

4.5. Geology and Soils

This section discusses the geological hazards and effects associated with construction and operation of the proposed Civic Center Wastewater Treatment Facility Project (“the Project”). Geologic hazards include seismic hazards (i.e., surface rupture, ground shaking, liquefaction, and subsidence) and other geologic issues (i.e., unstable soils and slopes, soil erosion) that could expose people or structures to substantial adverse effects, including the risk of loss, injury, or death.

The Project would be constructed in three phases and has four main elements that could result in impacts related to geologic hazards: 1) wastewater treatment facility; 2) pump stations; 3) wastewater collection and recycled water distribution system pipelines; and 4) percolation ponds and groundwater injection wells. For the purposes of this section, “Project area” refers to the area that encompasses the extents of the four main elements described above and the area that would be served by these proposed Project facilities, and “Project site” refers specifically to those areas that would be disturbed by construction activities associated with these four main elements. The Project would include a Local Coastal Program Amendment, and modification of zoning for the wastewater treatment facility to include an Institutional District Overlay.

4.5.1. Environmental Setting

Regulatory Setting

Federal Regulations

There are no federal regulations that are applicable to geologic and seismic hazards.

[Underground Injection Control Program](#)

[The Underground Injection Control \(UIC\) Program regulates groundwater injection operations under Title 40 of the Code of Federal Regulations. The Safe Drinking Water Act \(SDWA\) establishes requirements and provisions for the UIC Program, including Part 144 – Underground Injection Control Program, and Part 148 – Underground Injection Control Program: Criteria and Standards. Under the UIC Program, injection wells are grouped in six classes of injection wells depending on function, construction and operating features. The U.S. Environmental Protection Agency \(USEPA\) regulates these types of wells and associated injection practices to protect public health by preventing injection wells from impacting underground sources of drinking water. Specifically, project proponents must register their injection wells with the UIC Program and obtain a permit from the USEPA or from a designated state program. Federal permit requirements may also be included in state-issued permits, and must be as stringent as federal permit requirements.](#)

State Regulations

Alquist-Priolo Act

Principal state guidance relating to geologic hazards is contained in the Alquist-Priolo Act (Public Resources Code Section 2621 et seq.) and in the Seismic Hazards Mapping Act of 1990 (Public Resources Code Sections 2690–2699.6). The Alquist-Priolo Act prohibits the location of most types

of structures for human occupancy across the active traces of faults in Earthquake Fault Zones, as shown on maps prepared by the state geologist, and regulates construction in corridors along active faults (Earthquake Fault Zones).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 focuses on hazards related to strong ground shaking, liquefaction, and seismically induced landslides. Under its provisions, the state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards. The maps are to be used by cities and counties in preparing their general plans and adopting land use policies to reduce and mitigate potential hazards to public health and safety.

Surface Mining and Reclamation Act

Pursuant to the Surface Mining and Reclamation Act (Public Resources Code Section 2710 et seq.), the State Mining and Geology Board identifies, in adopted regulations, areas of regional significance that are known to contain mineral deposits judged to be important in meeting the future needs of the area (see Public Resources Code Sections 2726 and 2790; Title 14, CCR Section 3550 et seq.). The State Mining and Geology Board also adopts state policies for the reclamation of mined lands and certifies local ordinances for reclamation plans when consistent with state policies (Public Resources Code Sections 2755– 2764 and 2774 et seq.).

Local Regulations

City of Malibu General Plan

The City's General Plan was adopted in 1996 (City of Malibu 1996a) and last revised in January 2014 with the adoption of the Housing Element Update. The General Plan is primarily a policy document that sets goals and policies concerning the community and gives direction to growth and development. In addition, it outlines the programs that were developed to accomplish the goals and policies of the General Plan.

Safety Element

California Code Section 65302(1) requires each local government to prepare and adopt a Safety Element as a component of its general plan. This involves identifying and mapping natural hazards and the administration of zoning and subdivision regulations that account for the safety hazards. The purpose of the Safety Element is to create a cohesive guide consisting of specific policy-oriented implementation measures.

The policies and implementation measures contained in this element provide direction and a course of possible future action for the various City departments. Below is a list of goals, objectives, and policies related to geologic hazards in the City.

Safety (S) Goal 1: A community that is free from all avoidable risks to safety, health, and welfare from natural and man-made hazards.

- **S Policy 1.1.1:** The City shall protect people and property from environmental hazards.
- **S Policy 1.1.7:** The City shall minimize the risks from landslides and debris flows.
- **S Policy 1.2.1:** The City shall require development to provide for analysis of site safety related to potential hazards of fault rupture, earthquake ground shaking, liquefaction, and rockfalls.

- **S Policy 1.2.2:** The City shall require development to provide site safety analysis related to landsliding, debris flows, expansive soils, collapsible soils, erosion/sedimentation, and groundwater effects.
- **S Policy 1.2.3:** The City shall require development to provide for safety from coastal storm flooding, coastal erosion, surfacing septic effluent, and tsunamis.
- **S Policy 1.2.4:** The City shall require development to be consistent with minimum Federal Emergency Management Agency (FEMA) guidelines for floodplain management.

City of Malibu Local Coastal Program (LCP)

The City lies entirely within with the Coastal Zone, as defined by the California Coastal Act. The Coastal Act requires that its goals and policies be implemented by local government through the LCP process. The Malibu LCP is composed of two parts: the Land Use Plan (LUP) and the Local Implementation Plan (LIP); both were certified by the California Coastal Commission on September 13, 2002.

Land Use Plan (LUP)

The policies pertaining to geology and soils identified in the LUP are listed below.

Policy 4.1 The City and the Santa Monica Mountains Coastal Zone contains areas subject to hazards that present substantial risks to life and property. These areas require additional development controls to minimize risks and include, but shall not be limited to, the following:

- **Low Slope Stability and Landslide/Rockfall Potential:** Hillside areas that have the potential to slide, fail, or collapse.
- **Fault Rupture:** Malibu Coast-Santa Monica Fault Zone.
- **Seismic Ground Shaking:** Shaking induced by seismic waves traveling through an area as a result of an earthquake on a regional geologic fault.
- **Liquefaction:** Areas where water-saturated materials (including soil, sediment, and certain types of volcanic deposits) can potentially lose strength and fail during strong ground shaking.
- **Liquefaction/Floodprone Areas:** Areas where saturated sediments lie in floodplains.

Policy 4.2 All new development shall be sized, designed, and sited to minimize risks to life and property from geologic, flood, and fire hazard.

Policy 4.3 Information should be provided to the public concerning hazards and appropriate means of minimizing the harmful effects of natural disasters upon persons and property relative to siting, design, and construction.

Policy 4.4 On ancient landslides, unstable slopes, and other geologic hazard areas, new development shall be permitted only where an adequate factor of safety can be provided, consistent with the applicable provisions of Chapter 9 of the certified Local Implementation Plan.

Policy 4.5 Applications for new development, where applicable, shall include a geologic/soils/geotechnical study that identifies any geologic hazards affecting the Project site and any necessary mitigation measures and contains a statement that the project site is suitable for the proposed development and that the development will be safe from geologic hazard. Such reports shall be signed by a licensed Certified Engineering Geologist or Geotechnical Engineer and subject to review and approval by the City Geologist.

Policy 4.6 The remediation or stabilization of landslides that affect existing structures or that threaten public health or safety may be permitted. Alternative remediation or stabilization techniques shall be analyzed to determine the least environmentally damaging alternative. Maximum feasible mitigation shall be incorporated into the project in order to minimize adverse impacts on resources.

Policy 4.7 Hillside Management Program requirements shall be applicable to proposed development on steep slopes.

Policy 4.12 Land divisions, including lot line adjustments, shall be prohibited unless all proposed parcels can be demonstrated to be safe from flooding, erosion, and geologic hazards and able to provide a safe, legal, all-weather access road(s), which can be constructed consistent with all policies of the LCP.

Local Implementation Plan (LIP)

The implementation measures governing the geology and soils under various sections of LIP are as follows:

- Section 3.10 discusses removal of natural vegetation, including native trees and plants to minimize erosion and sedimentation.
- LIP Chapter 8 is the Grading Chapter, which sets forth requirements to ensure that new development minimizes the visual and resource impacts of grading and landform alteration. Section 8.3, Development Standards, elaborates on various erosion and sediment control measures. Section 8.4 discusses seasonal restrictions on grading. This would be pertinent to the Project as it is adjacent to an Environmentally Sensitive Habitat Area (ESHA) recognized under the LCP.
- LIP Chapter 9, Hazards, provides for development standards, permit and application requirements, and other measures to ensure that permitted development is sited and designed to assure stability and structural integrity and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area. Section 9.2 of the chapter discusses the applicability of the implementation measures. Section 9.3 discusses the requirements and procedures for required findings and analysis that would address geologic hazards of the development. Section 9.4 elaborates on development standards to minimize geologic hazards and soil erosion from the development.

Existing Conditions

The Project area is located in the central portion of the City of Malibu ("City"), in the downtown/Civic Center area, generally east of Malibu Canyon and west of Malibu Creek, including a portion of unincorporated Los Angeles County, north of the City limits. The Project area includes areas where pipelines would be located (see Chapter 2, Project Description, for more information). The Phase 1 Project area is generally flat, but includes some hills that slope downward toward the Pacific Ocean; the Phase 2 and Phase 3 areas include some areas of steeply sloping terrain. The elevations in the central portion of the City generally range from 15 to 45 feet above mean sea level (amsl). Steeper areas north of Civic Center Way have 4 percent to 12 percent grades, and areas south of Civic Center Way generally have a grade of 1 percent or less (USGS 1994; City of Malibu 1996b). The treatment facility site is located on a 4.8-acre parcel on the south side of Civic Center Way.

Regional Geology

The City is located within the Santa Monica Mountains, in the northwestern corner of the Los Angeles basin. It lies at the juncture of two major provinces of Southern California: the Peninsular Ranges geomorphic province, consisting of a northwest-oriented structural grain, and the Transverse Ranges structural province, which features a predominantly east-west-oriented structural grain (City of Malibu 1996b).

The 45-mile-long Santa Monica Mountain range is part of the southernmost portion of the western Transverse Ranges province. It forms an east-west range of low mountains along the Southern California coast from the Oxnard Plain to Los Angeles. The Santa Monica Mountain range is characterized by long, south-draining canyons on its south flank and short, north-draining canyons on its north flank. The long, V-shaped canyons that drain the south flank of the range descend to sea level and are often deeply incised. Malibu Canyon and Winter Canyon are two significant canyons that affect the Project area (City of Malibu 1996b).

Geologic Formations

The Project area is bisected by the east-west-trending Malibu Coast fault (see dotted lines in Figure 4.5-1), which has resulted in two different geologic bedrock structures. Within the Civic Center area, the bedrock units that are exposed at the surface are composed of tertiary marine and nonmarine sandstones, siltstones, and mudstones as well as some intrusive volcanics and volcanic breccias. Sediments of the Monterey Formation are exposed within the southwestern portion of the Civic Center area. The Monterey Formation is a Miocene age marine sequence of silicified siltstone, diatomaceous claystone, and shale with some sandstone (City of Malibu 1996b).

Bedrock formations exposed within the Civic Center area north of the fault include (from oldest to youngest) Sespe, Vaqueros, Topanga, and Conejo, with some intrusive volcanics in the Sespe and Vaqueros formations. The Sespe Formation is a nonmarine sequence of sandstone and mudstone that is Eocene to early Miocene in age and characterized on a regional basis by its red strata. The Vaqueros Formation locally interfingers with the Sespe Formation and consists of a marine sequence of siltstone, claystone, and sandstone. The Vaqueros Formation is early Miocene. The Conejo Volcanics consist of andesitic and basaltic breccia and tuffaceous breccia. The Conejo Volcanics found in the Civic Center area are part of a thick sequence of middle- Miocene volcanic rocks. Volcanic tuff and highly weathered fractured amygdaloidal basalts are found in the western portion of the Project area (City of Malibu 1996b).

Soils

The surficial geology of the Project area is generally dominated by a combination of terrace deposits (Qt), alluvial flood deposits (Qalp), and beach deposits (Qb). According to Yerkes and Campbell (1980), these deposits generally consist of:

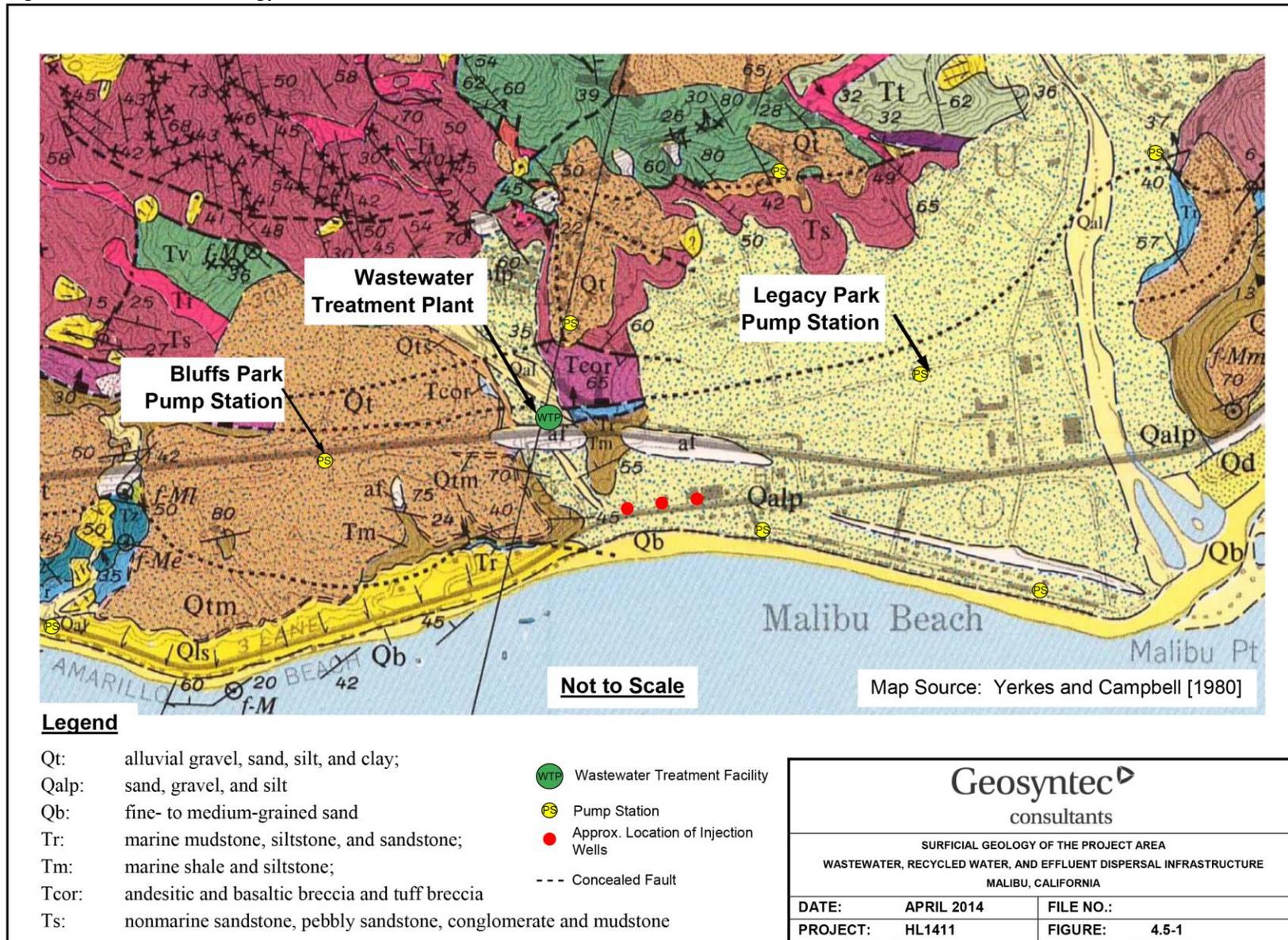
- Qt: alluvial gravel, sand, silt and clay;
- Qalp: sand, gravel and silt; and
- Qb: fine- to medium-grained sand.

Terrace deposits are generally distributed over the westerly portion of the Project site (i.e., the portion including Winter Canyon). Alluvial floodplain deposits generally cover the easterly portion of the Project area (i.e., areas including the Malibu Civic Center and Malibu Legacy Park). Beach

deposits are found along the southerly portion of the Project site (i.e., along Malibu Road, west of Webb Way).

Detailed information on depth to bedrock in the Project area (isolines of depth to bedrock) is presented in RMC (2012). This information is consistent with Yerkes and Campbell (1980), which indicates that surficial deposits within the Project area are approximately 50 to 100 feet thick. As shown in Figure 4.5-1, there are several bedrock outcrops present within the westerly portion of the Project area. The subsurface data, as well as geomorphic expression, indicate that the predominant course of Malibu Creek during the latest Pleistocene and throughout much of Holocene time was where the Civic Center stands today, emptying into the ocean south of where the Malibu Colony Plaza (commercial development southwest of the intersection of Pacific Coast Highway and Webb Way) is located (City of Malibu 1996b). The canyon of Malibu Creek is, for the most part, occupied by mapable active channel (Qalc) and floodplain (Qalp) deposits or undifferentiated alluvium (Qal) and/or terrace deposits (Qt). The depth of these soils is approximately 60 inches, with sandy loam at a depth of 18 to 60 inches (California Department of Conservation 2001).

Figure 4.5-1. Surficial Geology



Wastewater Treatment Facility Site

The wastewater treatment facility site is topographically divided into two terraces by an approximately 10-foot-high slope with an approximate inclination of 3 Horizontal : 1 Vertical. Subsurface soils at the site generally consist of silty sands and silts, though clays and clayey sands are also present. The density of the coarse-grained materials encountered (i.e., silty sands and clayey sands) generally range from “loose” to “very dense.” Consistency of the fine-grained materials encountered (i.e., silts and clays) generally range from “very stiff” to “very hard.” Soil testing conducted at the site indicates that soils at the site may be corrosive (Geosyntec Consultants 2014); therefore, Project facilities have been designed to account for these soils (i.e.g., specifications for special corrosion-resistant concrete mixtures). Depth to groundwater at the wastewater treatment facility site is approximately 30 feet or more.

Legacy Park Pump Station Site

The Phase 1 Legacy Park Pump Station site is relatively flat with subsurface soils consisting of sandy lean clays and clayey sands. Fine-grained soils at this location were found to have a consistency ranging from “stiff” to “very stiff,” while the density of coarse-grained soils (i.e., clayey sands to silty sands) at the site generally range from “loose” to “medium-dense.” Soils at the pump station site were also found to be potentially corrosive; therefore, the Project has been designed to account for these soils and includes measures/mitigations, such as sacrificial anodes and special concrete admixtures.

Bluffs Park Pump Station Site

The Phase 1 Bluffs Park Pump Station site is also relatively flat. Soils at this site were evaluated based on previous geological investigations in the vicinity (Geosystems 1986 and Leighton 2006). Subsurface soils at the site likely consist of a mixture of silty sands and silts with some gravel. Clays and clayey sands may also be present. Soils are likely of alluvial origin, but could contain some unengineered fill. The density of coarse-grained materials generally ranges from “loose” to “very dense”, while fine-grained materials likely range from “very stiff” to “very hard”.

Pipeline Alignment and Injection Well Sites

In general, the proposed pipeline networks for Phases 1, 2 and 3 are either within the City of Malibu or within State of California rights-of-way. Injection well sites are located along Malibu Road adjacent to the Phase 1 pipeline. The ground surface within the rights-of-way are generally covered by asphalt cement (AC) or Portland cement (PC) concrete-paved roadways. Grades within the right-of-way corridors are relative steep in some areas, and generally vary between approximately ½ percent and approximately 10 percent. Parcels along the proposed pipeline alignments generally consist of residential developments (notably along Malibu road), commercial developments (particularly along Cross Creek Road), and undeveloped or park land (Geosyntec Consultants 2014).

Soils along the pipeline alignments are a combination of silty sands, clayey sands, silts and clays. In general, these materials are either predominantly fine-grained or have significant fines contents. The predominantly fine-grained materials in these regions range in consistency from “soft” to “stiff,” while the predominantly coarse-grained materials range in density from “loose” to “very dense.”

Erosion Potential

The soil types located in the Civic Center area all have low to moderate erosion potential. There is greater concern for bedrock areas with moderate to high local relief where flow over extended periods seeks to reach lower adjacent base (elevation) levels. Severe erosion by flowing water is less of a concern for bedrock materials due to their cementation and relatively high density. Compact granular older alluvium would be less likely to undergo significant erosion than the younger near-surface alluvium (modern floodplain and estuary deposits), which is not cemented (City of Malibu 2008).

Seismicity

The City's General Plan Safety Element discusses primary seismic hazard potential in the City from both regional and local faults considered active or potentially active. It considers State of California Alquist-Priolo Special Studies Zone Act (Alquist-Priolo Act) guidelines (Public Resources Code Section 2621 et seq.) that define hazards from surface rupture and seismologic evidence of strong or damaging ground shaking in the immediate area.

Numerous faults could produce strong ground shaking in the Civic Center area. According to the California Division of Mines and Geology, the San Andreas fault, located approximately 82 miles east of the City, could cause a shaking intensity of Modified Mercalli Intensity VI for the area. This intensity is rated as marginally damaging; however, areas of high groundwater and/or alluvial soils, such as the Civic Center area, may experience increased shaking, the duration of which is likely to exceed 60 seconds. A portion of the Malibu Coast fault system is mapped as situated within the Civic Center area but is not considered a major hazard because it has not moved in the last 75,000 years (City of Malibu 1996b, Geosyntec Consultants 2014). No surface rupture is known to have occurred in the Project area within the last 10,000 years (City of Malibu 1996b).

An official Alquist-Priolo map of the Malibu quadrangle places the Project area outside of an Alquist-Priolo Fault Zone (Figure 4.5-2). The nearest fault zone is almost 3 miles west of the Project area (California Department of Conservation 2007). Nevertheless, the Project area is located in an area of high seismicity. According to a geotechnical report prepared for the wastewater treatment facility site, the seismic hazard in the Project area is governed by an event with a moment magnitude of (Mw) 7.04 (Geosyntec Consultants 2014).

Slope Instability, Landslides, and Mudslides

Slope stability is low when slopes contain a weak zone leading to the potential for landslides. Landslides and mudflows are associated with slopes that are unstable. As shown in Figure 4.5-3, the Civic Center area has some soils that are unstable and could result in landslides or liquefaction in the event of an earthquake. Some areas are susceptible to landslides and mudflows, particularly in the northern parts of the Civic Center area. An ancient landslide appears to underlie most of the Allied Nursery and a portion of the Malibu Racquet Club properties, which are both located along Stuart Ranch Road, northwest of the proposed Phase 1 Legacy Park pump station site and east of the proposed wastewater treatment facility site (Figures 4.5-4 and 4.5-5). Other minor areas of gross and surficial slope instability occur primarily on the east-facing slopes due to an easterly dipping bedrock orientation (City of Malibu 1996b). The wastewater treatment facility site and Phase 1 pump station sites appear to be outside zones of potential or historic seismically induced landsliding (Geosyntec Consultants 2014).

Liquefaction

Liquefaction is the sudden and temporary transformation of loose, water-saturated soil to a liquid mass when subjected to stress. Liquefaction-induced ground failure historically has been a major cause of earthquake damage in Southern California. According to a 2001 evaluation of the Malibu quadrangle, potentially liquefiable soils are generally confined to areas covered by Quaternary (less than about 1.5 million years) sedimentary deposits, which in the Malibu quadrangle consist mainly of low-lying shoreline regions, alleviated valleys, floodplains, and canyons.

As shown in Figure 4.5-3, liquefaction is a potential hazard for low-lying areas of the City, including the Civic Center area (California Department of Conservation 2001). Given the presence of sandy layers below portions of the Project area, there is potential for liquefaction during an earthquake (Geosyntec Consultants 2014).

Wastewater Treatment Facility Site

Geotechnical studies have identified potentially liquefiable soils within the treatment facility site; however, based on site inspections, the potential for soil liquefaction-induced lateral spreading at this site is considered low as the potentially liquefiable soil layer is not continuous and liquefiable lenses are relative deep, approximately 10 to 25 feet below the ground surface (Geosyntec Consultants 2014).

Legacy Park Pump Station Site

Although it is within an area identified as having a potential for liquefaction, soil borings at this Phase 1 pump station site suggest that the subsurface soil at this location is not liquefiable (Geosyntec Consultants 2014).

Bluffs Park Pump Station Site

The location of the Phase 1 Bluffs Park Pump Station is not within an area identified as prone to liquefaction (see Figure 4.5-3).

Figure 4.5-2. Alquist-Priolo Fault Zone Map

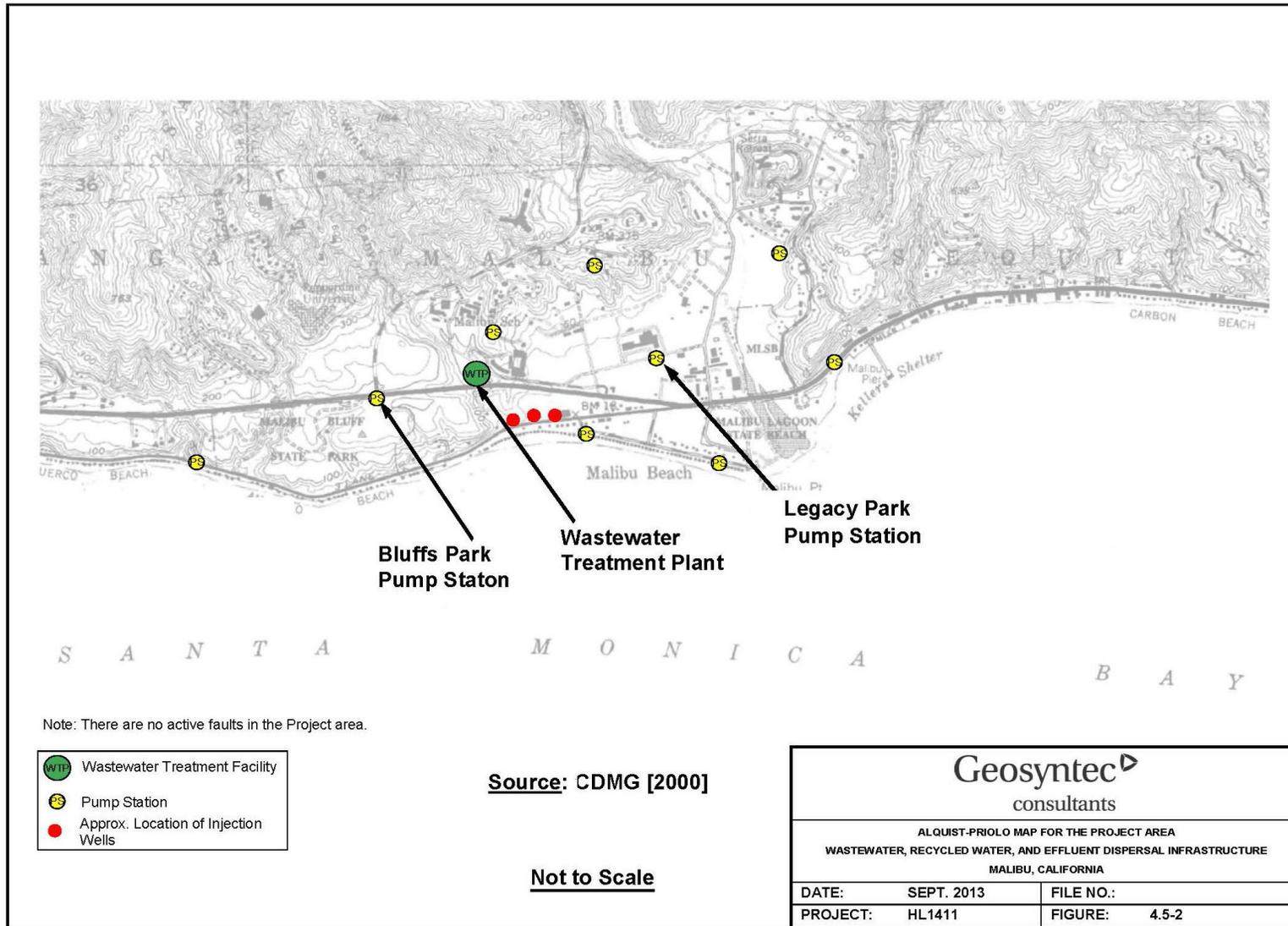


Figure 4.5-3. Liquefaction and Landslide Hazards

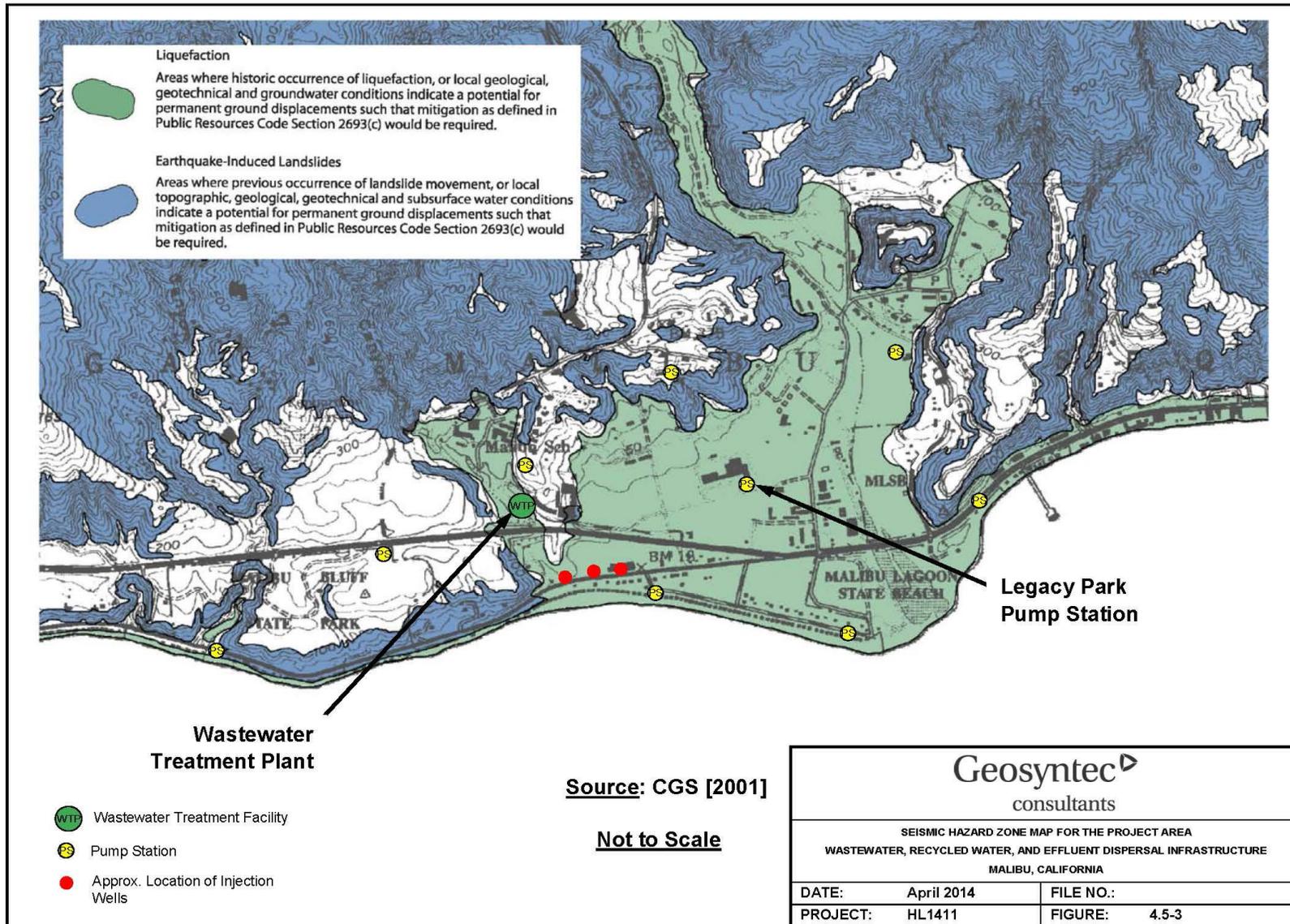


Figure 4.5-4. Geologic Map of the CCWTF Site

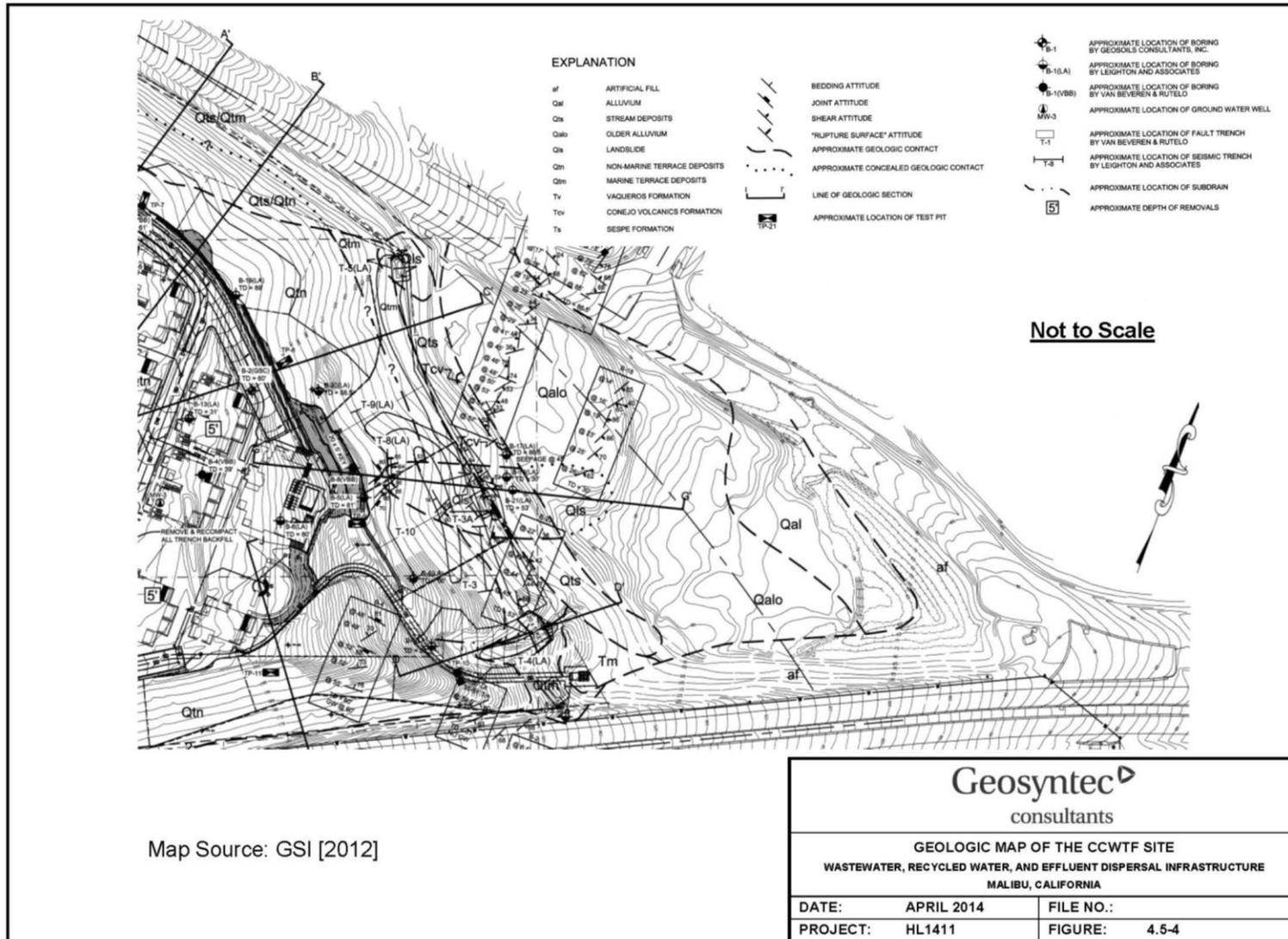
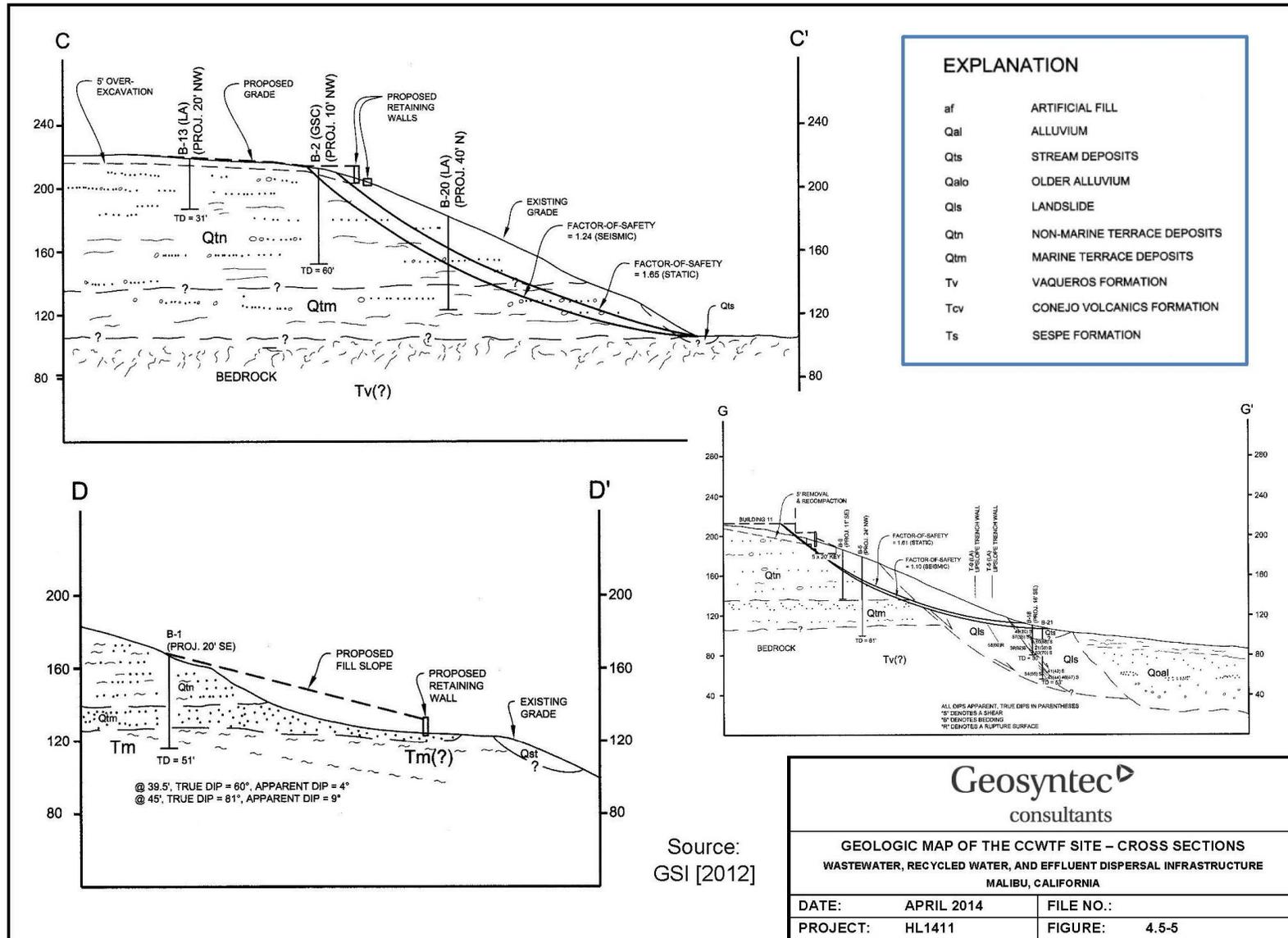


Figure 4.5-5. Geologic Map of the CCWTF Site



Pipeline Alignment and Injection Well Sites

Portions of the pipelines for all three phases would be constructed in areas that have been identified as prone to liquefaction (see Figure 4.5-3). Injection wells would also be located in an area prone to liquefaction.

Consolidation and Settlement

Seismic settlement is related to seismic shaking, usually accompanying a liquefaction event, and affects loose sandy deposits above the water table. Consolidation settlement is related to a stress increase, usually resulting from a foundation or soil load (City of Malibu 1996b). Younger near-surface alluvium (modern floodplain and estuary deposits) located in the Civic Center area has not been consolidated by overburden pressure and could have a moderate to high consolidation potential depending upon the material type. Clay-rich deposits tend toward higher consolidation potential. The City's General Plan Safety Element states that seismically induced settlement is likely to occur in the Civic Center area and cause significant foundation distress to buildings not designed to accommodate this occurrence (City of Malibu 1996a). As noted above in the discussion of liquefaction, the wastewater treatment facility site is in an area identified as having the potential for settlement due to liquefaction, but the likelihood of this occurring is low as the potentially liquefiable soil layer is not continuous and liquefiable lenses are relative deep (Geosyntec Consultants 2014).

Expansiveness

Ground movement beneath a structure's foundation can occur after shrinkage or swelling of expansive soils due to climactic changes, slope instability, or other causes. The bedrock formations in the Civic Center area have a low expansion potential, except for specific clay-rich layers of substantial thickness or surface extent, which may be encountered during grading. As discussed above, some soils in the area consist of shallow younger alluvium as a mix of sand, silt, and clay, with some gravel. Clay-rich materials predominate, which are generally slightly to moderately expansive (plastic), with occasional highly plastic layers (City of Malibu 2008). Expansive soils typically contain a relatively high percentage of clayey material, but their expansion potential is generally related to the type of clay mineral (Geosyntec Consultants 2014). Additionally, clayey materials in this area have been characterized by Leighton (2009) as having low to medium expansion potential.

Wastewater Treatment Facility Site, Injection Well Sites, and Legacy Park and Bluffs Park Pump Station Sites

Neither the wastewater treatment facility site, injection well sites, nor either of the Phase 1 pump station sites has been identified as having predominantly clayey soils in the top 15 feet below ground surface.

Phase 1 Pipelines

Portions of the Phase 1 pipeline alignments along Stuart Ranch Road, Webb Way, and Civic Center Way have predominantly clayey sand to clay in the top 15 feet below ground surface. However, because of the type of clay mineral, these soils only have low to moderate expansion potential (Geosyntec Consultants 2014).

Subsidence

Subsidence can occur as a secondary effect of seismic activity. However, the potential for ground subsidence in the Project area is low due to moderately compacted underlying soils. Additionally, site inspections did not find evidence of collapsible soils within the Project area (Geosyntec Consultants 2014). The potential for subsidence in the Project area is considered low (City of Malibu 2008).

4.5.2. Environmental Impact Analysis

Thresholds of Significance

For the purposes of this EIR and in accordance with Appendix G of the State CEQA Guidelines, the proposed Project would result in a significant impact with respect to geology or soils if it would:

1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:
 - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zone map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42).
 - Strong seismic ground shaking.
 - Seismically related ground failure, including liquefaction.
 - Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.
4. Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risk to life or property.
5. Have soils that are incapable of adequately supporting the use of septic tanks or alternative waste disposal systems where sewers are not available for the disposal of wastewater.

Impacts

Impact GEO-1: Would the Project Expose People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death, Involving Rupture of a Known Earthquake Fault?

There are no earthquake faults delineated on Alquist Priolo Fault Zone maps within the Project area. Because the Project area is not traversed by a known active fault and is not within 200 feet of an active fault trace, surface fault rupture is not considered to be a significant hazard for the Project area (Geosyntec Consultants 2014). In addition, in accordance with International Building Code (2009), none of the proposed Project facilities are considered critical structures; that is, structures whose damage or failure would pose a risk to human life, health and welfare (Geosyntec Consultants 2014).

Induced seismic activity (induced seismicity) is a phenomenon generally associated with injection of liquids at considerable depth below the ground surface (i.e., injection at depths reaching thousands of feet) and at high injection pressures (i.e. pressures in excess of several thousand pounds per square inch). The treated effluent injection wells to be included as part of the Project are relative shallow (up to approximately 150 feet below ground surface) and injection pressures are considered to be very low (approximately 5 psi). Therefore, the possibility of significant induced seismicity due to the proposed injection is considered to be unlikely (Geosyntec Consultants 2014).

The Project therefore would not expose people or structures to the risk of loss, injury or death as a result of surface fault rupture hazards. There would be no impact.

Impact GEO-2: Would the Project Expose People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death, Involving Hazards Due to Ground Shaking?

The Project area is located within a seismically active area of Southern California and may experience severe shaking in the future from the Malibu Coast fault and other nearby faults. Hazards associated with strong ground shaking are potentially significant, but can be mitigated to less than significant, with implementation of mitigation measures GEO-1, ~~and~~ GEO-2, ~~and~~ GEO-3.

Impact GEO-3: Would the Project Expose People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death, Involving Hazards Due to Liquefaction?

Geotechnical studies identified potentially liquefiable soils within the treatment facility site; however, based on site inspections, the potential for soil liquefaction-induced lateral spreading at this site is considered low as the potentially liquefiable soil layer is not continuous and liquefiable lenses are relative deep, approximately 10 to 25 feet below the ground surface. Furthermore, depth to groundwater at the location of the proposed percolation ponds is 30 feet or more, and percolation at this location ~~will~~would not elevate these water levels such that they ~~would~~will increase the potential for liquefaction.

The Phase 1 pump station locations at Legacy Park and Bluffs Park are not characterized as subject to liquefaction. However, the wastewater treatment facility site, possibly Phase 2 and 3 pump stations, and a large portion of proposed pipelines are within areas identified as subject to liquefaction. The possibility for facilities to be affected by liquefaction, resulting in damage to facilities, potentially including ruptured pipelines, would be potentially significant. However, design and construction of the Project would incorporate appropriate engineering practices to ensure seismic stability, as required by the California Building Standards Code. Proper design and construction using standard techniques such as permanent dewatering, ground modification, and reinforced mat or deep-pile foundations would be employed to ensure that facilities would not be damaged by liquefaction. Therefore, Project-related impacts would be less than significant.

In addition to the risk posed by existing conditions, the injection wells have the potential to increase liquefaction potential by increasing groundwater elevations in the injection area. The potential for injection to increase liquefaction was evaluated by Geosyntec Consultants (2014), and it was determined that increases in groundwater levels as a result of injection would have a negligible effect on liquefaction potential. This impact would be less than significant.

Impact GEO-4: Would the Project Expose People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death, Involving Hazards Due to Landslides or Slope Instability?

Construction

Some areas of slope instability have been identified within the Civic Center area. While it is naturally buttressed and the area is likely stable, the Project would require additional measures to confirm stability. In addition, there is the potential for localized sloughing of near-vertical slopes and overhangs, as well as toppling of soil columns during construction, which are potentially significant impacts. Surface runoff, groundwater seepage, and earthquake shaking were also considered to be contributors to the weakening and toppling of temporary slopes and reducing soil shear strength.

In general, the geologic and seismic hazards described above could be reduced by employing sound best management practices (BMPs), such as protecting graded or disturbed areas, including slopes, in accordance with the approved erosion control plan. To minimize hazards to construction workers from unstable temporary slopes and ensure that no significant adverse impacts would occur, mitigation measures GEO-34, GEO-45, and GEO-56 would be implemented by the construction contractor(s). This would reduce impacts to less than significant.

Operation

The majority of the Project area has a low risk of slope instability. Neither the wastewater treatment facility site nor any of the pump stations sites is located in an area with a substantial risk of landslides. Cut and fill slopes within the wastewater treatment facility site would be designed for an inclination of 2 Horizontal:1 Vertical, which would provide a safety factor against slope instability (Geosyntec Consultants 2014). Recycled water irrigation on sloped lands will be applied at agronomic rates in accordance with per Project permit requirements, reducing the potential for slope instability resulting from over-irrigation.

However, portions of Phase 3 pipeline along Malibu Road and in Malibu Canyon are in areas of slope instability, including areas that are potentially subject to earthquake-induced landslides. Potential damage to pipelines due to slope instability would be a significant impact, which can be mitigated to a less-than-significant level with implementation of mitigation measure GEO-67.

Impact GEO-5: Would the Project Result in Substantial Soil Erosion or Loss of Topsoil?

Construction

Much of the disturbance limits for the Project would occur within paved or otherwise previously disturbed areas with little or no vegetation. Pipelines for all phases would be constructed within existing roadways, and construction is not expected to result in loss of topsoil. However, at the wastewater treatment facility and pump station sites, any existing on-site groundcover and vegetation within the Project area disturbed limits would be removed during construction. With the loss of this vegetation, surface soils would be exposed to wind and surface water flow, which raises the potential for erosion. Further, as part of construction at the wastewater treatment facility site, grading and excavation activities would result in the removal of approximately 7,771 cubic yards (cy) of material at full buildout (5,377 cy for Phase 1 and an additional 2,394 cy during Phases 2 and

3). In addition, the Project would import approximately 3,000 cy of material. Grading and excavation would expose soils on the wastewater treatment facility site to wind and water erosion. Moreover, trenching along the roadways to install pipelines for the proposed collection and distribution system would lead to substantial soil exposure. These impacts would be potentially significant depending upon the amount and extent of erosion.

As described in Section 4.7 (Hydrology and Water Quality), any project involving grading of an area greater than 1 acre is required to apply for a NPDES permit from the Los Angeles Regional Water Quality Control Board (LARWQCB). This permit requires the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). A BMP program, as required by LARWQCB, would be prepared and implemented as part of the SWPPP. Since some construction activities would not be restricted to the dry months of the year, erosion control BMPs would be implemented to ensure that sediment is confined to the construction area and not transported off-site. Erosion control is required by the City, County, and LARWQCB through the City's General Plan, LCP and LIP policies, implementation measures, and regulatory permits. Implementation of the City's stormwater pollution-control BMPs; compliance with adopted regulations and policies, including the City's procedural and date regulations (i.e., no grading during the rainy season from November 1st to March 31st); and use of appropriate sloping, shoring, and bracing techniques, as well as covering or stabilizing topsoil stockpiles, would reduce soil erosion impacts to a less-than-significant level. The City's BMP requirements, as detailed in LIP Chapter 17, are briefly described in Section 4.7 under "Regulatory Setting." No mitigation beyond compliance with these measures is required.

Operations

Project operation and maintenance are not expected to result in increased erosion. Upon completion of construction, pipelines would be buried and surfaces repaved/restored to their existing conditions. The wastewater treatment facility and pump station sites would be paved and revegetated and mitigation measures as required by the LCP would be incorporated to minimize any unavoidable impacts, so that ongoing erosion would not occur. Vegetated areas would be maintained and irrigated as needed to ensure that vegetation remains established. Operation is thus not expected to increase erosion, and this impact would be less than significant.

Impact GEO-6: Would the Project Be Located on Expansive Soils Creating Substantial Risk to Life or Property?

According to the geotechnical investigations conducted in the Project area (Geosyntec Consultants 2014), the wastewater treatment facility site, pump station sites, injection well sites and areas where pipelines would be constructed under roadways have only low to moderate potential to contain expansive soils. Recommendations in the geotechnical report are being incorporated into the design of facilities to reduce any expansion potential. This impact would be less than significant.

Impact GEO-7: Would the Project Be Located on Soils that Are Incapable of Supporting Septic Systems

Because the Project would eliminate existing Onsite Wastewater Disposal Systems ([OWDSs](#)) and construct a new public sewer system, this impact is not applicable. There would be no impacts associated with soils that cannot support septic systems.

4.5.3. Mitigation Measures

The following measures would be implemented to ensure that potential impact GEO-2 would be reduced to a less-than-significant level.

MM GEO-1: All Project facilities shall be designed to comply with City and state seismic hazard requirements.

MM GEO-2: The Project shall conform to all applicable provisions and guidelines set forth by the Uniform Building Code, which sets forth regulations concerning proper design for seismic safety.

MM GEO-3: Project operating protocols shall include facility personnel training regarding appropriate response actions following a seismic event. These protocols will include required notification procedures, plant operation modifications, and inspection requirements.

The following measures would be implemented to ensure that potential impact GEO-4 would be reduced to a less-than-significant level.

MM GEO-34: All earthwork and grading shall meet the requirements of State of California building and structural codes and be performed in accordance with the recommendations in the geotechnical investigation conducted for the Project and the Erosion Control Plan required as part of the LARWQCB NPDES permit.

MM GEO-45: The Project shall comply with guidelines in the City's General Plan, LUP, and LIP Chapter 17, such as those related to fill buttressing, the use of retaining walls, drainage control, and the provision of debris basins and setbacks where appropriate.

MM GEO-56: Site preparation and earthwork shall be done in accordance with recommendations in geotechnical reports for the Project including recommendations from Geosytec (2014). This would include performing earthwork in accordance with Section 300 of the most recent approved edition of the *Standard Specifications for Public Works Construction and Regional Supplemental Amendments*.

MM GEO-67: Geotechnical investigations shall be conducted to develop slope stabilization criteria for any pipelines that would be constructed in areas that are prone to landslides. In addition, steep slopes shall be evaluated to determine whether detailed geotechnical investigations should be performed. The geotechnical reports shall be submitted to the City for review and approval of the slope stabilization measures as well as the collection and distribution system pipeline installations included in the Project design. Slope stabilization measures may include soil improvements, buttressing of the slopes, or compaction of trench backfill. In addition, erosion control measures, such as water bars, trench dams, and revegetation, shall be identified in the Project's Erosion Control, Landscaping, and Revegetation Plan.

4.5.4. Unavoidable Significant Adverse Impacts

There would be no significant unavoidable adverse impacts in the area of geology and soils.

4.5.5. Cumulative Impacts

The geographic scope of potential cumulative impacts related to geology and soils encompasses the Project site and immediate vicinity. Cumulative projects in the general vicinity include a variety of residential, commercial, and public facilities projects. Although many of the cumulative projects could have geologic impacts similar to the proposed Project, geologic and soils impacts are generally site-specific and depend on local geologic and soil conditions. Although the Project could result in potentially significant impacts related to slope instability and seismically-induced groundshaking, these impacts would be less than significant with implementation of mitigation measures GEO-1 through GEO-67. None of the cumulative projects (Table 3-1.3) have the potential to increase liquefaction potential by increasing groundwater elevations, and none would contribute to other cumulative geologic, soils, or seismic impacts in connection with implementation of the Project.