Appendix K

Preliminary Geotechnical Evaluation Groundwater Replenishment Project EIR Monterey County, California

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PRELIMINARY GEOTECHNICAL EVALUATION
GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

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December 2, 2014
Project No. 402251001

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December 2, 2014
Project No. 402251001

Ms. Diana Buhler
Denise Duffy & Associates
947 Cass Street, Suite 5
Monterey, California 93940

Subject: Preliminary Geotechnical Evaluation
Groundwater Replenishment Project EIR
Monterey County, California

Dear Ms. Buhler:

In accordance with your request, we have performed a preliminary geotechnical evaluation for the Environmental Impact Report on the Monterey Peninsula Groundwater Replenishment Project located in Monterey County, California. This report presents our preliminary findings, conclusions and recommendations regarding geotechnical aspects of the project for preliminary planning purposes.

We appreciate the opportunity to be of service on this project. If you have any questions or comments regarding our report, please contact the undersigned at your convenience.

Respectfully submitted,
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1. SUMMARY OF KEY FINDINGS

A brief summary of our key findings is presented below. More detailed information is presented in the following sections of this report.

- Variable geologic conditions are present within the project area. The project area may be divided into three general geologic regimes; northeastern, central, and southwestern. The northeastern area is comprised predominantly of the alluvial floodplain of the Salinas River. The central area is characterized by elevated rolling hills of wind blown eolian deposits. The geology of the southwestern area is variable and includes the flat coastline west of Canyon del Rey and elevated terrain of the Monterey Peninsula.

- Pipeline construction will vary along the alignments from north to south as the geologic conditions change. The northeastern low-lying areas are anticipated to encounter areas of shallow groundwater and soft soil conditions. The central areas are anticipated to encounter friable dune sands that may cave continuously in some areas. The southwestern areas will vary and may include soft wet soil conditions in canyon areas to difficult excavation in granodiorite.

- The project is located in an area of relatively high seismicity. Some active and potentially active faults do cross the project area. The preferred measure to minimize fault rupture hazards is to locate planned structures away from known fault traces. It may not be feasible or practical, however, to locate planned pipelines away from fault traces. Where pipelines cross known fault traces other measures may be considered depending on the potential risk and damage associated with fault rupture, the relative activity of faulting, and the soil conditions. Potential measures that may be considered include: 1) installation of isolation valves on either side of a pipeline fault crossing to reduce water loss in case of rupture, 2) oversize trench excavation and backfill with select compressible materials, or 3) open channel construction and/or flexible couplings. If damage were to occur to any of the pipelines due to fault rupture, it would amount to a pipe break. A broken pipeline could result in soil washout and sinkholes that could damage nearby non-project facilities or the environment. Locating and repairing damaged pipelines and pumps could require a temporary cessation of operations for a significant period of time.

- There is a strong potential for strong ground shaking, seismically induced soil liquefaction, and dynamic settlement at some locations within the project area. Soil liquefaction may impact some structure sites and pipeline alignments. Geotechnical evaluation of liquefaction potential and dynamic settlement, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including foundation design, excavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- The project may be impacted by corrosion of ferrous metals or sulfate attack on concrete due to corrosive/deleterious soils. The corrosivity depends on the material type and the proximity to saltwater. In general, clay deposits in the alluvium of the Salinas River Valley, southwestern alluvial areas, or coastal marine areas may constitute a corrosive or deleterious environment. Geotechnical evaluation of corrosive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including selection of construction materials may be developed based on the site specific geotechnical conditions.

- The project may be impacted by expansive soils in locations containing clays including the Salinas River Valley, southwestern alluvial areas, and potential locations containing clayey fills. The expansion characteristics of clayey soils may vary locally and should thus be considered during detailed project design on a site-specific basis. Geotechnical evaluation of expansive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including common grading practices such as soil lime treatment, overexcavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- Some of the low-lying project components are mapped in a 100-year flood zone (See Section 4.7). Some of the project components in low-lying coastal areas are mapped in a tsunami inundation area (See Section 4.3.1.5). Design of such project components should take these hazards into consideration. Damage to, temporary inundation of, or temporary exposure of the proposed new water supply infrastructure due to flooding or tsunami is not expected to result in a significant risk of loss of life or property.

2. INTRODUCTION

In accordance with your request and authorization we have performed a preliminary geotechnical evaluation to be used in the preparation of an Environmental Impact Report (EIR) for the Monterey Peninsula Groundwater Replenishment Project (Proposed Project or GWR Project) located in Monterey County, California (Figure 1). The GWR Project is a water resources improvement project in advanced planning phases by the Monterey Peninsula Water Management District (MPWMD), and the Monterey Regional Water Pollution Control Agency (MRWPCA). The purpose of our services has been to make a preliminary evaluation of the soil and geologic conditions within the Proposed Project source water site areas and to develop preliminary data regarding potential geologic and seismic hazards that may impact the project, as well as geotechnical constraints associated with the design and construction of project improvements.

The Proposed Project consists of two components: the Pure Water Monterey Groundwater Replenishment improvements and operations (GWR Features) that will develop high quality replacement water for existing urban supplies; and an enhanced agricultural irrigation (Crop Irrigation) component that will increase the amount of recycled water available to the existing Castroville Seawater Intrusion Project (CSIP) in northern Monterey County. Water supplies proposed to be recycled and reused by the Proposed Project include municipal wastewater, industrial wastewater, urban stormwater runoff and surface water diversions. The Proposed Project would create a reliable source of water supply by taking highly treated water from new and modified treatment facilities at the Regional Treatment Plant, including a new advanced water treatment (AWT) facility, Brine Mixing Facility, Product Water Pump Station and SVRP Modifications, and injecting it into the Seaside Groundwater Basin using a series of shallow and deep injection wells. The GWR Project is being proposed by the MRWPCA in partnership with the MPWMD. Figure 1 shows the regional location of the study area for the Proposed Project. Once injected into the Seaside Basin, the treated water would mix with the groundwater present in the aquifers and be stored for future use.

The primary purpose of the Proposed Project is to provide 3,500 acre-feet per year (AFY) of high quality replacement water to the Seaside Basin to allow California American Water Company (or CalAm[1]) to extract the same amount for delivery to its customers in the Monterey District Service Area, thereby enabling CalAm to reduce its diversions from the Carmel River system by this same amount. Another purpose of the Proposed Project is to provide additional water to the Regional Treatment Plant that could be by recycled at the existing, tertiary treatment facility, the Salinas Valley Reclamation Plant, and used for crop irrigation using the Castroville Seawater Intrusion Project system.

The areas potentially affected by the GWR project source water sites for EIR purposes extend along the coastline of Monterey Bay from near Castroville approximately 16 miles southwest to Pacific Grove and up to approximately 3 miles inland. Additional areas potentially affected by

[1] CalAm is an investor-owned public utility with approximately 38,500 connections in the Monterey Peninsula area.

the GWR project occur between Salinas and the Salinas River (Figure 1). General study area features are described in Section 4.1.

2.1. Project Components

This section describes the physical components of the Proposed Project. The following project components are proposed:

- *Source water diversion and storage sites*– diversion of new source waters to the existing municipal wastewater collection system and conveyance of those waters as municipal wastewater to the Regional Treatment Plant (RTP) to increase availability of secondary-treated wastewater for the Proposed Project. See "GWR Source Water Diversion and Storage" in Figure 2A.

- *Treatment facilities at RTP* – use of existing primary and secondary treatment facilities at the RTP, as well as new pre-treatment, advanced water treatment (AWT), product water stabilization, product water pump station, and concentrate disposal facilities, as well as modifications to the Salinas Valley Reclamation tertiary treatment plant. See "GWR Treatment Facilities" in Figure 2A.

- *Product water conveyance* – new pipelines, booster pump station, appurtenant facilities along one of two optional pipeline alignments to move the product water from the RTP to the Seaside Groundwater Basin injection well facilities. See "GWR Product Water Conveyance" in Figure 2A.

- *Injection well facilities* – new deep injection and vadose zone wells to inject Proposed Project product water into the Seaside Groundwater Basin, backflush facilities, pipelines, electricity/ power distribution facilities, and an electrical/motor control building. See "GWR Injection Wells and Backflush Facility" in Figure 2A.

- *Distribution of groundwater from Seaside Groundwater Basin* – new CalAm distribution system improvements needed to convey extracted groundwater and deliver it to CalAm customers. See "California American Water Distribution System" in Figure 2A. These same CalAm distribution improvements also would be needed if CalAm were to implement the Monterey Peninsula Water Supply Project (CalAm Water Supply Project), which is undergoing separate CEQA review.

Many existing facilities will be utilized to convey new source water to the existing RTP including the Salinas sanitary sewer pump station, MRWPCA's 36-inch sanitary sewer force main, City of Salinas industrial wastewater conveyance and treatment facilities, City of Salinas stormwater conveyance facilities, City of Monterey Lake El Estero and nearby wastewater collection systems, and MRWPCA's Monterey Peninsula interceptor system including pump stations. These existing components are part of the Proposed Project; however the use of these components is not being evaluated for impacts because the usage is part of the existing setting. A schematic of the project components is presented in Figure 2A.

2.2. Project Alternatives

The Monterey Peninsula Groundwater Replenishment Project is currently considering alternatives for:

- Alternative source water diversion locations at:
  - Laguna Grande Lake
  - Roberts Lake
  - Navy Lake
  - Bay Avenue Outfall
  - Del Monte Dry Weather Diversion
  - Areas of Special Biological Significance (ASBS) compliance Wet Weather Diversion

Alternative project components are not currently part of the Proposed Project, but are being evaluated as part of this report. The locations of the alternative project components in relation to the proposed and existing project components are illustrated in Figure 2B.

3. METHODOLOGY

Our study consisted of a preliminary geotechnical evaluation of the various sites and alignments for preliminary planning purposes. Subsurface exploration has not been performed. Specifically, our evaluation included the following tasks:

- Project coordination, including review of preliminary conceptual plans and participation in conference calls.

- Research and review of readily available geologic and seismic literature pertinent to the study area including geologic maps, regional fault maps, seismic data, and geotechnical reports prepared by Ninyo & Moore or other consultants for the study area vicinity. The reports and documents reviewed for this study are listed in Section 9 of this report.
- Compilation and analysis of the data obtained during our literature review to evaluate potential geologic and seismic hazards that may impact the project and evaluate geotechnical aspects of the project for preliminary design and construction consideration.
- Preparation of this preliminary geotechnical evaluation report presenting our findings, conclusions, and recommendations regarding the geotechnical aspects of the project.

4. EXISTING CONDITIONS

The general features, geologic conditions, surface soil erosion characteristics, and faulting and seismic conditions as they currently exist over the project study area, are discussed in the following sections.

4.1. General Study Area Features

The study area extends from the Castroville area at the Tembladero Slough southwest to the Pacific Grove area in the Monterey Peninsula, and as far inland as Salinas (Figure 1). The project may be divided into three general areas that have relatively distinct geologic and topographic characteristics. These project areas include a northeastern area, a central area, and a southwestern area. The northeastern area of the project includes a large area of low-lying agricultural fields in the floodplain of the Salinas River. Castroville is located within this area approximately 2 miles from the coast, and Salinas is located within this area approximately 8 miles from the coast. The central portion of the project includes rolling hills extending inland from the coast comprised of wind blown eolian deposits. This area includes the urbanized developments of Seaside, and Marina, as well as the former Fort Ord military base. The southwestern portion of the project area includes rolling hills extending inland generally west of Canyon Del Rey into the Monterey Peninsula. The geologic characteristics and boundaries of the northeastern, central and southwestern areas are discussed further in Section 4.2.1.

4.2. Geologic Conditions

The regional geologic setting and the various geologic units encountered with the study area are discussed in the following sections.

4.2.1. Geologic Setting

The project area is located within the Coast Ranges physiographic province which is characterized by a series of northwest-trending mountain ranges and valleys that are generally fault controlled. A regional fault map is presented on Figure 3. The Coast Ranges are chiefly composed of thick Mesozoic- and Cenozoic-age sedimentary strata. The northern and southern parts of the ranges are separated by a depression containing the San Francisco Bay. Faults juxtapose blocks of different origins. The majority of the Monterey area is underlain by the Salinian block, which is generally bounded by the San Andreas fault zone to the northeast and the San Gregorio fault zone to the southwest (Rosenberg, 2001h). The Salinian block is comprised of Mesozoic granitic rock and Paleozoic to Mesozoic meta-sedimentary rock (Norris & Webb, 1990). A series of thick Cretaceous- and Tertiary-age sedimentary strata overly much of the Salinian block, and were deposited during marine transgressions and regressions during this timeframe. Several episodes of volcanism, indicative of crustal extension and normal faulting, also occurred in the region during late Oligocene and Miocene time, and produced extrusive igneous rocks ranging in composition from basalt to rhyolite (Rosenberg, 2001h). During Quaternary time, the region has been uplifted to its current elevation and a combination of tectonic and geomorphic processes have shaped the present landscape, including the exposure of marine terraces, deposition of eolian sand, alluvial deposition, and landsliding.

The project may be divided into three general areas, northeastern, central, and southwestern, that have relatively distinct geologic and topographic characteristics. The northeastern portion extends north of the active Salinas River channel and generally consists of a relatively broad low-lying, alluvial floodplain. The central area of the project consists of eolian deposits that form a zone of moderately elevated, rolling hills extending several miles inland from the coastline and south from the Salinas River channel to Canyon del Rey. The southwestern portion of the project extends generally west along the coastline from the Canyon del Rey into elevated terrain of the Monterey Peninsula, which is the coastal expression of a northwesterly trending mountain range uplifted by faulting. The uplifted peninsula includes a variety of geologic units that includes a core of Cretaceous-age granitic rocks, Tertiary-age sedimentary rocks, Pleistocene-age terrace deposits, landslides and alluvial sediments.

4.2.2. Geologic Units

Based on our geologic literature review, the geologic units anticipated within the project study area include fill, alluvium, eolian deposits, terrace deposits, Tertiary-age Monterey Formation, and Cretaceous-age poryphyritic granodiorite of Monterey. The distribution of the various geologic units is shown on the regional geology map in Figure 4 along with the existing and proposed project components. The regional geology map symbols are described on Figure 5. A brief summary of these geologic units and their anticipated engineering characteristics are presented below.

4.2.2.1. Fill

Artificial fill materials are mapped along the proposed CalAm Monterey and Transfer pipelines in the southwest portion of the project study area. We also anticipate that fill materials will be encountered elsewhere throughout the study area where human alterations to the subsurface have occurred. The thickness of fill deposits varies. Based on our experience we anticipate that the fill materials are generally derived from local natural soils and will be similar to the natural soils as described in the following sections. Fill materials may also include imported materials, construction debris, or other waste products. Documentation of the compaction of the fill materials was not available for review.

4.2.2.2. Alluvium

Alluvial materials are generally mapped in the northeast and southwest portions of the project study area. Alluvium is generally comprised of unconsolidated sediments deposited in alluvial fans, along active stream and river channels, and in floodplains. Project components in the northeastern area of the project are mapped as being underlain by Holocene-age flood-plain deposits, Holocene basin deposits, Holocene alluvial deposits, and Holocene stream channel deposits (Rosenberg, 2001a). The alluvium in the northeastern area of the project is anticipated to generally consist of interbedded silts, clays, sands, and gravels. The northeastern area is largely agricultural and relatively flat, with relatively poor drainage features. Groundwater is anticipated to be within 10 feet of the ground surface (and shallower) in the low-lying areas. The alluvial materials in the northeastern floodplain area of the project are mapped as having moderate to high liquefaction susceptibility (Rosenberg, 2001d).

Portions of the project components in the southwestern area of the project are mapped as being underlain by Holocene basin deposits and Holocene alluvial deposits (Rosenberg, 2001a). Specifically, the proposed Lake El Estero, alternative Laguna Grande Lake[2], alternative Roberts Lake[2], and alternative Navy Lake[2] source water locations are mapped as being underlain by Holocene basin and alluvial deposits. Also, the proposed CalAm Monterey and Transfer pipelines and alternative ASBS Wet Weather Diversion area[2] are underlain by Holocene alluvial deposits where they intersect drainage courses. Alluvial materials in the southwestern project area are anticipated to be more variable due to the complex geologic conditions and terrain associated with the Monterey Peninsula and may include moist to wet, loose/soft clays, silts, and sands. The alluvial materials in the southwestern area of the project are mapped as having high liquefaction susceptibility (Rosenberg, 2001d).

4.2.2.3. Eolian Deposits

The central portion of the project between the Salinas River and Canyon del Rey is mapped as being underlain by Pleistocene-age eolian deposits (Rosenberg, 2001a). Rosenberg (2001g) describes these deposits as being weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand deposited in an extensive coastal dune field. Shallow groundwater is not anticipated within the elevated eolian deposits, except for localized low-lying areas along the coastline. The eolian deposits are generally mapped as having low liquefaction susceptibility, except where shallow groundwater may be present in localized low-lying areas (Rosenberg, 2001d). The soil erosion hazard within the eolian deposits in the central portion of the project area is mapped as moderate, except along the coast where the soil erosion hazard is mapped as high (Rosenberg, 2001f). Eolian deposits may also be collapsible. Collapsible soil is broadly defined as loose and cemented soil with low moisture content that is susceptible to a large and sudden reduction in volume upon wetting, with no increase in vertical stress.

4.2.2.4. Terrace Deposits

Pleistocene-age coastal terrace deposits are mapped within the southwestern portion of the project (Rosenberg 2001a). Rosenberg (2001g) describes these deposits as semiconsolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. These deposits can locally include some terrace surfaces and debris flow deposits resting on terrace surfaces. In general, the liquefaction hazard and landslide seismic hazard are mapped as low in areas underlain by coastal terrace deposits (Rosenberg 2001b & 2001d). The soil erosion hazard is mapped as moderate in areas underlain by coastal terraces (Rosenberg 2001f).

[2] Alternative project elements are not currently part of the Proposed Project, but are being evaluated as part of this report.

4.2.2.5. Monterey Formation

The Tertiary-age Monterey Formation is mapped in the southwestern portion of the project along the southern margins of Lake El Estero (Rosenberg, 2001a). However, we understand that proposed physical facilities and disturbance associated with the Lake El Estero diversion will be limited to the northeastern side of the lake. Based on our review of available literature, we do not anticipate the Monterey Formation will be present within the footprint of the Lake El Estero diversion facilities.

Rosenberg (2001g) describes the Monterey Formation as light brown to white, hard, brittle, and platy siliceous mudstone. Clark (1997) describes this unit as thin-bedded and laminated, light brown to white porcelanite with thin clay partings between the porcelanite beds and with thin interbeds of waxy yellow chert. Bentonite beds are present within the Monterey Formation, which are prone to landsliding in sloped areas.

4.2.2.6. Poryphyritic Granodiorite of Monterey

The Poryphyritic Granodiorite of Monterey is mapped in the southwestern portion of the project along segments of the proposed CalAm Monterey and Transfer Pipeline and a portion of the alternative ASBS Wet Weather Diversion area[2]. This Cretaceous-age granitic rock is light gray to moderate pink, medium-grained, and contains orthoclase phenocrysts 3 to 10 centimeters long (Clark, 1997).

4.3. Faulting and Seismicity

The study site is located in the Coast Ranges geomorphic province of California, an area considered seismically active, as are most areas of California. The Coast Ranges are comprised of a series of parallel, northwest-trending mountain ranges and valleys generally controlled by faults. Faults juxtapose blocks of geologic units of different origins called belts. The Monterey area is located within the Salinian block which is a northwest-trending belt bounded to the east by the San Andreas fault, and to the west by the San Gregorio (Sur) fault (Harden, 1998).

Several active and potentially active faults have been mapped within or close to the study area. As defined by the California Geological Survey (CGS), an “active” fault is one that has exhibited seismic activity or has evidence of fault displacement within Holocene time (roughly during the last 11,000 years). “Potentially active” faults are those which show evidence of displacement during Quaternary time (roughly during the last 1.6 million years), but for which evidence of Holocene movement has not been established. The approximate locations of the major faults in the region and their geographic relationship to the project area are shown on Figure 3 and in greater detail on Figure 6.

The California Geological Survey has designated certain active fault traces as Earthquake Fault Zones under the Alquist-Priolo Special Studies Zone Act of 1972 (CGS, 2007). The study area does not include faults designated as Alquist-Priolo Earthquake Fault Zones. The closest such zoned fault is the San Andreas fault located to the northwest of the project.

Table 1 lists selected nearby principal active and potentially active faults that may impact the Proposed Project and the alternative project areas, the estimated maximum moment magnitude of each fault, and the estimated slip rate for each fault. For Proposed Project components, the maximum distances to each fault are based on estimated distances from the southwestern end of the proposed CalAm Distribution System, the Tembladero Slough diversion site, or the Reclamation Ditch diversion site. For alternative project areas, the distances to each fault are based on estimated distances from the Bay Avenue Outfall alternative source water area[2] or the alternative ASBS Wet Weather Diversion area[2].

Table 1 – Principal Active and Potentially Active Faults

Fault	Fault to Proposed Project Area Distance (Range in Miles)	Fault to Alternative Project Areas Distance (Range in Miles)	Maximum Moment Magnitude (Mmax) [1]	Slip Rate (mm/yr) [2]
Monterey Bay – Tularcitos Fault Zone	0-11	0-3	7.3	0.5
Rinconada Fault Zone	0-7.5	6-8	7.5	1.0
San Andreas (Santa Cruz Mtn Section)	12-26	23.5-25	7.0	17.0

1 Cao, 2003
2 Wills et. al, 2008

The Reliz fault zone is the northward extension of the Rinconada fault zone which trends to the northwest along the base of the mountains at the southwest side of the Salinas River valley. The northernmost known indication of Quaternary movement along this fault zone is the steeply dipping Paso Robles Formation beds near the Spreckels area (Rosenberg, 2001f). The Reliz fault has been projected northwest from Spreckels crossing through the central portion of the project area in the Marina vicinity (Jennings and Bryant, 2010; Rosenberg, 2001c). This portion of the fault passes beneath eolian deposits and the location is uncertain. This fault system has displaced materials of late Quaternary age (11,000 to 750,000 years old) and is considered potentially active (Rosenberg, 2001c).

The Monterey Bay-Tularcitos fault zone crosses through the Monterey-Seaside area and extends offshore (Clark et al., 1997). The onshore portion in the project vicinity includes the Ord Terrace, Seaside, Chupines, and Navy faults. These faults create an approximately 5 to 9 mile wide zone of short en echelon northwest-striking faults that are genetically related. The activity and locations of these faults are not well defined. Geologic data indicates Holocene displacement at some locations and these faults should be considered active for planning purposes.

The northernmost Ord Terrace fault is mapped beneath eolian deposits in the central portion of the project area through the proposed CalAm Monterey and Transfer Pipelines and near the proposed GWR Injection Well Facilities (Figure 6). The Ord Terrace fault is a steeply southwest-dipping reverse fault. There is evidence for Pleistocene activity in the northward extension of the fault into Monterey Bay, where it cuts Pleistocene strata and offsets the sea floor (Rosenberg, 2001h). Rosenberg (2001c) shows displacement on the Ord Terrace fault within Quaternary time but prior to the middle Pleistocene (Figure 6).

The Seaside fault is mapped beneath eolian deposits through the proposed CalAm Monterey and Transfer pipelines in the central portion of the project area. The Seaside fault is a steeply southwest-dipping reverse fault and well data suggests that its trace connects to a splinter of the Chupines fault near Highway 68. Well logs on either side of the fault show an approximate 275 foot vertical offset of Pleistocene continental deposits, but evidence for Holocene movement is lacking (Rosenberg, 2001h). Rosenberg (2001c) shows displacement along the Seaside fault within Quaternary time but prior to the middle Pleistocene (Figure 6).

The Chupines fault is mapped to the northeast of the Roberts Lake and Laguna Grande Lake through the proposed CalAm Monterey pipeline within the southwestern edge of the central portion of the project area. At locations where the fault orientation is measurable, its dip ranges from 50 degrees southwest to near-vertical. A probable offshore extension of the Chupines fault cuts Holocene deposits and seafloor deposits (Rosenberg, 2001h). Thus the portion of the fault within the project area is considered active.

The Navy fault is mapped to the southwest of Navy Lake through the proposed CalAm Monterey Pipeline within the southwestern portion of the project area. Its northwest-striking alignment is consistent with the Tularcitos fault zone and extends from Carmel Valley to Monterey Bay. The Navy fault dips steeply to the southwest and geomorphic features along its trace such as linear drainages and aligned benches indicate predominantly strike-slip movement. Clark (1997) reports Holocene activity on the Navy fault based on Holocene displacements of offshore strata and earthquake epicenter plots near the fault trace. Rosenberg (2001c) however shows displacement within Quaternary time but prior to the middle

Pleistocene. The Fault Activity Map of California (Jennings & Bryant, 2010) indicates that displacement along the onshore portion of the Navy fault within the study area dates to late Quaternary and pre-Holocene time.

4.3.1. Seismic Hazards

Seismic hazards that could potentially affect improvements within the study area include surface fault rupture, ground shaking, soil liquefaction and dynamic settlement, lateral spreading, tsunamis and landsliding. Seismic hazards associated with the Proposed Project and project alternatives are discussed in the following sections.

4.3.1.1. Fault Rupture

Evaluation of fault rupture hazard is based on the concepts of recency and recurrence of faulting along existing faults. Faults of known historic activity during the last 200 years, as a class, have a greater probability for future activity than faults classified as Holocene age (last 11,000 years), and a much greater probability of future activity than faults classified as Quaternary age (last 1.6 million years). However, it should be kept in mind that certain faults have recurrent activity measured in tens or hundreds of years whereas other faults may be inactive for thousands of years before being reactivated. The magnitude, sense, and nature of fault rupture also vary for different faults or along different strands of the same fault. Even so, future faulting generally is expected to recur along pre-existing faults (Bonilla, 1970). The development of a new fault or reactivation of a long-inactive fault is relatively uncommon.

Faults in the vicinity of the project have demonstrated Quaternary movement and can be considered at least potentially active (Figures 6A & 6B). The Chupines fault, the Navy fault, and the Seaside Fault have demonstrated Holocene movement and can be considered active. Based on our review of the project plans and geologic maps, these faults cross the proposed CalAm Monterey Pipeline. As such, there is potential for fault rupture within the project area.

The Reliz, Chupines, and Navy faults cross the proposed CalAm Monterey Pipeline. The Ord Terrace fault potentially crosses the CalAm Monterey Pipeline and traces very near the proposed GWR Injection Well Facilities. These faults have shown evidence of displacement within Quaternary time but have not shown displacement within Holocene time. The approximate location of these faults and their geographic relationship to the proposed improvements are shown on Figure 6.

4.3.1.2. Ground Shaking

Strong ground shaking may occur due to earthquake events along active faults nearby or distant to the study area. Disregarding local variations in ground conditions, the intensity of shaking at different locations within the area can generally be expected to decrease with distance away from an earthquake source. Measurements of peak ground acceleration, in units of g, may be used for quantification of shaking intensity. In general, peak ground accelerations of less than 0.10g are indicative of weak shaking, values between 0.10g and 0.20g are indicative of moderate shaking, and values over 0.20g are indicative of strong shaking. The shaking intensity due to an earthquake felt at any given site depends on the shear wave velocity properties of the soil or rock conditions at that site. The California Geologic Survey Ground Motion Interpolator (CGS, 2008) based on the 2008 Probalistic Seismic Hazard Assessment by the United States Geological Survey (Petersen et al, 2008), indicates that the peak ground acceleration with a 2 percent chance of being exceeded in 50 years ranges between 0.60g and 0.65g over the study area for an assumed shear wave velocity of 270 meters per second, which is representative of a site underlain by stiff soil.

4.3.1.3. Soil Liquefaction and Dynamic Settlement

Liquefaction is a phenomenon in which soil loses its shear strength for short periods of time during an earthquake. Ground shaking of sufficient duration results in the loss of grain-to-grain contact, due to a rapid increase in pore water pressure, causing the soil to behave as a fluid for short periods of time. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling, and buckling of deep foundations due to liquefaction-induced ground settlement. Dynamic settlement may also occur in loose, dry sands above the water table.

In general, a relatively high potential for liquefaction exists in loose, sandy soils that are within 50 feet of the ground surface and are saturated (below the groundwater table). Some locations within the project study area, including the floodplain of the Salinas River, low-lying coastal areas, and alluvial river-bottom areas such as Canyon del Rey (Highway 68) and other drainages within the southwestern portion of the project have a moderate to high liquefaction potential (Figure 7). Separate locations of historical liquefaction incidents have been documented within the project area, the majority of which were located within the northeastern project area (Figure 7). There may be a moderate potential for dynamic settlement of dry, loose sands within the elevated dune sand deposits.

4.3.1.4. Lateral Spreading

Lateral spreading is horizontal earth movement associated with soil liquefaction. Lateral spreading generally occurs in shallow ground water areas with unsupported embankments including natural creek banks, fill slopes, levees, etc. Areas that have a potential for lateral spreading within the study area are low-lying areas near river channels, sloughs, or other drainages.

4.3.1.5. Tsunami

Tsunamis are open sea tidal waves generated by earthquakes. Tsunami damage is typically confined to low-lying coastal areas. Project components along the low-lying coastal areas may be impacted by tsunamis. A majority of the coastline along

Monterey Bay is mapped within a tsunami inundation area (Figure 10), which includes some project components. Portions of the proposed CalAm Monterey Pipeline, the area within and around the proposed Lake El Estero, Tembladero Slough, and Blanco Drain source water locations are mapped within a tsunami inundation zone. The alternative source water locations[2] at Navy Lake, Roberts Lake, Laguna Grande Lake, and Bay Avenue are mapped within a tsunami inundation zone (CGS, 2009a,b,c).

4.3.1.6. Earthquake-Induced Landslides

Landslides initiated by earthquakes have historically been a major cause of earthquake damage. Landslides initiated by the 1971 San Fernando, 1989 Loma Prieta and 1994 Northridge earthquakes were responsible for destroying or damaging numerous homes and other structures, blocking major transportation corridors, and damaging various types of lifeline infrastructure. Seismically induced landsliding includes surficial sliding/rock falls and deep seated landsliding. Relatively shallow surficial sliding may occur throughout the project area where steep slope gradients are present and/or loose soil conditions exist (such as eolian sands, loose topsoil, and fill slopes). The relative potential for earthquake induced landslides within the project study area is presented in Figure 8. The project study area is generally considered to be in an area of low susceptibility to earthquake-induced landsliding (Rosenberg, 2001b).

4.4. Surface Soil Erosion

Surface soils tend to erode under the wearing action of flowing water, waves, wind, and gravity. Factors influencing erosion include topography, soil type, precipitation and other environmental conditions. In general, granular soils with relatively low cohesion and soils located on relatively steep topography have relatively high erosion potential. Within the project area, coastal areas north of Lake El Estero and the slopes on the southern side of the Salinas River have a high potential for erosion (Rosenberg, 2001f). The coastal terrace and eolian deposits inland from the coastline with less steep topography are considered to have a moderate potential for erosion. The relatively flat areas within the Salinas River valley have a low potential for erosion.

Coastal erosion in the Southern Monterey Bay is expected to increase with accelerating sea level rise. As the sea level rises over the next century and beyond, some of the project components may be affected during major storm events by wave run-up into dune areas and subsequent undercutting at the dune toe, causing increased erosion. A memorandum prepared by ESA PWA, 2014, shows selected coastal zones at risk of damage during a major storm event, considering sea level rise scenarios through 2060. The memorandum includes a longitudinal profile spanning between Lake El Estero and Monterey Bay, with the approximate location of the proposed CalAm Monterey Pipeline plotted within the envelope of erosion for a 100-year storm considering predicted sea levels in 2040 and 2060. Coastal areas significantly east and west of the above longitudinal profile location are not specifically analyzed in the memorandum, however it is possible that coastal erosion exacerbated by sea level rise may affect nearby project components.

The project may include earthwork for the construction of project improvements, including trenching for pipelines and miscellaneous excavations. Disturbed areas will have a relatively high potential for erosion. Standard construction practices to mitigate erosion include preparation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP includes construction best management practice measures such as desilting basins, silt fences, hydroseeding of slopes, and monitoring and clean-up requirements. Erosion control plans prepared and designed by the project civil engineer are recommended. Long term best management practice measures may include vegetating graded slopes, design of appropriate drainage control systems and suitable drainage outlets.

4.5. Expansive Soils

Some clay minerals undergo volume changes upon wetting or drying. Unsaturated soils containing those minerals will shrink/swell with the removal/addition of water. The heaving pressures associated with this expansion can damage structures, flatwork, and pipelines. Clayey soils may be encountered throughout the project area in fill, alluvial, and formational materials. The expansion characteristics of clayey soils may vary locally and should thus be evaluated on a site-specific basis. Such an evaluation may include laboratory testing.

4.6. Collapse Potential

Collapsible soil is broadly defined as loose and cemented soil with low moisture content that is susceptible to a large and sudden reduction in volume upon wetting, with no increase in vertical stress. The process of soil collapse upon wetting is referred to as hydrocollapse. Another type of collapse can occur in saturated soil bearing soluble minerals when subjected to continuous leaching. Some common soluble soil minerals include calcium chloride, magnesium chloride, sodium chloride, potassium chloride, gypsum, anhydrite, dolomite, and calcium carbonate (Mansour, 2008). The composition of minerals dissolved in leaching water will affect the soil mineral dissolution rate.

The most common types of collapsible soil include alluvial soils, eolian deposits, and residual soils formed by extensive weathering of parent materials such as granitic rock (Mansour, 2008). Within the project area alluvial materials, eolian deposits, and residual soil over granodiorite are present. Settlement may occur where these materials are loose, relatively dry, and subjected to a significant increase in moisture content. A site-specific evaluation of collapse potential and resulting settlement should be performed in these materials where saturation of the soil or a substantial rise in groundwater levels above the historic highs are anticipated.

4.7. Flooding

Our review of flood mapping by the Monterey County Resource Management Agency (2010) found that some of the project area is within a 100 year flood zone. A majority of the coastline along Monterey Bay is mapped within a 100 year flood zone (Figure 11), which includes some project components such as portions of the proposed CalAm, Monterey and Transfer pipelines and the Bay Avenue alternative source water location[2]. In the southwestern part of the project area, the areas within and around the proposed Lake El Estero source water location, and alternative source water locations[2] at Navy Lake, Roberts Lake, and Laguna Grande Lake are mapped within the 100 year flood zone. In the central part of the project area, there are sporadic zones within the vicinity of Marina and north of Seaside that are mapped within the 100 year flood zone. In the northeastern part of the project area, a majority of the Salinas River floodplain and Tembladero Slough vicinity is mapped within the 100 year flood zone.

5. PROJECT IMPACT ANALYSIS

The following sections discuss the impacts that the existing/anticipated geotechnical, geologic, and seismic conditions might have on the construction and performance of the proposed project. Each project element will be discussed in turn. Detailed design information regarding many of the project components is not yet available.

5.1. Proposed GWR Injection Wells and Backflush Facilitiy

It is our understanding that the proposed project includes the construction of an Injection Well Facility, which will include both deep injection wells into the confined Santa Margarita Aquifer and vadose zone wells to recharge the shallower Paso Robles Aquifer, as well as monitoring wells, a backflush basin, pipelines, and operations buildings. The location considered for this site is east of Seaside, along the eastern side of General Jim Moore Boulevard and south of Eucalyptus Road (Figure 2A). Elevations at this proposed site range from approximately 330 to 425 feet above mean sea level (MSL). This location is underlain by eolian deposits that are anticipated to consist of weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand. Groundwater is expected to be relatively deep; around 400 feet below the ground surface.

There are potential geologic hazards and considerations associated with the use of this site as an Injection Well Facility. The surface trace of the Ord Terrace Fault is mapped approximately ¼ mile southwest of this site; however the location of this fault within the

Pleistocene eolian deposits is not well-defined. The Ord Terrace fault is considered potentially active but dips steeply toward the southwest away from the site (Rosenberg 2001h),thus minimizing exposure of Injection Well Facilities to fault rupture.

The eolian deposits that underlie the proposed location for the Injection Well Facilities may be susceptible to hydro-collapse that would result in ground subsidence if large quantities of water are injected into the ground above historic high groundwater levels. However, we understand that the proposed vadose zone wells are designed to reach depths of 100 to 200 feet, so wetting of the eolian deposits would occur at 100 feet or deeper, and mounding beneath the vadose zone wells is not expected to be significant. Based on this scenario, we consider the potential for hydrocollapse due to the vadose zone injection wells to be negligible. We also understand that the proposed back-flush basin may cause wetting of the shallow eolian deposits. However, the back-flush basin is only expected to receive pumped water for a few hours per week so settlement due to hydrocollapse is anticipated to be relatively minor and limited to the footprint of the back-flush basin which can accommodate minor settlement. As such, we do not consider the impact of hydrocollapse resulting from use of the back-flush basin to be significant.

5.2. Water Collection, Conveyance, Distribution, and Storage Alignments

The existing and proposed project components are illustrated in Figure 2A. The alternative project components are illustrated in Figure 2B. As discussed in Section 4.2.1, the project study area may be divided into three general regions with relatively distinct geologic and topographic characteristics. In the following sections, we will address the potential impacts that the proposed project and alternative components experience in each of the three general areas: northeastern, central, and southwestern.

5.2.1. Northeastern Area

The northeastern area contains proposed project components including the Salinas Treatment Facility, the Salinas Pump Station, Tembladero Slough, Reclamation Ditch , and the eastern portion of the Blanco Drain source water diversion site. The Blanco

Drain source water site will require a new pipeline for connection to the RTP in the central project area.

The northeastern area includes low-lying, relatively flat, alluvial plains of the Salinas River valley and the relatively narrow flood plains of the Tembladero Slough. Ground surface elevations in the Salinas River valley area of the project generally range from approximately 10 to 45 feet above MSL. Ground surface elevations near the Tembladero Slough source water site[2] range from approximately 4 to 10 feet above MSL. The northeastern area is generally developed with agricultural fields, industrial facilities, and some mixed residential/commercial development in Salinas and Castroville.

The low-lying floodplain areas are underlain by Holocene alluvial deposits. These deposits include unconsolidated interbedded silts, clays, sands, and gravels. Groundwater is anticipated to be approximately 10 feet deep or less in low-lying areas. Drainage conditions are relatively poor and the subsurface is anticipated to consist of moist to saturated soils. Trench excavations may encounter groundwater, moist to wet soils, and soft ground conditions. Trench dewatering may be required. Moist to wet soil conditions along lower elevations may require drying/mixing prior to trench backfill compaction. Soft ground may require overexcavation and stabilization with crushed rock/filter fabric to provide suitable pipe bedding support. The liquefaction susceptibility in low-lying flood plain areas is moderate to high. Clayey soils are potentially corrosive and/or expansive.

5.2.2. Central Area

The central portion of the study area includes the proposed GWR product water conveyance alignments, the eastern portion of the proposed CalAm Monterey and Transfer pipelines, the proposed GWR Injection Well Facility, and the western portion of the Blanco Drain source water diversion site. The Blanco Drain source water will require a new pipeline for connection to the RTP. The central area also contains several site locations considered as alternative project components[2] for supplemental source water, including the Bay Avenue alternative outfall site and the Del Monte Boulevard Dry Weather Diversion site.

This central area includes gently to moderately rolling dunes with elevations ranging from approximately 10 feet above MSL near the Salinas River to approximately 350 feet above MSL along southernmost portion of the proposed GWR product water conveyance alignment. The project components in this area traverse agricultural fields, undeveloped areas, and residential, commercial, and military developments.

Trenching for pipelines in the central area will generally encounter eolian deposits and fill materials. The eolian deposits are anticipated to consist of weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand. Fill materials are generally anticipated to consist of compacted silts and sands generated locally from the natural eolian deposits. Fill materials may also include imported soils and miscellaneous debris (particularly in older developed areas and along the former Fort Ord military base). We generally anticipate well-drained conditions and relatively deep groundwater, although shallow groundwater may be present along low-lying coastal areas. Trenching conditions can vary depending on presence/absence of cementation and/or groundwater. Excavations in eolian deposits may encounter flowing sands and caving. Temporary construction slopes may range up to 1.5:1 or 3:1 (horizontal:vertical) inclinations. Continuous shoring may be appropriate to protect existing improvements, where temporary slopes are not feasible. Flowing sand conditions may warrant special excavation and shoring procedures to protect adjacent improvements and existing utilities, such as trench shields placed during excavation and limited open trench conditions. Sandy materials should be suitable for trench zone and trench backfill. The susceptibility to liquefaction is considered low, except in low-lying coastal areas. Dynamic settlement of loose dry sands may be a potential hazard to pipelines. Sands are anticipated to have low corrosivity potential and moderate to high potential for erosion. The Reliz fault has been projected across the proposed pipeline alignments near Marina. Similarly, the Chupines, Seaside and Ord Terrace faults have been traced across the proposed alignments near Seaside and Del Rey Oaks. As such there is potential that rupture along these faults may impact the pipelines at these locations.

5.2.3. Southwestern Area

The southwestern portion of the study area includes the western portion of the proposed CalAm Monterey and Transfer pipelines and the Lake El Estero source water site.

The southwestern area also contains several site locations considered as alternative project components[2] for supplemental source water, including the Laguna Grande Lake alternative source water diversion site, the Roberts Lake alternative source water diversion site, the Navy Lake alternative source water diversion site, and the ASBS Wet Weather Diversion area.

The topography in the southwestern area is variable and includes the relatively low-lying coastal area between Canyon del Rey and Lake El Estero, gently sloping terraces beginning several blocks west of Lake El Estero and inland, and undulating coastal bluffs on portions of the coastline. Elevations range from approximately 10 feet above MSL between Canyon Del Rey and Lake El Estero to approximately 220 feet above MSL at the western terminus of the proposed CalAm Monterey Pipeline. The project components span park areas, commercial developments, and residential developments.

Variable geologic conditions are present within the southwestern area, including fill materials, Holocene-age alluvial materials, Pleistocene-age coastal terraces, Tertiary-age Monterey Formation, and Cretaceous-age Porphyritic granodiorite of Monterey. It is anticipated that the fill materials are generally derived from local natural soils and will be similar to the natural soils. Fill materials may also include imported materials, construction debris, or other waste products. Alluvium along canyon bottoms and drainages is anticipated to include moist to wet, loose/soft clays, silts, and sands. Shallow groundwater may be encountered along lower canyon and drainage areas. Flat and sloped areas throughout the southwestern portion of the study area contain coastal terrace deposits anticipated to be comprised of semi-consolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. The southwestern edge of Lake El Estero is mapped as being underlain by the Monterey Formation. The western portion of the proposed CalAm Monterey Pipeline is anticipated to encounter granodiorite in several locations.

Trench excavations in the low-lying alluvial areas may encounter some soft, wet, alluvium with a potential for caving and unstable trench bottoms. Dewatering may be required. Moist to wet soil conditions along lower elevations may require drying/mixing prior to trench backfill compaction. Soft ground may require overexcavation and stabilization with crushed rock/filter fabric to provide suitable pipe bedding support. Low-lying alluvial areas may be considered to have a relatively high susceptibility to liquefaction and dynamic settlement. Trenches excavated in coastal terrace deposits may experience variable stability due to potential zones where debris flow deposits locally overlie the terrace deposits. Monterey Formation and granodiorite materials are anticipated to be relatively stable in trench excavations. Difficult excavating may be encountered in granodiorite and strongly cemented layers of the Monterey Formation. Specialized excavation equipment, such as ripper teeth or chipper attachments may be appropriate for trenching in these deposits. The materials generated from trench excavations in the southern area will vary and are not anticipated to be suitable for use as pipe zone material. Imported sand should be used for backfill around pipes. The majority of excavated material should be suitable for trench backfill, but oversize rock fragments from hard rock areas may be unsuitable.

The proposed CalAm Monterey Pipeline in the City of Monterey crosses a mapped trace of the Navy fault. Additionally, project components underlain by fill or alluvium may have high liquefaction susceptibility. Soil erosion hazards within this area range from low to high. Subsequent geotechnical evaluations within these areas of the project should further evaluate potential liquefaction and fault rupture hazards.

6. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

The purpose of our preliminary geotechnical services has been to evaluate the soil and geologic conditions within the project area and to develop preliminary data regarding geologic and seismic hazards and geotechnical constraints that may impact the project. To accomplish this we have reviewed geologic and seismic background data of the current Proposed Project and alternative project components. Detailed design information regarding most of the project components is not available yet. Based on the results of our preliminary evaluation, it is our opinion that the project is feasible from a geotechnical perspective, provided appropriate design, engineering and construction considerations are incorporated into the project. This report has been prepared for use in the preliminary planning of the project. Prior to design of facilities geotechnical evaluations should be performed to prepare appropriate geotechnical design criteria for pipeline alignments and sites, as required by the appropriate city, county, and state building codes and ordinances. A summary of our preliminary findings and recommendations is presented below.

- Variable geologic conditions are present within the project area. The project area may be divided into three general geologic regimes; northeastern, central, and southwestern. The northeastern area is comprised predominantly of the alluvial floodplain of the Salinas River. The central area is characterized by elevated rolling hills of wind blown eolian deposits. The geology of the southwestern area is variable and includes the flat coastline west of Canyon del Rey and elevated terrain of the Monterey Peninsula.

- Pipeline construction will vary along the alignments from north to south as the geologic conditions change. The northeastern low-lying areas are anticipated to encounter areas of shallow groundwater and soft soil conditions. The central areas are anticipated to encounter friable dune sands that may cave continuously in some areas. The southwestern areas will vary and may include soft wet soil conditions in canyon areas to difficult excavation in granodiorite.

- The project is located in an area of relatively high seismicity. Some active and potentially active faults do cross the project area. The preferred measure to minimize fault rupture hazards is to locate planned structures away from known fault traces. It may not be feasible or practical, however, to locate planned pipelines away from fault traces. Where pipelines cross known fault traces other measures may be considered depending on the potential risk and damage associated with fault rupture, the relative activity of faulting, and the soil conditions. Potential measures that may be considered include: 1) installation of isolation valves on either side of a pipeline fault crossing to reduce water loss in case of rupture, 2) oversize trench excavation and backfill with select compressible materials, or 3) open channel construction and/or flexible couplings. If damage were to occur to any of the pipelines due to fault rupture, it would amount to a pipe break. A broken pipeline could result in soil washout and sinkholes that could damage nearby non-project facilities or the environment. Locating and repairing damaged pipelines and pumps could require a temporary cessation of operations for a significant period of time.

- There is a strong potential for strong ground shaking, seismically induced soil liquefaction, and dynamic settlement at some locations within the project area. Soil liquefaction may impact some structure sites and pipeline alignments. Geotechnical evaluation of liquefaction potential and dynamic settlement, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including foundation design, excavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- The project may be impacted by corrosion of ferrous metals or sulfate attack on concrete due to corrosive/deleterious soils. The corrosivity depends on the material type and the proximity to saltwater. In general, clay deposits in the alluvium of the Salinas River Valley, southwestern alluvial areas, or coastal marine areas may constitute a corrosive or deleterious environment. Geotechnical evaluation of corrosive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including selection of construction materials may be developed based on the site specific geotechnical conditions.

- The project may be impacted by expansive soils in locations containing clays including the Salinas River Valley, southwestern alluvial areas, and potential locations containing clayey fills. The expansion characteristics of clayey soils may vary locally and should thus be considered during detailed project design on a site-specific basis. Geotechnical evaluation of expansive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including common grading practices such as soil lime treatment, overexcavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- Some of the low-lying project components are mapped in a 100-year flood zone (See Section 4.7). Some of the project components in low-lying coastal areas are mapped in a tsunami inundation area (See Section 4.3.1.5). Design of such project components should take these hazards into consideration. Damage to, temporary inundation of, or temporary exposure of the proposed new water supply infrastructure due to flooding or tsunami is not expected to result in a significant risk of loss of life or property.

7. FUTURE WORK

Detailed site-specific geotechnical engineering studies including subsurface exploration and laboratory testing should be performed during future design phases of the project, as required by the appropriate city, county, and state building codes and ordinances to identify engineering and geotechnical design criteria related to liquefaction potential, fault surface rupture, or other geotechnical constraints at the specific sites so that appropriate geotechnical design and construction recommendations can be prepared. Subsurface exploration may also be considered to provide additional data for selection of alternative sites. The recommendations developed as part of the final geotechnical study would provide the engineering and construction design details related to seismic design considerations, foundation design, excavation characteristics, and backfill requirements. Design measures may include foundation parameters, removal of problematic soils, compaction requirements, pipe bedding requirements, and special trench backfill requirements that represent standard engineering practices typically utilized for infrastructure and pipeline projects.

8. LIMITATIONS

The desktop evaluation and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. Conditions not described in this report may be encountered during subsurface exploration and construction. Uncertainties relative to subsurface conditions can be reduced through subsurface exploration. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for preliminary planning purposes only. A detailed geotechnical evaluation, including subsurface exploration should be performed prior to detailed design and construction.

Our conclusions, recommendations, and opinions are based on a review of preliminary conceptual plans and geologic and seismic literature. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

9. REFERENCES

Bonilla, M.G., 1970, Surface Faulting and Related Effects in Wiegel, R.L., editor, Earthquake Engineering: Prentice Hall, p. 47-74.

California Geological Survey, 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, Special Publication 42, Interim Revision 2007

California Geological Survey, 2008, Probalistic Seismic Hazards Ground Motion Interpolator, Accessed on April 2, 2014. www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html.

California Geological Survey, 2009a, Tsunami Map for Emergency Planning, State of California County of Monterey Marina Quadrangle, Scale 1:24,000: dated July 1.

California Geological Survey, 2009b, Tsunami Map for Emergency Planning, State of California County of Monterey Moss Landing Quadrangle Prunedale Quadrangle, Scale 1:24,000: dated July 1.

California Geological Survey, 2009c, Tsunami Map for Emergency Planning, State of California County of Monterey Seaside Quadrangle, Scale 1:24,000: dated July 1.

California Geological Survey (CGS), 2014, Online Maps of Official Alquist-Priolo Earthquake Fault Zones, accessed January 14. www.quake.ca.gov/gmaps/WH/regulatorymaps.htm.

Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C. J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, California, United States Geological Survey/ California Geological Survey (USGS/CGS): dated June.

Clark, J.C., Dupre, W.R., and Rosenberg, L.I., 1997, Geologic Map of the Monterey and Seaside 7.5-minute Quadrangles, Monterey County, California: A Digital Database, United States Geological Survey (USGS), Open-File Report 97-30, Scale 1:24,000.

Denise Duffy and Associates, Inc. (DD&A), 2014, Draft Area of Potential Effect Map Booklet, Pure Water Monterey Groundwater Replenishment Project: Version Date November 7, 2014.

Dibblee, T.W., 2007, Geologic Map of the Marina and Salinas Quadrangles, Monterey County, DF-353, Scale 1:24,000.

ESA PWA, 2014, Analysis of Historic and Future Coastal Erosion with Sea Level Rise memorandum, Monterey Peninsula Water Supply Project: dated March 19.

Harden, D.R., 1998, California Geology, Prentice-Hall, Inc., 479 pages.

Jennings, C.W., and Bryant, W.A., 2010, Fault Activity Map of California, California Geological Survey (CGS), Scale 1:750,000.

Mansour, Z., Chik, Z., Taha, M.R., 2008, On Soil Collapse Potential Evaluation, International Conference on Construction and Building Technology.

Monterey County, 2001, 21st Century Monterey County Draft General Plan: dated December 18, http://www.co.monterey.ca.us/.

Monterey County Resource Management Agency (MCRMA), 2010, Monterey County Federal Emergency management Agency (FEMA) 100 Year Flood Map: dated January 22. http://www.co.monterey.ca.us/planning/gpu/GPU_2007/2010_Mo_Co_General_Plan_Adopted_102610/Figures/Fig8bFEMA_100Year_Flood.pdf.

National Resources Conservation Services (NRCS), 1999, Soil Survey Geographic (SSURGO) Database for Monterey County: www.nrcs.usda.gov/wps/portal/nrcs/main/national/ngce/.

Ninyo & Moore, 2005, Preliminary Geotechnical Evaluation, Monterey County Coastal Water Project, Monterey County, California, Project No. 400988001: dated April 29.

Ninyo & Moore, 2009, Geotechnical Evaluation, Seaside North-Water Main Replacement, Seaside, California, Project No. 401574001: dated September 17.

Ninyo & Moore, 2009, Geotechnical Evaluation, Aquifer Storage & Recovery Phase I, Del Monte Avenue, Camino Aguajito, and Aguajito Road, Monterey, California, Project No. 401574002: dated November 9.

Norris, R.M. and Webb, R.W., 1990, Geology of California: John Wiley & Sons, Inc.

Petersen, M.D., Frankel, A.D., Harmsen, S.C., Mueller, C.S., Haller, K.M., Wheeler, R.L., Wesson, R.L., Zeng, Y., Boyd, O.S., Perkins, D.M., Luco, N., Field, E.H., Wills, C.J., Rukstales, K.S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008-1128. 61p.

Rosenberg, L.I., 2001a, Digital Geologic Map of Monterey County, California, Scale 1:250,000.

Rosenberg, L.I., 2001b, Digital Map Showing Relative Earthquake-Induced Landslide Susceptibility of Monterey County, California, Scale 1:250,000.

Rosenberg, L.I., 2001c, Digital Map Showing Relative Fault Hazards of Monterey County, California, Scale 1:250,000.

Rosenberg, L.I., 2001d, Digital Map Showing Relative Liquefaction Susceptibility of Monterey County, California, Scale 1:250,000.

Rosenberg, L.I., 2001e, Digital Map Showing Relative Seismic Shaking Hazards of Monterey County, California, Scale 1:250,000.

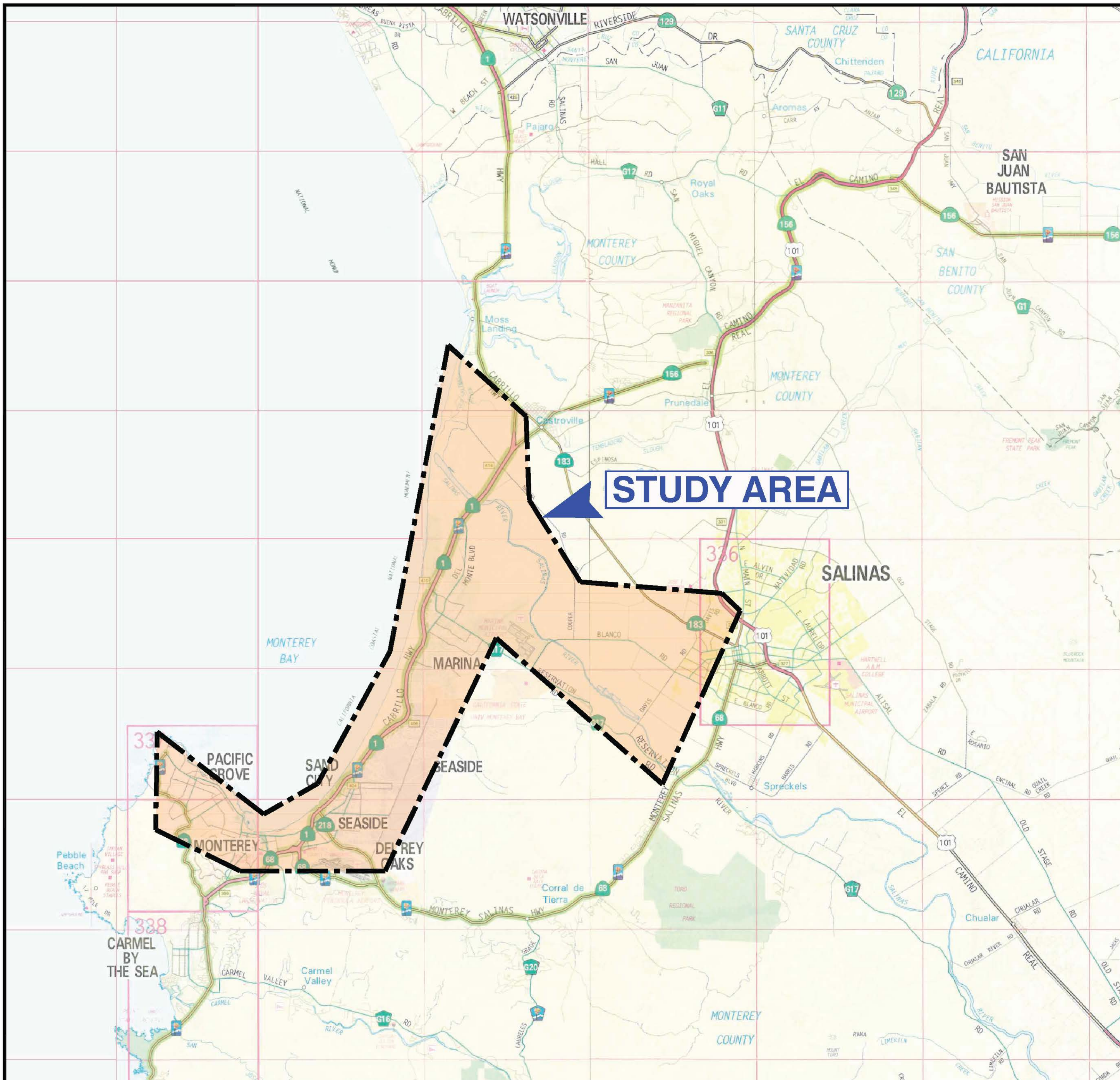
Rosenberg, L.I., 2001f, Digital Map Showing Relative Soil Erosion Hazards of Monterey County, California, Scale 1:250,000.

Rosenberg, L.I., 2001g, Explanation for Digital Geologic Map of Monterey County, California.

Rosenberg, L.I., 2001h, Geologic Resources and Constraints, Monterey County, California, A technical Report for the Monterey County 21th Century General Plan Update: dated April.

URS, 2013, Geotechnical Baseline Report, Proposed Desalination Plant, Monterey Peninsula Water Supply Project, Marina, Monterey County, California, Project No. 26818647: dated June 20.

Wills, C.J., Weldon, R.J., Bryant, W.A., 2008, California Fault Parameters for the National Seismic Hazard Maps and Working Group on California Earthquake Probablilities 2007, USGS Open File Report 2007-1437A



REFERENCE: CALIFORNIA ROAD ATLAS, THOMAS GUIDE, 2006.

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SCALE IN MILES

0 4 8

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

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Ninyo & Moore		STUDY AREA LOCATION	FIGURE
PROJECT NO.	DATE	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	1
402251001	3/15		

REFERENCE: GOOGLE EARTH IMAGERY, 2013.

LEGEND

- EXISTING WASTEWATER PIPELINE
- EXISTING OCEAN OUTFALL
- GWR PRODUCT WATER CONVEYANCE
- CALIFORNIA AMERICAN WATER DISTRIBUTION SYSTEM
- GWR INJECTION WELLS AND BACKFLUSH FACILITY
- GWR TREATMENT FACILITIES
- GWR SOURCE WATER DIVERSION AND STORAGE SITES

N

SCALE IN MILES

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NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

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PROJECT NO.	DATE
402251001	3/15

PROJECT COMPONENTS

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

FIGURE

2A

REFERENCE: GOOGLE EARTH IMAGERY, 2013.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

- EXISTING WASTEWATER PIPELINE
- EXISTING OCEAN OUTFALL
- GWR PRODUCT WATER CONVEYANCE
- CALIFORNIA AMERICAN WATER DISTRIBUTION SYSTEM
- GWR INJECTION WELLS AND BACKFLUSH FACILITY
- GWR TREATMENT FACILITIES
- GWR SOURCE WATER DIVERSION AND STORAGE SITES
- ALTERNATIVE PROJECT COMPONENT LOCATION

Ninyo & Moore

PROJECT NO.	DATE
402251001	3/15

PROJECT COMPONENTS

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

FIGURE

2B

402251001-PC-B.dwg, Mar 24, 2015, 10:43am, SN

SOURCE: Fault Activity Map of California, 2010, Jennings, C.W., and Bryant, W.A., California Geological Survey.

APPROXIMATE SCALE

0 20 40 MILES

LEGEND

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- STATE/COUNTY BOUNDARY
- QUATERNARY (POTENTIALLY ACTIVE)
- LATE QUATERNARY (POTENTIALLY ACTIVE)

NOTES: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

C:\GIS\DATA\fault_loc_2010_OAK\fault_loc_2010_OAK_92.mxd

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REGIONAL FAULT LOCATIONS

PROJECT NO.	DATE	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	FIGURE
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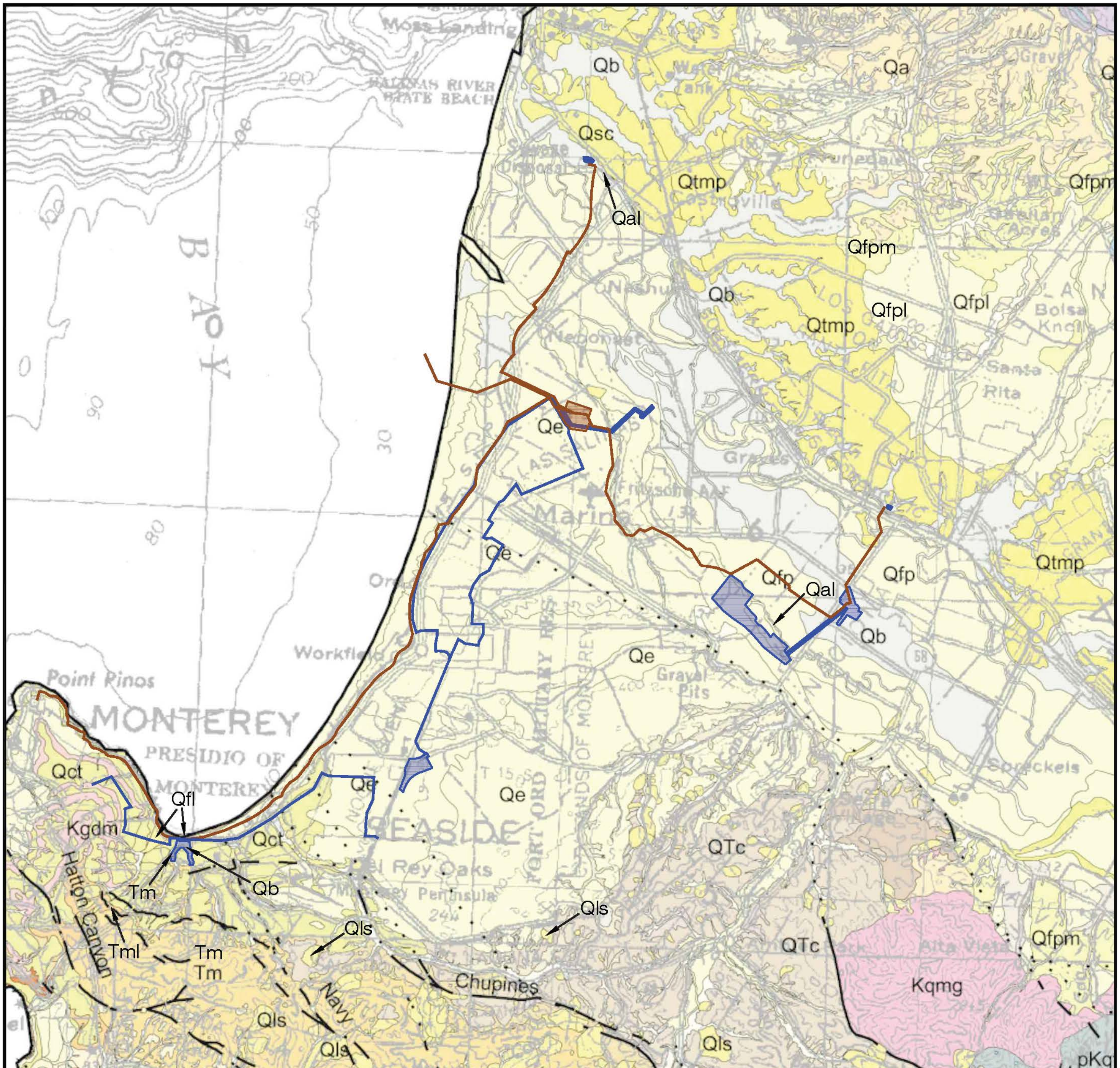


REFERENCE: ROSENBERG, L.I., 2001, DIGITAL GEOLOGIC MAP OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

EXISTING WASTEWATER FACILITIES

PROJECT COMPONENT

Ninyo & Moore

PROJECT NO.	DATE
402251001	3/15

REGIONAL GEOLOGY

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

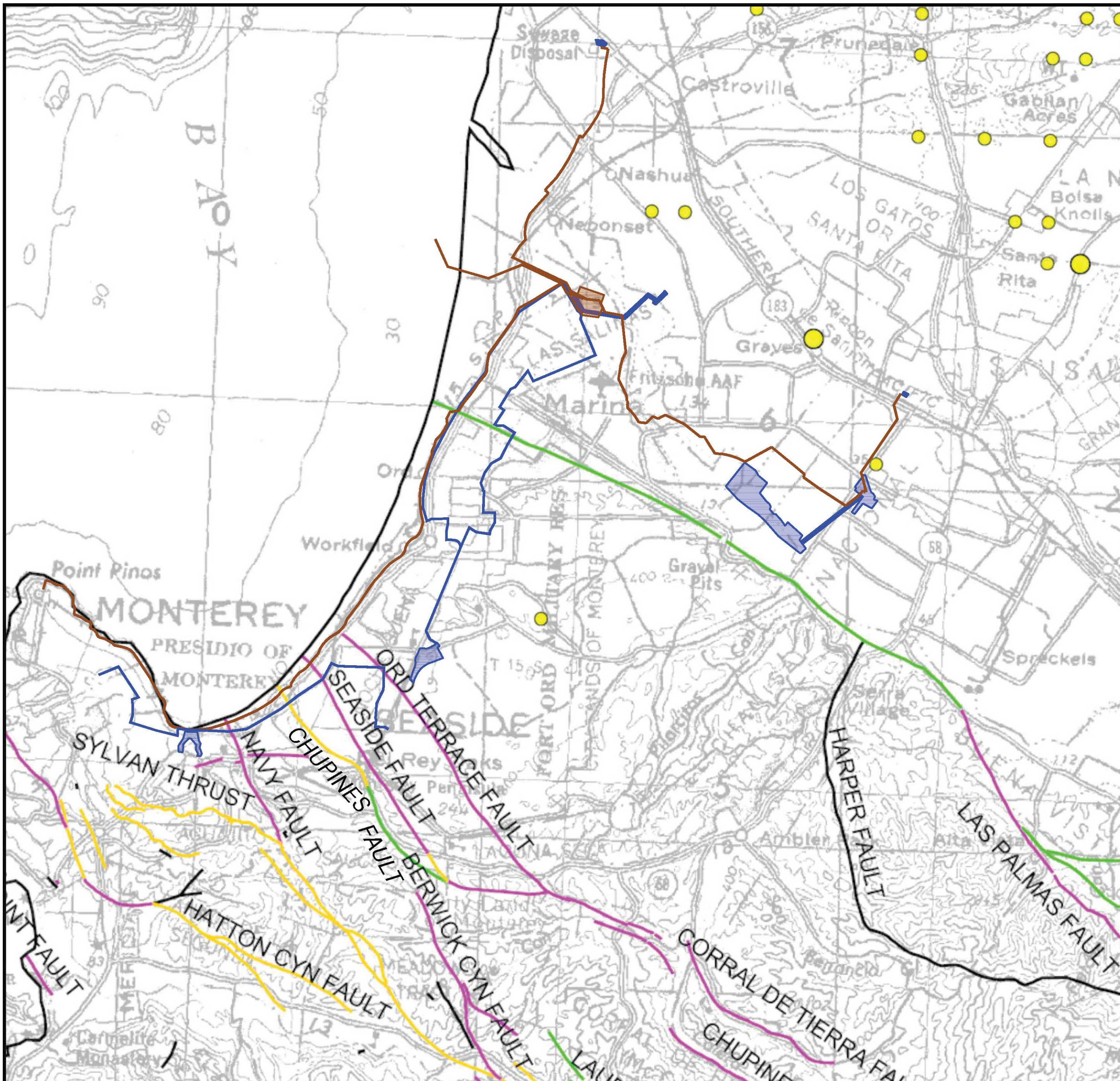
FIGURE 4

402251001-RG.dwg, Mar 24, 2015, 10:45am, SN

Qfl	**Artificial fill (Historic)**—Deposits of fill resulting from human construction or mining activities ranging from well-compacted sand and silt to poorly compacted sediment high in organic content; only locally delineated
Qbs	**Beach sand (Holocene)**—Unconsolidated, well-sorted, medium- to coarse-grained sand; local layers of pebbles and cobbles
Qb	**Basin deposits (Holocene)**—Unconsolidated, plastic clay and silty clay containing much organic material; locally contains interbedded thin layers of silt and silty sand
Qal	**Alluvial deposits, undifferentiated (Holocene)**—Unconsolidated, heterogeneous, moderately sorted silt and sand with discontinuous lenses of clay and silty clay
Qhf	**Alluvial fan deposits, undifferentiated (Holocene)**—Unconsolidated, moderately to poorly sorted sand, silt, and gravel, with layers of silty clay
Qfp	**Flood-plain deposits, undifferentiated (Holocene)**—Unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt; commonly includes relatively thin, discontinuous layers of clay
Qsc	**Stream channel deposits, undifferentiated (Holocene)**—Modern stream channels and channel deposits of the Salinas River and principal tributaries. Loose, moderately- to well-sorted gravel, coarse- to fine-grained sand and silt
Qls	**Landslide deposits (Quaternary)**—Heterogeneous mixture of deposits ranging from large block slides of indurated bedrock to debris flows in semiconsolidated sand and clay
Qe	**Eolian deposits, undifferentiated (Pleistocene)**—Weakly to moderately consolidated, moderately to well-sorted silt and fine-to medium-grained sand deposited in extensive coastal dune field
Qfpl	**Alluvial fans (late Pleistocene)**—Weakly consolidated, moderately to poorly sorted sand, silt, and gravel
Qfpm	**Alluvial fans (middle Pleistocene)**—Moderately consolidated, deeply weathered, moderately to poorly sorted sand, silt, and gravel, capped with moderately well drained, maximally developed soils
Qtlp	**Fluvial terrace deposits (late Pleistocene)**—Semi-consolidated, moderately to poorly sorted silt, sand, silty clay, and gravel
Qtmp	**Fluvial terrace deposits (middle Pleistocene)**—Semi-consolidated, moderately well to poorly sorted sand, silt, and clay with interbedded gravel
Qct	**Coastal terraces, undifferentiated (Pleistocene)**—Semiconsolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. Locally includes some terrace surfaces and debris flow deposits resting on terrace surfaces
QTc	**Continental deposits, undifferentiated (Pleistocene-Pliocene?)**—Semiconsolidated, relatively fine-grained, oxidized sand and silt. Probably equivalent to Paso Robles Formation
Tm	**Monterey Formation, siliceous mudstone (Miocene)**—Light brown to white, hard, brittle, platy; Mohnian Stage. Mapped as McLure Shale Member northeast of San Andreas fault.
Tml	**Monterey Formation, semi-siliceous mudstone (middle Miocene)**—Semi-siliceous mudstone and siltstone (Sandholdt Shale Member of Durham, 1968; 1974)
Kgdm	**Porphyritic granodiorite of Monterey (Ross, 1976) (Cretaceous)**
————	**Contact**—Accuracy ranges from well-located to approximately located. Most sedimentary units are well-located and most igneous and metamorphic units are approximately located at main mapping scale of 1:62,500
—— — —?—·····?··	**Fault**—Solid where accurately located; dashed where approximately located; dotted where concealed; queried where location or existence uncertain. Includes strike-slip, normal and reverse dip-slip, oblique-slip, and thrust faults

REFERENCE: ROSENBERG, L.I., 2001, EXPLANATION FOR DIGITAL GEOLOGIC MAP OF MONTEREY COUNTY.

Ninyo & Moore	EXPLANATION OF REGIONAL GEOLOGY	FIGURE
PROJECT NO. / 402251001	DATE / 3/15	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	5



REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE FAULT HAZARDS OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

EXISTING WASTEWATER FACILITIES

PROJECT COMPONENT

Historic (younger than 200 years before present)—Displacement during historic time (1906 San Andreas fault earthquake)

Holocene (younger than 11,000 years before present)—Fault offsets Holocene deposits as dated by radiocarbon methods; delineated by well-developed geomorphic features such as deflected stream channels, linear drainages, saddles, notches, and troughs; aligned with historic seismicity recorded by the UCB/USGS Northern California Earthquake Data Center

Late Quaternary (750,000 to 11,000 years before present)—Fault cuts middle Pleistocene or younger deposits. Marine terrace age estimates based on correlations by McKittrick (1988) and Dupré (1990). Alluvial fan age estimates based on correlations by Tinsley (1975), Dupré and Tinsley (1980), and Klaus (1999)

Undivided Quaternary (younger than 1,600,000 years before present)—Offset of Quaternary deposits not otherwise determined to be younger than middle Pleistocene

Pre-Quaternary (older than 1,600,000 years before present)—Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.

Earthquake epicenter (magnitude 3.0-3.9)

Earthquake epicenter (magnitude 5.0-5.9)

Earthquake epicenter (magnitude 4.0-4.9)

Earthquake epicenter (magnitude 6.0-6.9)

Ninyo & Moore		PROJECT FAULT LOCATIONS	FIGURE
PROJECT NO.	DATE	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	6
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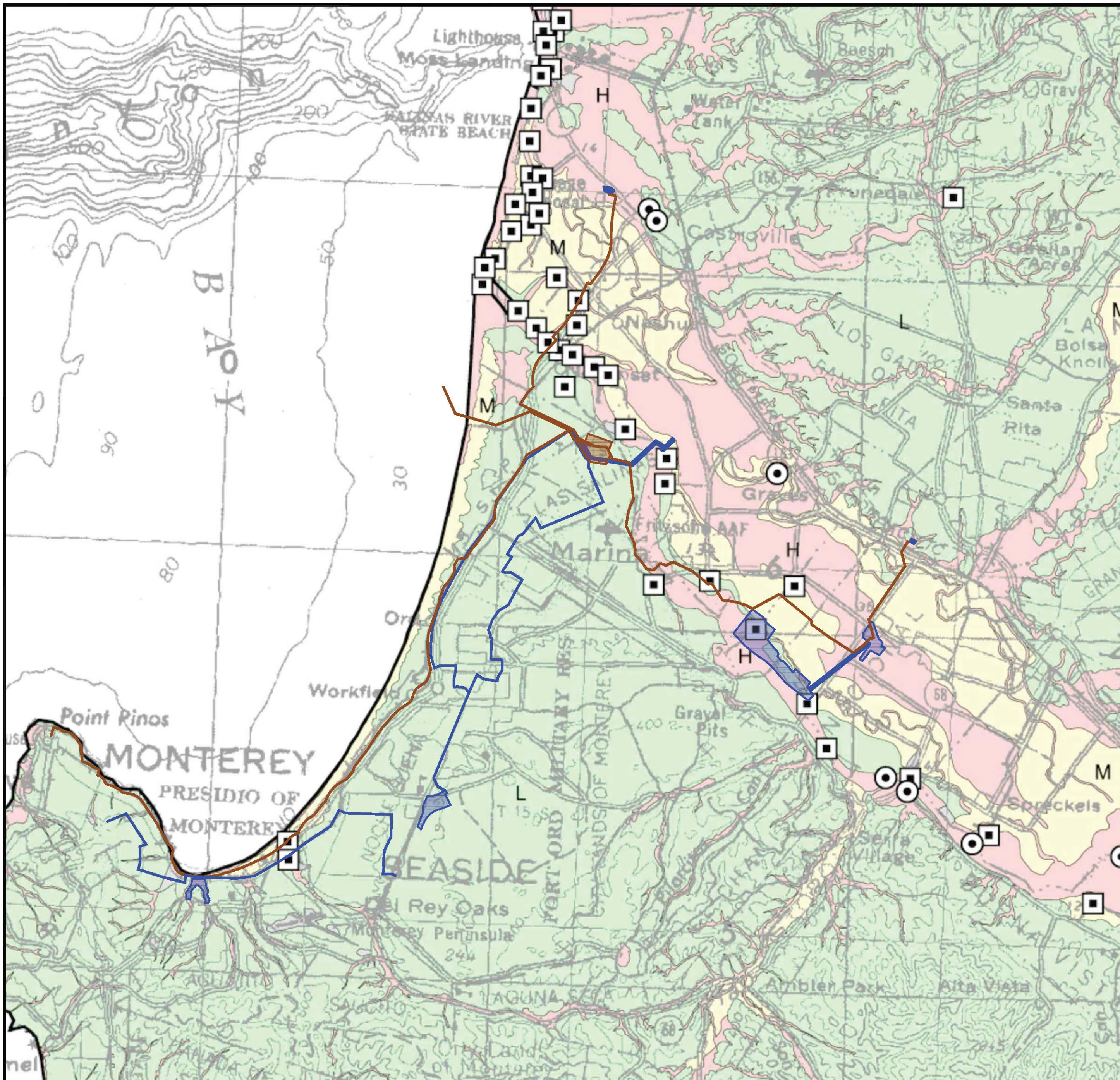

REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE LIQUEFACTION SUSCEPTIBILITY OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

LEGEND

EXISTING WASTEWATER FACILITIES — PROJECT COMPONENT

H — **High liquefaction susceptibility**— Engineering tests and shallow ground water, the local presence of free faces, or historical evidence of liquefaction-induced ground failure in the 1906 San Francisco or 1989 Loma Prieta earthquakes. Mainly latest Holocene (0-500 years before present) younger flood-plain deposits and most Holocene basin deposits, undivided alluvial deposits, and abandoned channel-fill deposits. Sediments are likely to liquefy in a nearby major earthquake

M — **Moderate liquefaction susceptibility**—Historical evidence of liquefaction-induced ground failure absent, although high susceptibilities calculated in engineering tests. Includes late Holocene (500-5,000 years before present) older flood-plain deposits, colluvium, and some late Pleistocene-Holocene eolian deposits. May liquefy in a nearby major earthquake

L — **Low liquefaction susceptibility**—Includes almost all Pleistocene deposits and pre-Quaternary deposits, and Holocene deposits where the historical high ground water table is at least 30 feet below the ground surface (e.g., most alluvial fan deposits). Unlike to liquefy, even in a nearby major earthquake

V — **Variable liquefaction susceptibility**—Areas of mapped artificial fill. Depending on the type of material and method of placement, the suceptibility may range from high to low

Historical liquefaction present in 1906 San Francisco or 1989 Loma Prieta earthquakes

Historical liquefaction absent in 1906 San Francisco or 1989 Loma Prieta earthquakes

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

402251001-LH.dwg, Mar 24, 2015, 10:41am, SN

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LIQUEFACTION HAZARDS

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

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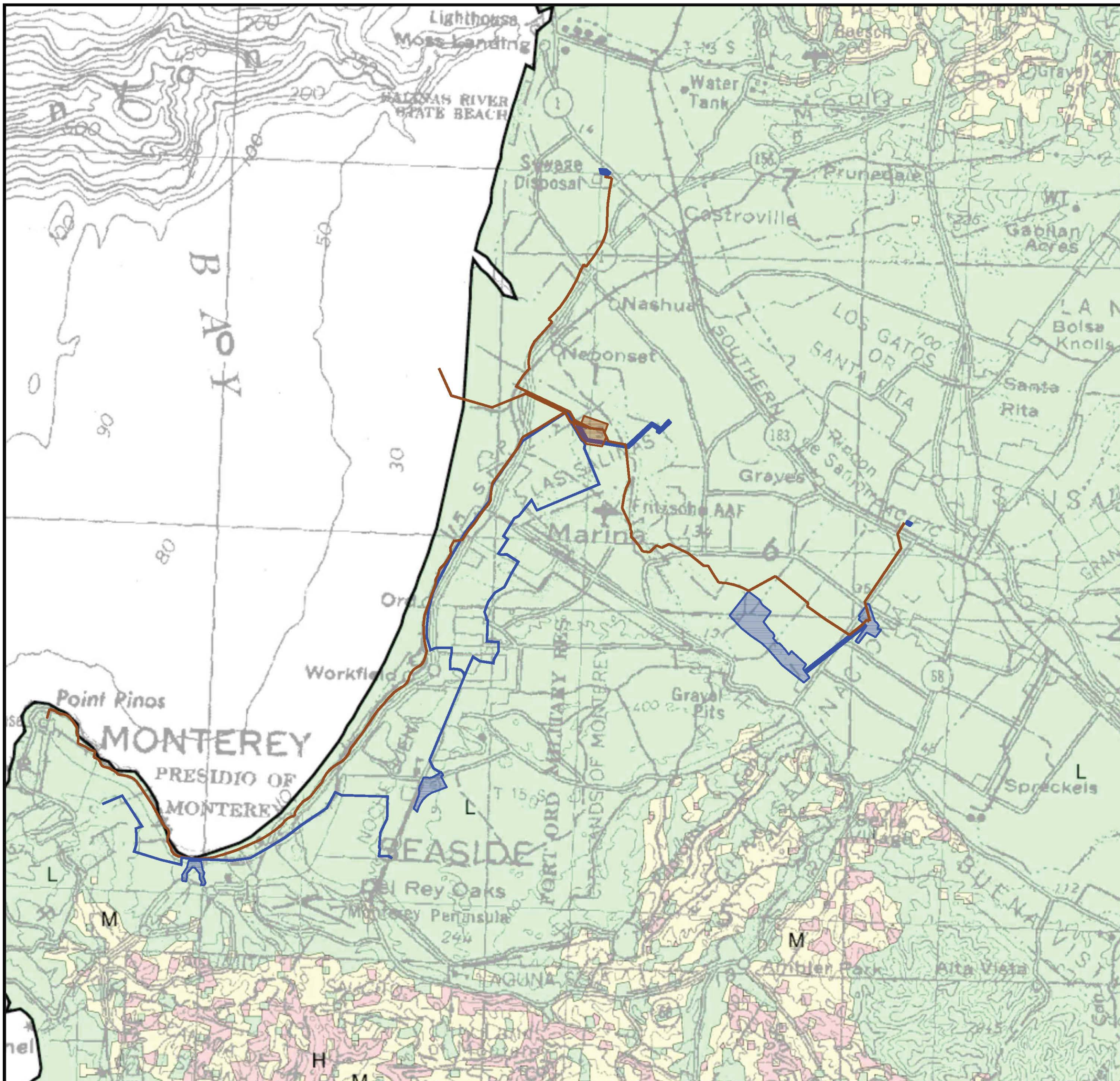
FIGURE
7



REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE EARTHQUAKE-INDUCED LANDSLIDE SUSCEPTIBILITY OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT
- H — Area of high susceptibility to earthquake-induced landsliding
- M — Area of moderate susceptibility to earthquake-induced landsliding
- L — Area of low susceptibility to earthquake-induced landsliding

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LANDSLIDE SEISMIC HAZARDS

FIGURE 8

PROJECT NO.	DATE
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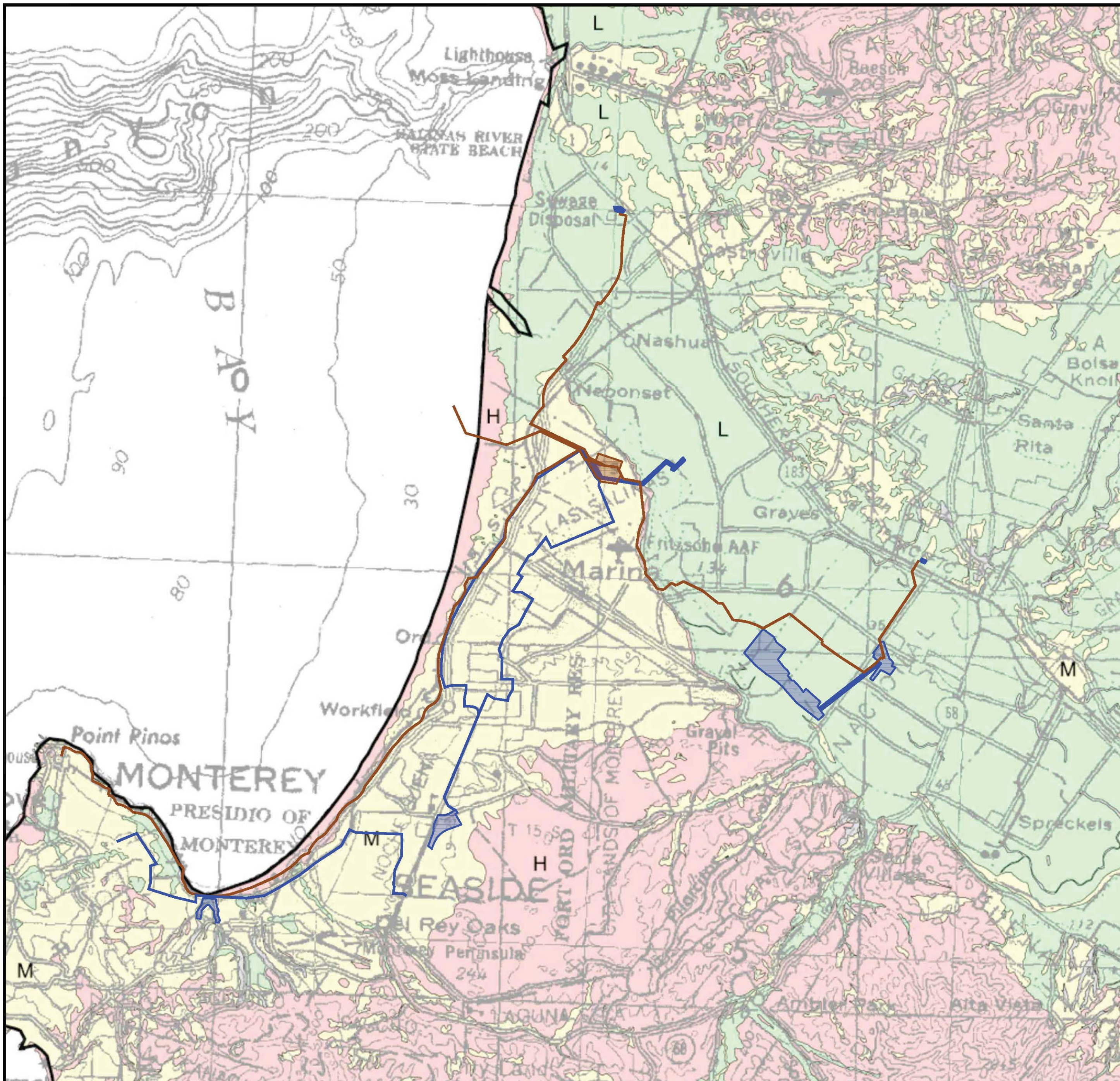
GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

402251001-LSH.dwg, Mar 24, 2015, 10:42am, SN



REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE SOIL EROSION HAZARDS OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

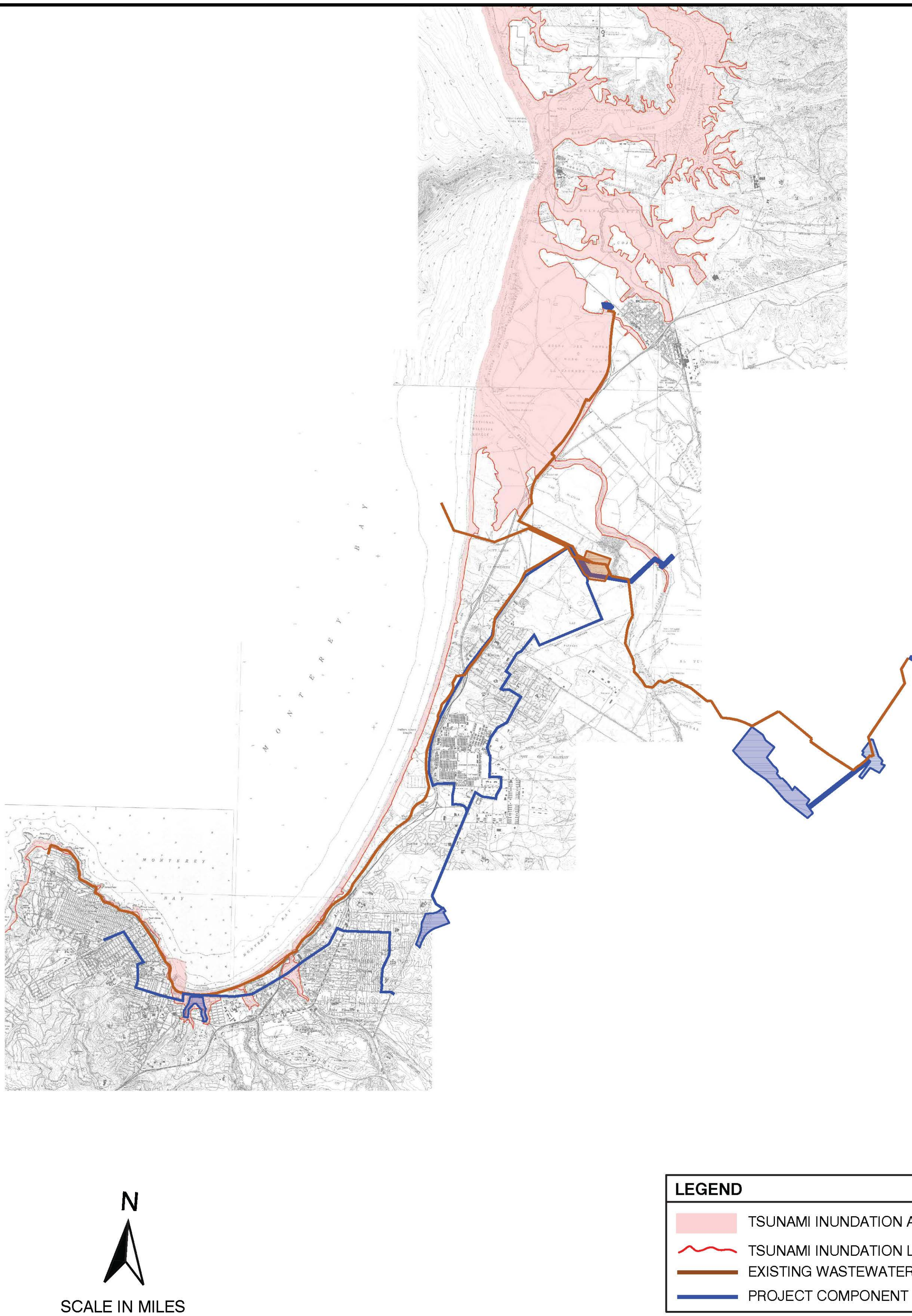
NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT
- H — **Area of high erosion hazard**—Includes areas classified by Cook (1978) as high and very high, high or very high, high to very high, moderate to high, slight to high, very high, and high
- M — **Area of moderate erosion hazard**—Includes areas classified by Cook (1978) as moderate, and slight to moderate
- L — **Area of low erosion hazard**—Includes areas classified by Cook (1978) as minimal, minimal to slight, none, and slight
- V — **Area of variable erosion hazard**—Includes areas classified by Cook (1978) as variable

402251001-SEH.dwg, Mar 24, 2015, 10:45am, SN

Ninyo & Moore	SOIL EROSION HAZARDS	FIGURE
PROJECT NO. 402251001 / DATE 3/15	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	9



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND	
	TSUNAMI INUNDATION AREA
	TSUNAMI INUNDATION LINE
	EXISTING WASTEWATER FACILITIES
	PROJECT COMPONENT

REFERENCE: CALIFORNIA EMERGENCY MANAGEMENT AGENCY, CALIFORNIA GEOLOGICAL SURVEY, UNIVERSITY OF SOUTHERN CALIFORNIA, 2009, TSUNAMI INUNDATION MAP, MOSS LANDING, PRUNEDALE, MARINA, AND SEASIDE QUADRANGLES, SCALE: 1:24000, DATED JULY 1.

TSUNAMI INUNDATION AREAS

Ninyo & Moore		TSUNAMI INUNDATION AREAS	FIGURE
PROJECT NO.	DATE	GROUNDWATER REPLENISHMENT PROJECT EIR MONTEREY COUNTY, CALIFORNIA	10
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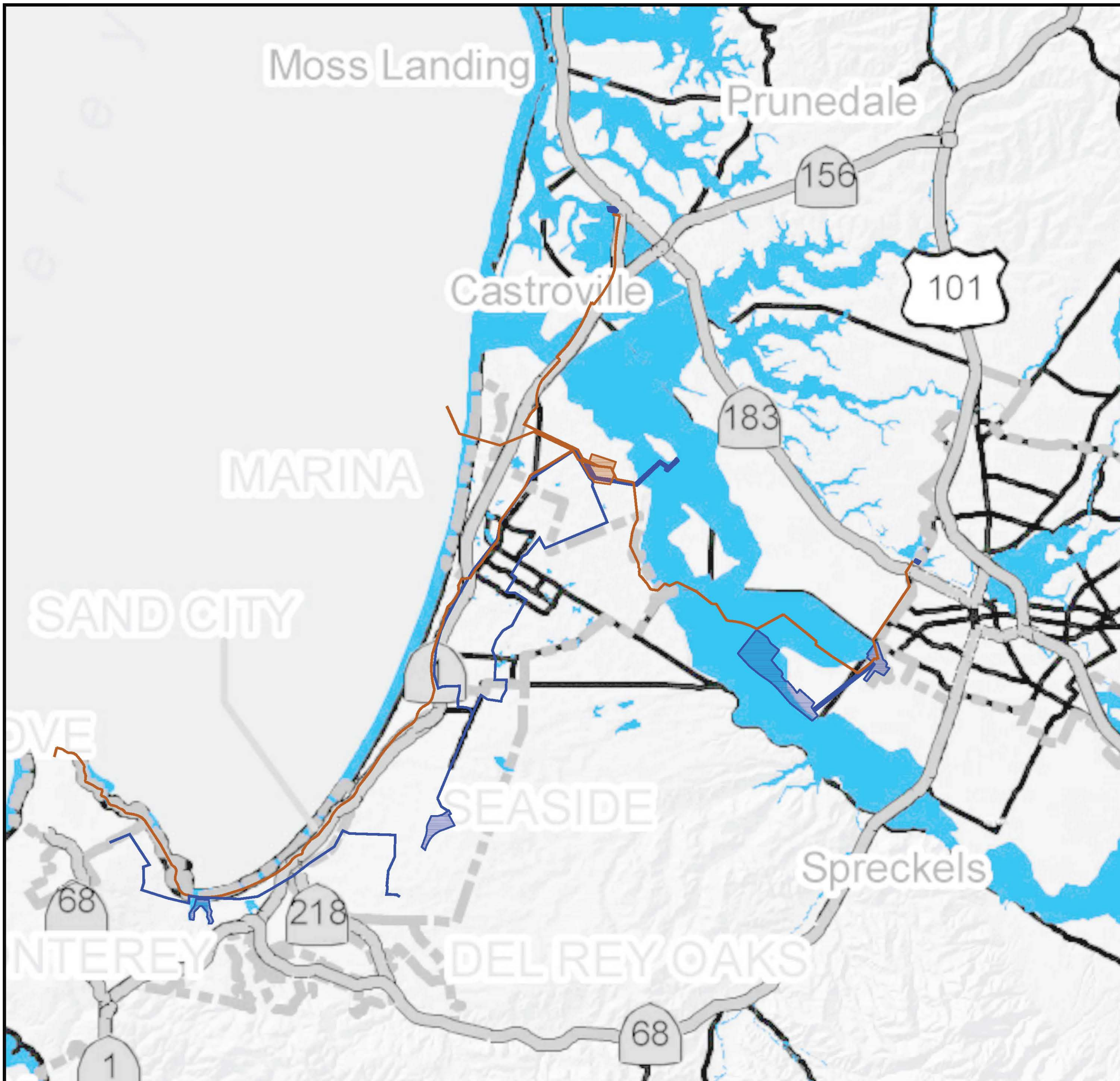

REFERENCE: MCRMA, 2010, MONTEREY COUNTY, FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
100 YEAR FLOOD MAP: DATED JANUARY 22.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

- 100 YEAR FLOOD ZONE
- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT

Ninyo & Moore

100-YEAR FLOOD ZONES

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

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FIGURE **11**

402251001-100 YFZ.dwg, Mar 24, 2015, 10:41am, SN