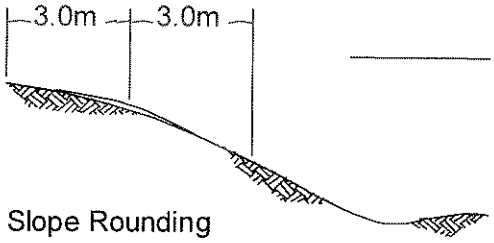


Contour Furrows
Not to Scale

Note: Actual layout determined by design.



Terraced Slope
Not to Scale



Slope Rounding

Hard Surfaces

Description:

Hard surfaces consist of placing concrete, rock, or rock and mortar slope protection. The designer needs to consider the effects of increased runoff from impervious areas.

Appropriate Applications:

Apply on disturbed soil areas where vegetation would not provide adequate erosion protection. Hard surfaces are also considered where it is difficult to maintain vegetation.

Implementation:

- Rock Slope Protection (RSP) (See the California Bank and Shore Rock Slope Protection Design Manual. Web site: http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm):
  - Angular rock of specified size is placed over fabric and used as rip rap to armor slopes, steambanks, etc.;
  - RSP consists of placing revetment-type rock courses;
  - Remove loose, sharp, or extraneous material from the slope to be treated;
  - Place underlayment fabric loosely over the surface so that the fabric conforms to the surface without damage. Equipment or vehicles should not be driven directly on the fabric;
  - Excavate a footing trench along the toe of the slope; and
  - Local surface irregularities should not vary from the planned slope by more than 0.3 meters (m) (0.1 feet [ft]) as measured at right angles to the slope.
- Concreted RSP:
  - Angular rock of specified size is placed over fabric;
  - Concrete is placed into the rock interstices by gravity flow and a minimum of brushing and troweling; and
  - Used to armor streambanks.
- Rock Blanket:
  - Consists of round cobble rock placed as a landscape feature in areas often inundated with water.
- Sacked Concrete Slope Protection:
  - Bags are filled with concrete mix and stacked against the slope to cure. Rebar can be driven into the wet mix and bags.
  - Used to create revetment or bank protection. (This is aesthetically less desirable.)

- Slope Paving:
  - Used almost exclusively below bridge decks at abutments.
  - Provides erosion control and soil stabilization in areas too dark for vegetation to establish.
  - May be constructed of finish poured Portland Cement Concrete (PCC), shotcrete, or masonry paving units.
  - Foundation areas should be evenly graded and thoroughly compacted, with moisture sufficient to allow a firm foundation and to prevent absorption of water from the concrete or mortar. Work should be scheduled so that the work (including placing, finishing, and application of curing compound) between timber borders is started and completed in the same day. There should not be any construction joints between timber spacers.
- Articulated Revetments:
  - Mattresses composed of concrete units that are interlocked or interconnected with cables.
- Gabions:
  - Wire cages filled with rock. These units are then constructed into structures of various configurations.