4.5 GEOLOGIC PROCESSES

The following analysis of geologic impacts is based on the following project-specific studies, as well as the Tajiguas Landfill Environmental Documents:

- Soils Engineering Report and Engineering Geology Investigation, Tajiguas Resource Recovery Project (GeoSolutions, Inc., October 2013) (see Appendix G).
- Slope Stability Evaluation, Tajiguas Resource Recovery Project Compost Management Unit (Geo-Logic Associates, September 2013) (see Appendix H).
- Response to Design Modifications – Revised Building Locations and Grading Design (GeoSolutions, Inc., October 7, 2015) (see Appendix G).

4.5.1 Setting

4.5.1.1 Regional Geology

The Tajiguas Landfill is located on the south flank of the Santa Ynez Mountains, a component of the Transverse Range Geomorphic Province. This geomorphic province is characterized by generally east-west trending mountain ranges and intervening valleys. Older uplifted bedrock is exposed in the mountains, while the valleys are filled with sedimentary rocks and alluvial deposits. The Transverse Ranges are bordered by the Santa Monica fault to the south and the Santa Ynez fault to the north.

The Santa Ynez Mountains extend from Gaviota Canyon eastward to the Matilija Gorge in Ventura County. The range is composed of a single main crest that is continuous for approximately 50 miles. The northern flank of the Santa Ynez Range is a steep escarpment created by uplift along the Santa Ynez fault. The southern flank, where the Tajiguas Landfill site is located is characterized by south-plunging ridges that separate incised drainage canyons. These canyons generally include a perennial stream bounded by steep east- and west-facing slopes. The indurated sandstone units typically form prominent, more resistant outcrops and generally support dense chaparral vegetation. The poorly indurated and finer-grained units typically form more gently-sloping, grass-covered hills (Geosyntec, 2008).

4.5.1.2 Local Geology

Bedrock units underlying the landfill site include the Rincon Shale (Tr), Vaqueros Sandstone (Tvq), and Sespe Formation (Tsp) (see Figure 4.5-1). Rincon Shale and Vaqueros Sandstone underlie the operations deck area, which is overlain by artificial fill, municipal solid waste, and landslide deposits. The proposed composting area site (also identified as the top deck) is underlain by MSW and the composting area runoff collection tank site is underlain by the Sespe Formation. Vaqueros Sandstone underlies the proposed water tank site (well water and recycled water storage).

4.5.1.3 Surficial Units

Artificial fill was encountered during soil borings at the operations deck at various depths. The operations deck was constructed to its current elevation in 2007. The artificial fill encountered during the field investigation of the operations deck consisted of reddish brown to light brown sandy clay with gravel to light brown clayey sand with gravel encountered in a slightly moist and medium dense to dense condition. Methane gas was detected in surface monitors during drilling operations.

MSW with a final cover system extends within the eastern one-third of the existing operations deck and MSW with an intermediate soil cover completely underlies the proposed composting area site. The depth of refuse at the operations deck was observed to be 80-95 feet thick. The proposed composting area site is currently within an active area of landfilling and up to an additional 80 feet of MSW would be placed prior to the establishment of the compost area.

4.5.1.4 Formational Units

As discussed above, formational units underlying the Tajiguas Resource Recovery Project facilities include Rincon Shale, Vaqueros Sandstone and Sespe Formation. These units are briefly discussed below. A comprehensive discussion of formational units underlying the entire landfill property is included in the Tajiguas Landfill Environmental Documents.

Rincon Shale

The early Miocene age (11-1.8 million years old) Rincon Shale unit is composed of poorly bedded gray clay shale or claystone (Dibblee, 1988). Rincon Shale was observed in cut slopes throughout the operations deck including the west borrow area to the west. The Rincon Shale at the landfill site was observed as light gray shale and claystone in a dry to slightly moist condition. The observed Rincon Shale is massive, fresh to slightly weathered (severely weathered at the surface), and moderately soft to moderately hard. Based on rock coring at the site, the Rincon Shale is fair to good rock quality, with layers of poor, very poor, and excellent quality.

Vaqueros Sandstone

The early Miocene age Vaqueros Formation south of Santa Ynez fault is composed of light gray calcareous sandstone (Dibblee, 1988). The Vaqueros Sandstone at the landfill site is light brown sandstone in a dry and hard condition.

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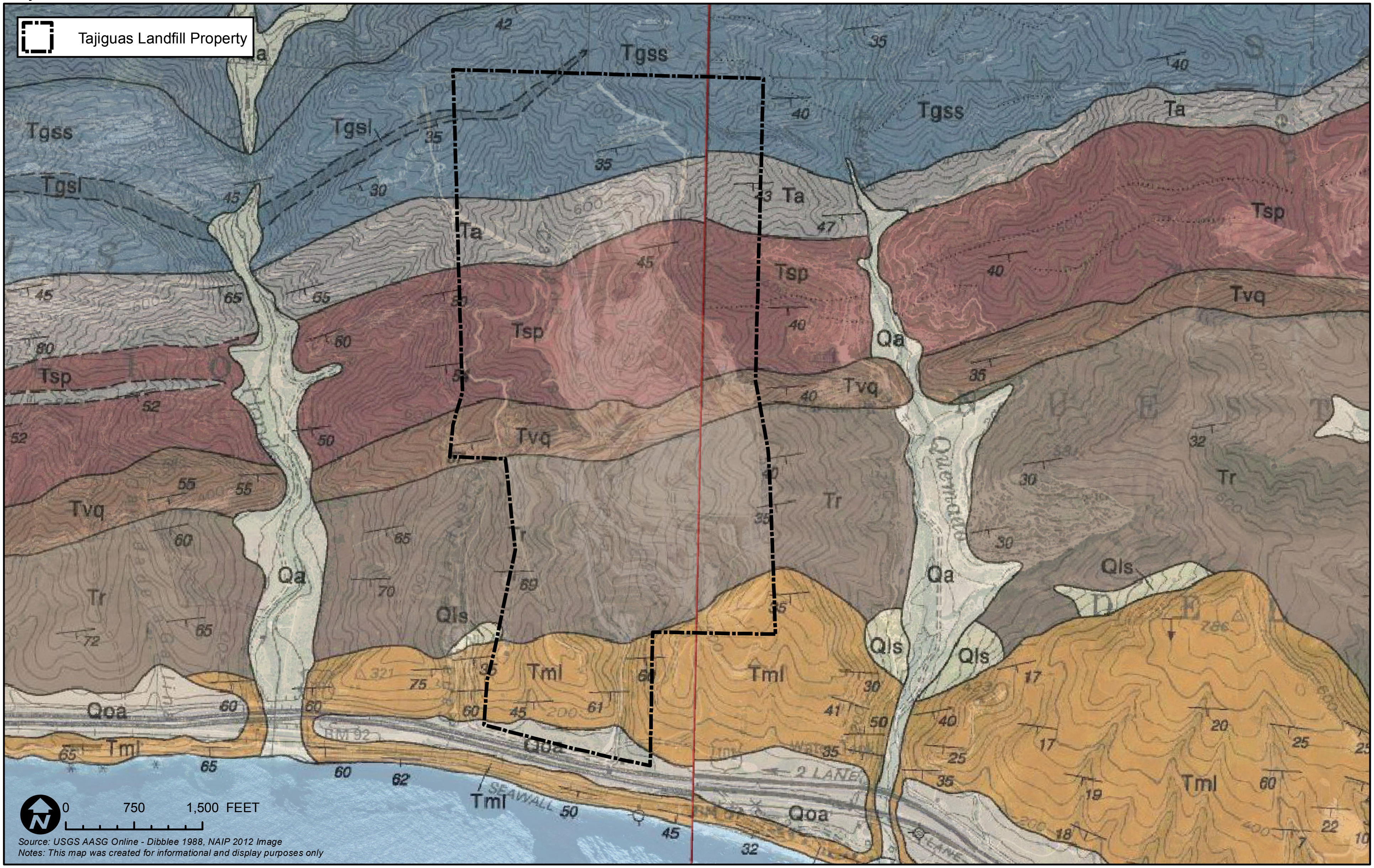

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Tajiguas Resource Recovery Project

REGIONAL GEOLOGICAL MAP
FIGURE 4.5-1

Back of Figure 4.5-1

Sespe Formation

The Oligocene age (33.7-23.8 million years old) Sespe Formation is composed of gray to tan sandstone and green to red siltstone and claystone (Dibblee, 1988). The Sespe Formation at the landfill site was observed as tan to red to green thinly to thickly bedded siltstone and claystone in a dry and hard condition.

4.5.1.5 Surface and Groundwater Conditions

Surface drainage at the proposed location of the MRF and ADF buildings would flow toward the operations deck then into the proposed storm drain system. Surface drainage in the vicinity of the proposed composting area would sheet flow into the proposed storm drain system. The composting area would be surrounded by berms and a perimeter drainage and surface runoff (up to the 25-year, 24-hour storm) from within the bermed area would be directed to the composting area runoff collection tank. Surface drainage in the vicinity of the water tank pads (east and west) would sheet flow off the pad to the west. No springs or seeps were observed at any of the proposed facility sites. No evidence of shallow groundwater was observed within the borings at any of the proposed facility sites.

4.5.1.6 Landslides

The Rincon Shale is generally a weaker unit and prone to landslides when saturated; therefore, within the Rincon Shale units there is a moderate potential for landslides. Due to the character of the Vaqueros Sandstone and Sespe Formation, there is a low potential for landslides within these units. Dibblee (1988) did not identify any landslides at the landfill property. During site mapping and identified in previous reports (Geo-Logic, 2008), two surficial landslides were observed within the cut slope at the west borrow area. The northern landslide appears to be a shallow rotational instability within the Rincon shale, while the southern landslide appears to be a shallow mud-flow type of instability. The upper portion of the southern landslide was removed during the most recent modification to the west borrow area. The southern landslide would not affect the proposed facilities. The northern landslide would be partially removed as part of the modified cut slope configuration to provide space for the MRF/AD Facility.

4.5.1.7 Regional Faulting and Seismicity

Similar to the surrounding areas, the landfill site may be affected by moderate to major earthquakes centered on one of the known large, active faults. These faults include the Santa Ynez Fault located approximately 15.5 miles from the site, the Los Alamos Fault located 16 miles from the site, and the San Andreas Fault located 52 miles from the site. The closest known Holocene age fault is the Santa Ynez Fault; however, the San Andreas Fault is the most likely active fault to produce ground shaking at the site.

The deterministic seismic hazard evaluation performed for the landfill site indicates the seismic risk is generally controlled by the nearby Pitas Point (Lower, west) fault, an offshore low-angle reverse thrust fault that dips beneath the site at an angle of about 13 degrees to the northeast. The maximum probable earthquake magnitude along this fault is 6.1, and the peak ground acceleration associated with this fault is 0.42 g at a distance of 14.3 miles (Geo-Logic, 2013).

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 requires that the California State Geologist establish Earthquake Fault Zones around the surface traces of active faults and to issue appropriate maps. The landfill site is not located within an Earthquake Fault Zone (Jennings, 2010).

4.5.1.8 Tsunami/Seiches

Tsunamis and seiches are two types of water waves that are generated by earthquake events. Tsunamis are broad-wavelength ocean waves and seiches are standing waves within confined bodies of water, typically reservoirs. The landfill site is not located within a tsunami inundation hazard zone as designated by the California Emergency Management Agency. Seiches are not anticipated to occur within the northern sedimentation basin located upslope of the current operations deck, since it is too small and drained regularly using a skimmer system.

4.5.1.9 Settlement

Seismically-induced settlement occurs in loose to medium dense unconsolidated soil above groundwater. These soils compress (settle) when subject to seismic shaking. The settlement can be exacerbated by increased loading, such as from the construction of buildings. Based on the presence of clay in the fill and formational units, there is a low potential for seismically-induced settlement at the landfill site.

Buried MSW is known to undergo settlement and may affect structures constructed in disposal areas. Settlement of MSW is attributed to physical and mechanical processes, chemical processes, dissolution processes, and biological decomposition. In addition, studies show that primary (or short term) and secondary (long-term) settlement occurs. Primary settlement usually occurs within the first four months of placement, and secondary settlement occurs under constant load after completion of primary settlement (Sharma and De, 2007). Settlement of MSW has been observed just east of the operations deck.

4.5.1.10 Liquefaction Potential

In the context of soil mechanics, liquefaction is the process that occurs when the dynamic loading of a soil mass causes the shear strength of the soil mass to rapidly decrease. Liquefaction can occur in saturated cohesion-less soils. The most typical liquefaction-induced failures include consolidation of liquefied soils, surface sand boils, lateral spreading of the ground surface, bearing capacity failures of structural foundations, flotation of buried structures, and differential settlement of above-ground structures.

The presence of loose, poorly graded, fine sand material that is saturated by groundwater within an area that is known to be subjected to high intensity earthquakes and long-duration ground motion are the key factors that indicate potentially liquefiable areas and conditions that lead to liquefaction. Based on the consistency and relative density of the in-situ soils (clay/rock) and the depth to groundwater, the potential for seismic liquefaction of soils at the site is very low.

4.5.1.11 Expansive Soils

Expansive soils are primarily clay-rich soils subject to changes in volume with changes in moisture content. The resultant shrinking and swelling of soils can influence fixed structures, utilities and roadways. In addition, as expansive soils on sloping ground expands and contracts, it tends to move downslope in response to gravity. Soil from the Rincon Formation present at the project site was classified as having a medium expansion index based on laboratory testing (GeoSolutions, 2013).

4.5.2 Impact Analysis and Mitigation Measures

4.5.2.1 Thresholds of Significance

The assessment of geologic impacts is based on guidance and thresholds from the State CEQA Guidelines (Appendix G, Initial Study Checklist), the County's Environmental Thresholds and Guidelines Manual (Geologic Constraints Guidelines) and California Code of Regulations (CCR) Title 27 standards.

Appendix G of the State CEQA Guidelines. A potential geologic impact would occur if the project would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault, strong seismic ground-shaking, seismic-related ground failure, including liquefaction and landslides.
- Result in substantial soil erosion or the loss of topsoil.
- 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 on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (2010), creating substantial risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

Santa Barbara County Environmental Thresholds and Guidelines Manual. Geologic impacts have the potential to be significant if the project involves any of the following characteristics:

- Project sites or part of the project located on land having substantial geologic constraints, such as active or potentially active faults, underlain by rock types associated with compressible/collapsible soils, or susceptible to landslides or severe erosion.
- The project results in potentially hazardous geologic conditions such as construction of cut slopes exceeding a grade of 1.5H:1V.
- The project proposes construction of a cut slope over 15 feet in height as measured from the lowest finished grade.
- The project is located on slopes exceeding 20 percent grade.

California Code of Regulations - Title 27 and California Department of Water Resources Slope Stability Criteria.

- Permanent cut slopes and waste fill slopes must be constructed to provide a minimum Factor of Safety of 1.5;
- The maximum seismic displacement caused by the maximum credible earthquake must not exceed 36 inches for permanent cut slopes;
- The maximum seismic displacement caused by the maximum credible earthquake must not exceed 12 inches for permanent waste fill slopes;

4.5.2.2 Approved Tajiguas Landfill Expansion Project

The following is a summary of the geologic impacts identified in 01-EIR-05 for the approved Tajiguas Landfill Expansion Project (see Section 3.2.3).

1. Earthquake faults mapped within the landfill footprint were evaluated to be inactive and not a constraint to landfill development. Impacts to landfill environmental control systems, structures and access roads from potential fault rupture were identified as less than significant (Class III).
2. Earth materials underlying the landfill expansion were identified as primarily Tertiary sedimentary rock, which are not typically susceptible to liquefaction. Potential liquefaction impacts were considered to be less than significant (Class III).

3. Shallow landslides have been reported on natural slopes adjacent to the landfill, and may adversely affect landfill operations. It was expected that grading plans and drainage improvements would minimize the potential for landslides by limiting the size of exposed areas, diversion of storm water away from landslides and geologic monitoring. Potential landslide impacts were identified as less than significant (Class III).

4. Portions of cut slopes within moderately to extremely weathered materials could become unstable if inclined steeper than 2:1. Potential landslide impacts were considered significant but mitigable (Class II). Mitigation measure GEO-1 was provided to limit the gradient of cut slopes to 2:1 and/or orienting cut slopes to avoid adverse bedding planes.

5. Vertical expansion may result in slopes with gradients of up to 2.5:1. Based on the results of a slope stability analysis included in 01-EIR-05, the engineered buttress fill along the west refuse toe was determined to provide adequate stability under static and seismic conditions. Potential landslide impacts were identified as less than significant (Class III).

6. Collapsible soils were not observed at the site, and were not expected to impact the project. Expansive soil formed by weathering of Rincon mudstones occurs at the landfill site. If used for engineered fills the expansive soils had the potential to result in damage to structures or roads built over them. Potential damage to structures or roads resulting from construction on expansive soil were considered significant but mitigable impact (Class II). Mitigation measure GEO-2 was provided to require excavation of expansive soil prior to waste placement and implementation of geotechnical engineering practices if expansive soils are used as fill under sensitive structures or pavements.

7. Severe erosion of on-site soils was identified as a potentially adverse but less than significant impact (Class III) with the continued implementation of best management practices (soil berms, soil compaction, drainage systems, benching, revegetation, straw bales and wattles, etc.).

8. With proper engineering design and monitoring, excessive differential settlement of waste material, soil cover, or landfill foundation material was not expected. Potential impacts due to differential settlement were considered less than significant (Class III).

4.5.2.3 Approved Tajiguas Landfill Reconfiguration and Barton Ranch Restoration Project

Landfill reconfiguration would create different waste fill slopes and cut slopes as compared to the approved expansion and would eliminate the proposed engineered buttress. The slope stability analysis indicated the reconfigured slopes would have adequate static and seismic stability to meet CCR Title 27 requirements. Therefore, impacts associated with the stability of the new waste slopes and cut slopes would be less than significant (Class III).

4.5.2.4 Proposed Tajiguas Resource Recovery Project

Impact TRRP G-1: Earthwork associated with project construction and application of reclaimed water on graded slopes may result in unstable slopes that may generate landslides – Class II Impact.

A numerical slope stability analysis was conducted by GeoSolutions on the following slopes:

- Cut slope west of the proposed MRF/AD Facility site: 2.5:1 (horizontal:vertical), 40 feet in height, 15 foot wide bench, then extending up another 8 to 20 feet where it would daylight with the existing 3:1 cut slope (cross-sections 1-1' and 2-2');
- Fill slope south of the proposed MRF/AD Facility site: 2:1, existing 85 feet in height, benched every 40 feet, with the addition of 10 to 14 feet of fill proposed at 3:1 at the top of the slope (cross-section 3-3'); and
- Fill slope west of the proposed maintenance building site: 2:1, existing 250 feet in height, benched every 40 feet (145 feet of fill) (cross-section 4-4').

The numerical slope stability analysis was performed utilizing SLOPE/W, a software program that uses limit equilibrium theory to compute the factor of safety of earth slopes. The results of laboratory testing on representative samples of soil and rock material from the slope areas were used in the analysis. The engineering standard for permanent slopes is a factor of safety of 1.5 for static conditions, and 1.1 for pseudo-static (seismic) conditions. The location of the four slope cross-sections included in the analysis are provided in Figure 4.5-2.

The location of the proposed MRF/AD Facility site was moved approximately 20 feet towards the west as part of design refinements, such that the cut slope would be steepened from 2.5:1 to 2:1. The slope stability analysis was updated by Earth Systems Southern California (2014) to reflect this steeper slope (see Table 4.5-1).

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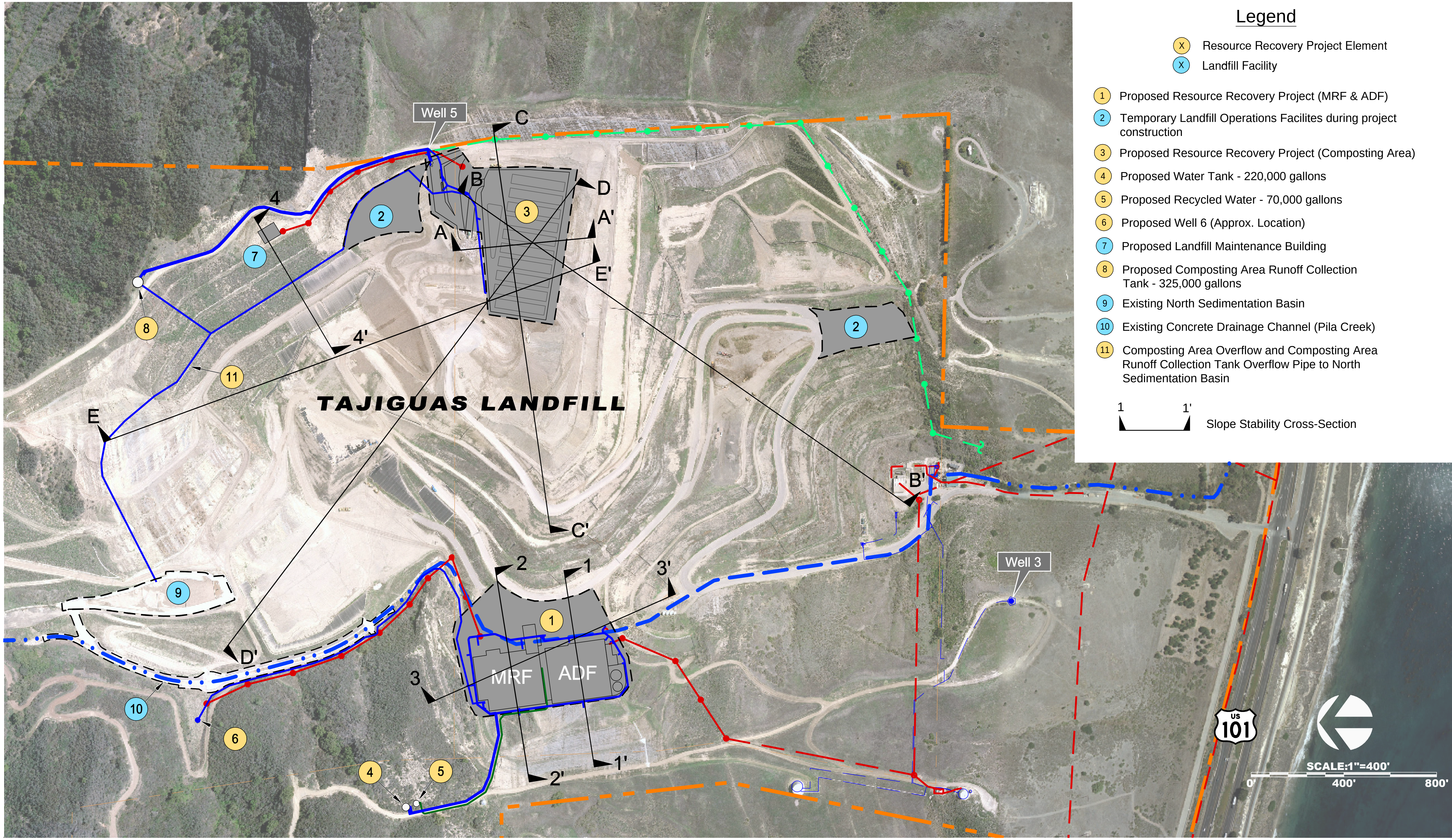

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SLOPE CROSS-SECTION LOCATION MAP
UPDATED FIGURE 4.5-2

Back of Figure 4.5-2

Table 4.5-1 provides the results of the slope stability analysis and indicates the minimum safety standards are met for both static and pseudo-static conditions. However, slope erosion by storm flows may substantially affect slope stability over time. Impacts to the proposed MRF, AD Facility and maintenance building associated with landslides and seismically-induced slope failures are considered potentially significant.

Table 4.5-1. Results of the Cut/Fill Slope Stability Analysis

Slope Cross-Section	Static Factor of Safety	Pseudo-Static Factor of Safety
Cross-section 1-1': Cut Slope, west of operations deck	1.52 ~~1.62~~	1.11
Cross-section 2-2': Cut Slope, west of operations deck	1.72	1.15
Cross-section 3-3': Fill Slope, south of operations deck	1.59	1.12
Cross-section 4-4': Fill Slope, west of maintenance building pad	2.02	1.41

Mitigation Measures:

MM TRRP G-1: Slope Stability Control. The following measures shall be implemented to facilitate stability of cut slopes:

- Excess free water shall not be allowed to pond on the slopes. Surface grades shall be maintained such that collected water is diverted and discharged away from the slope face.
- Concentrated over-slope drainage is to be strictly prevented. All water above the slope shall be maintained in secure pipelines or other approved erosion resistant structures.
- An engineer or engineering geologist shall observe the slope at the time construction is performed to verify subsurface conditions.
- Vegetation shall be established and maintained on cut and fill slopes.

Plan Requirements and Timing. The above drainage control measures shall be reflected in the construction plans and contract specifications for construction of the Resource Recovery Project. Grading and Drainage Plans shall be reviewed and approved by RRWMD and Planning & Development, Building and Safety.

Monitoring: During the excavation phase of the construction an approved engineer or engineering geologist shall be on-site to monitor conditions. A RRWMD approved construction manager shall monitor construction activities to ensure compliance with the plan and specifications. Drainage control devices shall be inspected for function and maintained as necessary.

Residual Impacts. Implementation of this mitigation measure would reduce geologic processes Impact TRRP G-1 associated with implementation of the proposed project to a level of less than significant.

Impact TRRP G-2: Placement of the compost area on the landfill top deck would not significantly compromise the stability of waste fill slopes – Class III Impact.

Two dimensional slope stability analyses were performed for five cross-sections (A-A' through E-E') using the computer program SLOPE/W. The location of these cross-sections is provided in Figure 4.5-2. Cross-section A-A' was located in a north-south direction across the proposed composting area footprint to evaluate the local stability of the compost windrows above the proposed linear low density polyethylene (LLDPE) membrane. The interface between the LLDPE membrane and the overlying and underlying non-woven geotextiles was assumed to be the critical interface for potential slope movement.

Cross sections B-B', C-C', D-D' and E-E' were located to evaluate the overall (gross) stability of the waste fill slopes in the post-closure configuration in three directions with the maximum height of the compost windrows in place. The minimum static factor of safety for the cross sections analyzed with the proposed compost in place is 1.55 (see Table 4.5-2). This result exceeds the engineering standard of 1.5 provided by the CCR Title 27. Therefore, the waste fill slopes are considered adequately stable under static conditions, and impacts would be less than significant.

In addition, seismic-induced permanent displacement of the waste fill slopes due to the maximum probable earthquake was estimated using procedures described by Bray et al., (1998), and Bray and Rathje (1998). The procedure is based on the premise that the sliding block will undergo displacement only during the periods when the maximum ground acceleration (k_{max}) exceeds the yield acceleration (k_y) for the sliding block, (i.e., displacements occur when k_{max} is greater than k_y). Therefore, slopes with a ratio of k_y/k_{max} greater than 1.0 are considered stable. This ratio is greater than 1.0 for all slopes analyzed (see Table 4.5-2). Therefore, the waste fill slopes are considered adequately stable under seismically-induced conditions, and impacts would be less than significant.

Table 4.5-2. Results of the Waste Fill Slope Stability Analysis

Cross-section	Stability Concern	Static Factor of Safety	k_y/k_{max}
A-A' (north side)	Failure of compost	2.50	1.38
A-A' (south side)	Failure of compost	2.92	1.17
B-B'	Failure of waste fill slopes	1.55	1.03
C-C'	Failure of waste fill slopes	2.50	3.17
D-D'	Failure of waste fill slopes	3.68	2.51
E-E'	Failure of waste fill slopes	2.96	1.85

Impact TRRP G-3: Grading and irrigation of the manufactured slope west of the proposed MRF/AD Facility site would not result in severe erosion and would not significantly affect the stability of the existing mapped landslides – Class III Impact.

Treated domestic wastewater stored in the proposed 70,000 gallon recycled water storage tank would be used to drip irrigate the slope west of the MRF/AD Facility site. The irrigation rates would be controlled automatically by a system that incorporates data received by soil moisture sensors and an on-site weather station. Controlled irrigation would facilitate establishment of vegetation that would stabilize the soil surface and minimize erosion. Overall, impacts associated with potential severe erosion are considered less than significant.

Impact TRRP G-4: The proposed facilities would not be impacted by fault rupture but may be subject to adverse but less than significant damage due to seismic ground-shaking - Class III Impact.

No active faults or earthquake fault zones are located on the project site. Therefore, significant impacts to project facilities associated with fault rupture would not occur. A seismic event on a nearby fault could produce ground-shaking at the project site; however, with implementation of standard building code requirements for seismically active areas, loss of life or damage to project facilities are not anticipated.

Impact TRRP G-5: The proposed facilities have a less than significant potential for damage due to seismic liquefaction – Class III Impact.

Based on laboratory testing of soils on-site, the consistency and relative density of the in-situ soils (clay/rock) are not conducive to liquefaction. In addition, groundwater is relatively deep, such that soil saturation is not anticipated. Overall, the potential for loss of life and/or property damage associated with liquefaction is considered less than significant.

Impact TRRP G-6: The use of expansive soils for fill may result in significant damage to the MRF, AD Facility and maintenance building – Class II Impact.

Laboratory testing of soil samples of the Rincon Formation at the landfill site indicate these soils have a medium expansion index (GeoSolutions, 2013). Additional fill at the operations deck is proposed to be Rincon Formation-derived soils from the west borrow area. Without proper engineering design, use of these soils could significantly impact the structural integrity of the proposed MRF and AD Facility buildings. The proposed maintenance building would be constructed on fill derived from the Sespe Formation (typically with a moderate shrink-swell potential) and may also be significantly affected by expansive soils.

Mitigation Measures:

MM TRRP G-2: Expansive Soils. Placement of fill at the operations deck shall be conducted per the recommendation of the Soils Engineering Report and Engineering Geology Investigation (see Appendix G), including the top 3 feet of fill placed under the MRF and AD Facility shall consist of a non-expansive material such as aggregate base or decomposed granite, which extends a minimum of 5 feet beyond the perimeter foundation. Alternatively, a foundation system designed for expansive soils may be utilized.

The maintenance building pad shall be over-excavated at least 24 inches and extend a minimum of 5 feet beyond the perimeter foundation. The exposed surface shall be scarified to a depth of 12 inches, moisture conditioned and compacted to a relative density of 90 percent.

Plan Requirements and Timing. The above measure shall be incorporated into the grading and building design plans and included in the construction plans and contract specifications for the Resource Recovery Project. The design measures shall be implemented during construction. The grading and building design plans shall be reviewed and approved by RRWMD and Planning & Development, Building and Safety.

Monitoring: A RRWMD approved construction manager/construction quality assurance manager shall monitor for compliance.

Residual Impacts. Implementation of this mitigation measure would reduce geologic processes Impact TRRP G-6 associated with implementation of the proposed project to a level of less than significant.

Impact TRRP G-7: Differential settlement, associated with previously buried MSW and as a result of the differing soil types across the proposed building area, could significantly impact the MRF and AD Facility structures – Class II Impact.

The operations deck (including the MRF/AD Facility site) is located in a valley formed by Rincon Shale to the west and a refuse slope to the east. Artificial fill was placed and compacted within the valley to its current approximate 380 foot elevation height in 2006 and completed in 2007. A final cover system was installed over the refuse area of the operations deck. Surface cracking on the operations deck along the MSW footprint indicates long-term settlement is actively occurring at the site. As shown in Figure 3-5, portions of the MRF and AD Facility parking areas would be constructed over the MSW footprint.

A settlement analysis was performed to determine the potential settlement of the refuse during the 20-year design life of the facilities on the operations deck. Primary settlement of the refuse below the operations deck is assumed to have occurred due to the passage of time. Analysis of the secondary settlement of refuse utilized Sharma and De's method for secondary settlement under external loads (Sharma and De, 2007).

Eleven existing settlement monuments are located at various locations within the operations deck both within the area underlain with MSW and the area of fill. Settlement readings taken from December 12, 2007 to July 11, 2012 were utilized to establish a site-specific coefficient of secondary compression. Table 4.5-3 lists the predicted settlement at each monument for the approximate 20-year life span of the project (2017-2036).

Table 4.5-3. Estimated Total Settlement at the MRF/AD Facility Site

Monument Number	Underlying Soil (MSW or Fill)	Anticipated Total Settlement During the Life of the Project (feet, 2017-2036)
1	**MSW**	**2.16**
2	Fill	0.34
3	Fill	0.20
4	Fill	0.15
5	Fill	0.38
6	**MSW**	**1.96**
7	**MSW**	**1.53**
8	Fill	0.26
9	**MSW**	**2.06**
10	**MSW**	**1.26**
11	**MSW**	**2.94**

Approximately 1.26 to 2.94 feet of total settlement is anticipated in areas overlying MSW (bold values in Table 4.5-3) at the MRF/AD Facility site. Buildings are proposed to be constructed within the area underlain by artificial fill or Rincon Shale, which is anticipated to experience much lower total and annual settlement rates (0.15 to 0.38 feet, see Table 4.5-3). However, settlement at the MRF/AD Facility site has the potential to significantly affect the project structures and operation of the facilities.

Mitigation Measures:

MM TRRP G-3: Differential Settlement Control – MRF/AD Facility Site. The MRF and AD Facility shall be constructed consistent with the design specifications contained in the Soils Engineering Report and Engineering Geology Investigation, Tajiguas Resource Recovery Project (see Appendix G). The MRF and AD Facility shall be constructed with drilled cast-in-place caissons joined with grade beams, founded a minimum of 24 inches below the lowest adjacent grade. Alternatively, a system of end-bearing helical pier anchors shall be used instead of the concrete caissons. Additional detail concerning geotechnical foundation requirements is provided in Appendix G.

Plan Requirements and Timing. The above foundation design measures shall be reflected in the building and construction design plans and included in the contract specifications for the Resource Recovery Project and shall be implemented during construction. The Plans shall be subject to review and approval by RRWMD and Planning & Development, Building and Safety.

Monitoring: RRWMD and Planning & Development, Building and Safety shall review the construction design plans to confirm inclusion of the required foundation design measures. A RRWMD approved construction manager/construction quality assurance manager shall monitor for compliance during construction.

Residual Impacts. Implementation of this mitigation measure would reduce geologic processes Impact TRRP G-7 associated with implementation of the proposed project to a level of less than significant.

Impact TRRP G-8: Settlement associated with existing and planned MSW disposal in the Tajiguas Landfill top deck area could significantly impact the operation of the composting area – Class II.

The proposed composting area would be located on the landfill top deck, in an area which is currently being filled with MSW. and which will receive up to 80 additional feet of MSW prior to reaching its final design elevation and capacity in approximately 2016. Prior to locating the composting facilities in this area, the top deck area will undergo final closure and an engineered landfill cover system will be installed. Above the landfill cover, the composting area would include a separate multi-layer foundation system. The composting area system would consist of 3 inches of asphalt over MPV 600 paving mat, over 3 inches of asphalt base course, over geofabric, over 9 inches of crushed aggregate base, over geogrid, over 6 to 24 inches of compacted earth fill (see Figure 3-12).

A previous Settlement Analysis was performed on the top deck by SWT Engineering (2009), which stated “the total projected remaining settlement expected during the Post-Closure life is estimated to range from approximately 0.51 feet to 19.67 feet.” Settlement monitors were installed along the west and south boundaries of the proposed top deck in January, 2012. Although the composting area would not support any habitable structures, settlement may result in damage to the composting area multi-layer system and adversely affect use of the area for composting operations.

Mitigation Measures:

MM TRRP G-4: Settlement Control – Composting Area. The composting area shall be constructed consistent with the design specifications contained in the Soils Engineering Report and Engineering Geology Investigation, Tajiguas Resource Recovery Project (GeoSolutions, Inc., October 2013). The composting area pad shall not be developed for a minimum of 6 months after final waste placement is complete in this section of the landfill to allow for primary settlement to occur. The structure pavement section for the composting area shall consist of a minimum of 3 inches of asphalt concrete over 12 inches of Class II aggregate base moisture conditioned to 3-5 percent over optimum moisture content. Additional detail concerning geotechnical foundation requirements is provided in Appendix G.

Plan Requirements and Timing. The above measures shall be reflected in the plans and contract specifications for the Resource Recovery Project, and shall be implemented during construction. Plans shall be reviewed and approved by RRWMD and the RWQCB.

Monitoring: A RRWMD approved construction manager/construction quality assurance manager shall monitor for compliance during construction.

Residual Impacts. Implementation of these mitigation measures would reduce geologic processes Impact TRRP G-8 associated with implementation of the proposed project to a level of less than significant.

Relocated Landfill Facilities

Operations facilities (primarily portable offices) may be temporarily relocated during the project construction period to an area north of the landfill top deck or to the southern portion of the landfill. Landfill equipment maintenance facilities would be relocated to the area north of the landfill top deck (see Figure 3-4). Landfill operations facilities may be relocated within a waste fill area and could experience small amounts of secondary settlement. However, the portable offices would be supported by temporary piers and monitored during the approximately 16 month construction period. Settlement hazards to landfill staff are not anticipated. Impacts associated with the relocated maintenance facilities are addressed above under Impact TRRP G-6, and mitigation measures are provided to address expansive soils.

4.5.2.5 Proposed Tajiguas Resource Recovery Project with Optional Comingled Source Separated Recyclables (CSSR) Component

The optional CSSR element would add an additional 10,000 square feet of sorting facilities to the proposed MRF building (see Figure 3-8). All other project facilities would be the same. Additionally, the number of employees on the site would increase by 20 during the day and there would be additional deliveries of recyclable materials and transport of sorted materials off-site after processing. The small increase in the MRF building area would not increase the magnitude of geologic impacts such that implementation of the optional CSSR element would not alter the significance level of these impacts as identified in Section 4.5.2.4 above.

4.5.2.6 Extension of Landfill Life Impacts

Impact TRRP G-9: Project-related extension of the life of the Tajiguas Landfill would extend the duration of less than significant erosion and sedimentation impacts – Class III Impact.

As discussed in Section 3.4, project-related diversion of recyclable material and organic waste is anticipated to extend the life of the Tajiguas Landfill by about 10 years. This would delay final closure of the landfill, although phased closure would continue to occur. Construction of new waste cells and installation of the associated liner systems occurs well in advance of the waste placement due to the need to have disposal space available[1]. Therefore, grading and construction of the final permitted waste cells and installation of the landfill liner systems will be completed within the current life of the landfill (prior to 2026). Therefore, no geologic processes impacts associated with project-related extension of these activities would occur.

[1] Construction of the Phase 3B groundwater protection system project, which is the last major landfill liner project, is scheduled to continue through fall 2014. Construction of the remaining smaller liner projects would be completed prior to 2026.

Because closure and placement of a final cover system over the entire landfill area would be delayed, there may be some extension of less than significant (Class III) landfill-related erosion and sedimentation impacts. These impacts would continue to be minimized by the landfill storm water management systems, interim erosion control measures during construction and operations, and phased closure of areas of the landfill where waste placement has been completed.

4.5.2.7 Decommissioning Impacts

Decommissioning activities would not involve the construction or modification of any slopes or other changes to the topography of the project site. Building pads, foundations and paving would remain in place. Buried water pipelines and utility lines would be abandoned in place or removed and the trench would be backfilled. No changes in slope stability, localized erosion, seismic ground-shaking, liquefaction or expansive soils would occur. Currently permitted landfill closure activities would include revegetation of the project site to minimize soil erosion following decommissioning.

4.5.2.8 Cumulative Impacts of the Tajiguas Resource Recovery Project

Other projects in the region (see Section 3.6) may generate or be exposed to local and regional geologic hazards, including landslides, fault rupture, ground-shaking, liquefaction, expansive soils and tsunami inundation. However, geologic impacts, by their nature, primarily involve site specific effects related to the particular geologic conditions and geologic hazards present in the immediate vicinity of the project site and their effect on project facilities (e.g., damage to structures due to expansive soils or differential settlement) or directly affected by project activities (e.g., grading that would impact slope stability). Except for regional seismicity, which would impact cumulative projects throughout the Gaviota Coast and South Coast region, no other cumulative projects are proposed on the landfill property or the immediate project area that would impact or be impacted by the same geologic conditions as the proposed project. Therefore, the project would not contribute to cumulative geologic impacts.