5.8 SITE STABILITY AND MANAGEMENT

5.8.1 Corridor Setting

The North Coast Corridor (NCC) parallels the Southern California coastline and is located in a region where transportation infrastructure is vulnerable to a variety of natural hazards, including threats from earthquakes, landslides, storm waves, and flooding. The coastal bluffs, beaches, lagoons, and steep hillsides within the corridor are particularly subject to erosion and potential instability due to heavy rains and, in the case of coastal bluffs, beaches, and lagoons, wave uprush associated with winter storms.

Transportation infrastructure must ensure the safety of its users in light of both natural and operational hazards. As travel demand grows, improving and maintaining safe rail and highway facilities will be an ongoing and important priority for the region; thus, proposed program improvements must be designed to assure stability and structural integrity. In addition, a key safety consideration for the PWP/TREP would focus on reducing or eliminating potential conflicts between and among people, automobiles, and trains. As discussed in more detail in Section 5.3, Public Access and Recreation, proposed PWP/TREP improvements would provide numerous new or upgraded rail and highway facility crossings to address and reduce potential conflicts between and among people, automobiles, and trains along the corridor, thereby facilitating safe coastal access and recreation opportunities in the corridor.

5.8.1.1 Geology, Soils, Seismicity, and Topography

The corridor's geology, soils, seismicity, and topography are documented in the *LOSSAN Final Program EIR/EIS* (September 2007) for the LOSSAN rail corridor improvements, and a Preliminary Geotechnical Report, prepared by the California Department of Transportation's (Caltrans) Office of Geotechnical Design South 2 for the proposed NCC improvements, the findings of which are incorporated into the *I-5 NCC Project Final EIR/EIS* (October 2013). The Preliminary Geotechnical Report presents the results of initial archival research of pre-existing data, field reconnaissance, and preliminary analysis and recommendations for the proposed highway improvements.

Geology/Soils

The NCC traverses terrain comprising three predominate and repetitive geologic features: 1) through-cuts in relatively young marine terrace, sandstone, and shale formation; 2) artificial fills; and 3) unconsolidated lagoonal alluvium.

Natural and artificial cut slopes along the corridor are primarily composed of Torrey Sandstone and Delmar Formation. Torrey Sandstone is porous and permeable, and therefore susceptible to erosion. Delmar Formation is considered to be poorly bedded and indurated, consisting of sandy clay stone interbedded with medium- to coarse-grained gray sandstone; therefore, steep unprotected slopes are susceptible to erosion. These formations are generally capable of supporting large stable cut slopes at a 1:2-foot (vertical to horizontal) inclination and may support much steeper temporary excavations. The borrow soil derived from these units is generally well suited for use as engineered embankment fill.

The largest features of engineered artificial fill in the corridor occur where rail and freeway embankment fill has been placed at lagoon crossings. Numerous other, smaller fill areas exist elsewhere along the corridor. Highway fills have slopes at 1:2-foot (vertical to horizontal) inclination and appear to be performing well. Large areas of embankment settlement along the highway corridor have been observed and determined to be the result of settlement of the underlying alluvium.

Lagoonal Alluvium consists of lagoon sediments that are composed of weak, poorly consolidated, sand, silt, clay, and gravel with more consolidated soil at depth. These relatively weak soils may be subject to settlement and bearing capacity failure, as evidenced at the highway corridor where 6 to 9 feet of settlement of the finished embankment was recorded.

Seismicity

The seismicity of Southern California is dominated by the intersection of the north-northwest trending San Andreas Fault system and the east-west trending Transverse Ranges Fault system. The corridor is subject to ground shaking associated with earthquakes on faults of both these systems.

Major fault expressions near the corridor include the San Andreas, San Jacinto, Elsinore, and Rose Canyon Fault Zones. Additionally, a complex system of northwest trending faults offshore from San Diego, which includes the Coronado Banks and San Diego Trough Faults, are seismic sources that may cause minimal to moderate shaking in the corridor. The closest active major fault to the corridor facilities is the Newport Inglewood/Rose Canyon East Fault, which runs offshore in a northwest trend and then comes onshore in La Jolla, just south of the corridor, and runs to Mission Bay.

Earthquakes can cause soil liquefaction where loosely packed, saturated sediments come loose from the intense shaking of the earthquake. Seeps, springs, ephemeral streams, and perched water have been identified within the corridor, generally occurring at the toe of slopes and embankments, at the contact between permeable sandstone and impermeable shale, within cut-slope faces, at grade, and within canyons crossed or traversed by the rail and highway facilities. Therefore, it is anticipated that saturated older and younger alluvium deposits will underlie the proposed improvement areas, which are considered liquefiable from the surface to depths on the order of 50 to 60 feet. This includes alluvial deposits underlying the existing bridge structures and the embankment fills. Areas underlain by Quaternary terrace material as well as all bedrock units are not considered liquefiable due to their high density, clay content, age, and/or unsaturated conditions.

Topography

Landforms in the corridor are comprised of a series of uplifted and incised wave-cut terraces that parallel the coastline. East-west trending river valleys and drainages dissect the terraces and convey ephemeral streams and perennial rivers and streams west to the ocean. Terrace elevations are typically 328 feet or less, while stream and lagoon elevations are at, or slightly above, sea level. The lagoons and rivers in the corridor represent broad topographic lows that occur at semi-regular intervals along the corridor. These topographic lows are subject to tidal flow and episodic flooding arising from hinterland storm runoff. Steep topography in the corridor is commonly the result of landform incision by the generally westward flowing drainages, resulting in oversteepened slopes in some areas of the corridor. Steep slopes and bluffs resulting from beach side erosion and wave action occur adjacent to the LOSSAN rail corridor in Del Mar and Encinitas.

Existing rail and highway improvements traverse lagoons, marine terraces, small canyons, and drainages in a series of through-cuts and fill embankments. Natural slopes along the corridor demonstrate a maximum slope of approximately 1:3-foot (vertical to horizontal) inclination. Existing cut slopes are typically at 1:2-foot inclination (vertical to horizontal) and are up to 148 feet high. The cut slopes primarily expose Torrey Sandstone and are considered relatively stable.

5.8.1.2 Drainage and Flood Areas

Hydrologic resources of the corridor are documented in the *LOSSAN Final Program EIR/EIS* for the LOSSAN rail corridor improvements and Location Hydraulic Studies (February 2008/February 2009) prepared for the *I-5 NCC Project Final EIR/EIS*, which incorporate the results of the Hydrologic Engineering Centers Rivers Analysis System.

The PWP/TREP improvement areas parallel the coastline throughout Northern San Diego County, residing entirely within the coastal region of the San Diego Basin and traversing surface streams and floodplains along with lagoons, small canyons, and drainages. The improvement areas cross four of the 11 hydrologic units (HU) within the San Diego Regional Water Quality Control Board (RWQCB) Basin. These HUs include San Luis Rey, Carlsbad, San Dieguito, and Los Peñasquitos. The corridor's surfaced hydrology is primarily influenced by five lagoons, five creeks, and the San Luis Rey River.

The San Luis Rey watershed is the largest of the four HUs within the corridor and is drained by the San Luis Rey River. The Carlsbad HU comprises seven sub-basins that include San Elijo Lagoon (Escondido Creek), Cottonwood Creek, Batiquitos Lagoon (San Marcos Creek), Encinas Creek, Agua Hedionda Lagoon (Agua Hedionda Creek), Buena Vista Lagoon (Buena Vista Creek), and Loma Alta Creek. The San Dieguito HU drains into the San Dieguito River. The corridor begins near the middle of the Los Peñasquitos HU and crosses Carroll Canyon Creek, Los Peñasquitos Creek, and Carmel Creek.

In addition to the large watershed features described above, the corridor includes several small drainages and culverts that convey minor year-round flows attributable to urban runoff and/or perched groundwater seepage. All of the significant hydrologic features in the corridor receive runoff from both natural and developed areas.

Floodplains are land next to a waterbody that becomes covered by water when the waterbody overflows its banks. The zone of interest for the analysis of hydrologic resources in this PWP/TREP evaluation is defined as a special flood hazard area or Zone A, which is the flood insurance rate zone that corresponds to the 100-year flood hazard area in the hydrologic resource study area.

Floodplains encompass floodways, which are the primary areas that convey flood flows. Typically, floodways are channels of a stream, including any adjacent areas such as lagoons, floodplains and smaller streams that must be generally kept free of encroachment so that the 100-year flood can be carried without substantial increases to flood heights. The area between the floodway and the 100-year floodplain boundary is referred to as the floodway fringe. According to guidelines established by the Federal Emergency Management Agency (FEMA), an increase in flood height in the floodway due to any encroachment in the floodway fringe areas may not exceed 12 inches, provided that hazardous velocities are not produced in the water body.

As delineated by FEMA, 100-year floodplains in the study area are associated with significant drainage channels, riparian areas, and lagoons. Significant surface waters noted along both the rail and highway corridors include floodplains of Soledad Canyon Creek, Los Peñasquitos Creek, San Dieguito Lagoon, San Elijo Lagoon, Batiquitos Lagoon, Agua Hedionda Lagoon, Buena Vista Lagoon, Loma Alta Creek, and San Luis Rey River. In addition, Carmel Creek, Cottonwood Creek, and Encinas Creek have been identified as significant water features for the highway facility.

5.8.1.3 Shoreline Erosion/Sea Level Rise

Through Del Mar, as well as a limited portion of Encinitas, existing and proposed LOSSAN rail corridor improvements occur along, and adjacent to, coastal bluffs and are therefore subject to shoreline/coastal bluff erosion and retreat. In addition, many of the rail and highway bridges cross waterbodies that may also be subject to shoreline erosion, particularly the corridor's lagoons and river systems. In general, shoreline erosion is controlled by a combination of marine, fluvial, and subaerial erosion. Marine erosion results from the effects of the ocean and wave action along beaches and/or the base of coastal bluffs. Fluvial shoreline or bank erosion occurs internally at lagoons along waterways, and results from the force of running water in creeks, streams, and rivers. Subaerial erosion results from erosional influences that exist above the high-water line and includes erosion due to surface runoff, groundwater seepage, wind, pedestrian traffic, rodent activity, and slope instability.

Sea level rise has occurred on a global and local scale over the last century, and projections suggest that the rate might accelerate into future planning horizons. Because several of the PWP/TREP elements are located within, or directly adjacent to, the marine environment, sea level rise considerations must be incorporated into project planning and design to determine the potential effects sea level rise may have on the infrastructure improvements, and/or how planning to accommodate sea level in project design may have potential secondary effects on the environment. Potential effects of sea level rise include increased shoreline erosion and scour, increased nearshore wave energy, flooding, and reduced beach area, all of which can affect the long-term stability of the infrastructure located within, or directly adjacent to, the marine environment. In turn, projected sea level rise design considerations may have the potential to raise issues with wetlands encroachment, views, and right-of-way impacts.

In March 2013, the State of California, via the California Climate Action Team and Ocean Protection Council, established the latest sea level rise guidance, which was based on the latest and most relevant scientific study presented in the 2012 National Research Council study (NRC 2012). The latest state guidance is to consider a range in sea level rise of 0.13 foot to 0.98 foot between 2000 (Base Year) and 2030, 0.39 foot to 2.00 feet between 2000 and 2050, and 1.38 feet to 5.48 feet between 2000 and 2100. The guidance also recommends a site-specific risk analysis to determine the appropriate sea level rise projection for design considerations.

To assist in planning and designing of the NCC lagoon bridge crossings, the San Diego Association of Governments (SANDAG) and Caltrans prepared the San Diego Region Coastal Sea Level Rise Analysis (September 2013), included as Appendix D, which assesses potential drainage, tidal inundation and flooding impacts to NCC transportation infrastructure crossing various waterbodies throughout the corridor. The analysis summarizes and compiles all relevant state, federal, and local guidance and provides recommendations for establishing planning and design criteria, and conducting risk assessment for the NCC bridges. Guidance for design water levels for the NCC bridge projects was provided across the full range of potential future mean sea levels in consideration of high ocean water levels both with and without fluvial floods (50-year and 100-year). High future water levels that combine the extreme flood event with sea level rise of 1.5 feet, 3.0 feet, and 5.5 feet are compared to existing and proposed rail and highway bridge elevations to assist in bridge design and risk assessment for each bridge.

5.8.1.4 Hazardous Wastes

The *LOSSAN Final Program EIR/EIS* for the rail corridor improvements cites the following available databases and information that were reviewed to identify the extent and nature of known hazardous materials/hazardous waste sites to assess potential hazardous materials risks:

- **Federal National Priorities List/Superfund:** This U.S. Environmental Protection Agency-developed database lists sites that pose an immediate public health hazard, and where an immediate response to the hazard is necessary. These listings are also found in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) database, also known as CERCLIS (Title 42 U.S.C. Chapter 103).

- **State Priority List:** Sites listed in this Department of Toxic Substances Control and RWQCB database are priority sites that were compiled from Annual Workplan and CAL-SITE databases, and sites where Preliminary Endangerment Assessments were conducted by the California Environmental Protection Agency. The Annual Workplan database lists contaminated sites authorized for cleanup under the Bond Expenditure Plan developed by the California Department of Public Health as a site-specific expenditure plan to support appropriating Hazardous Substance Cleanup Bond Act funds.
- **State of California Solid-Waste Landfills:** The landfill sites listed in this database generally have been identified by the state as accepting solid wastes. This database includes open, closed, and inactive solid-waste disposal facilities and transfer stations pursuant to the Solid Waste Management and Resource Recovery Act of 1972 and is maintained by the California Integrated Waste Management Board. The locations of the disposal facilities are primarily identified through permit applications and local enforcement agencies.

The following reports were prepared for the proposed highway improvements and are incorporated into the *I-5 NCC Project Final EIR/EIS*:

- *Site Investigation, Lead Investigation on Route 5 from Via de la Valle to Leucadia Boulevard, San Diego, Solana Beach, and Encinitas, California*, KP R57.9/R68.7 (PM R36.0/R42.7). Geocon Consultants, Inc., dated June 22, 2001.
- *Aerial Deposited Lead Investigation, Contract No. 43A0012, Task Order No. 11-07830K-VW, Route 5 Between Leucadia Boulevard and Brooks Street, San Diego County California*. PM 42.7/R51.2. KP R68.7/82.4. PSI, dated June 28, 2001.
- *Limited Phase II Environmental Site Assessment Interstate 5 Expansion, Del Mar Heights Road to Birmingham Drive, San Diego California*. November 15, 2005.
- *Phase II Environmental Site Assessment Interstate 5 Expansion, Birmingham Drive to Vandergrift Boulevard, San Diego California*. October 31, 2006.
- *Environmental Geodata [LOSSAN]*. Environmental Data Resources, Inc.. January 2003.

These reports evaluate the potential hazardous waste/material concerns within the project study area. These studies indicate that the following contaminants occur, or have the potential to occur within the highway project area:

- Aerially deposited lead
- Petroleum hydrocarbons
- Landfills
- Pesticides and herbicides
- Chemical spills
- Asbestos
- Lead
- Treated wood

Hazardous materials and hazardous wastes are regulated by many state and federal laws. These include not only specific statutes governing hazardous waste, but also a variety of laws regulating air and water quality, human health, and land use. Hazardous waste in California is regulated primarily under the authority of the federal Resource Conservation and Recovery Act of 1976, and the California

Health and Safety Code. Other California laws that affect hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup, and emergency planning.

5.8.2 PWP/TREP Concerns

5.8.2.1 Geology, Soils, Seismicity, and Topography

As the proposed PWP/TREP program would involve rail and highway improvements to existing facilities, safety and stability concerns associated with project implementation within the NCC would be similar to those that currently exist today. Environmental documentation and analysis prepared for the PWP/TREP rail and highway corridor improvements indicate that the study area would be subject to ground shaking and the possibility of liquefaction. Surface fault rupture, ground shaking, and seismically induced ground failure could result in substantial damage to structures. In addition, concerns include potential risk to public safety due to collapse or toppling of partially constructed or completed transportation facilities during strong earthquakes. Interruption of service due to failed infrastructure caused by ground rupture along active faults or ground motion during strong earthquakes could affect transportation facilities that are critical for emergency evacuation for the region, which is also subject to geologic, flood, tsunami, and fire hazards.

Earthquakes could also trigger landslides where slopes are prone to failure because of geologic conditions or because of modifications during construction. Slope instability could also occur naturally due to factors such as fracture patterns, soil saturation, steep slopes, or excessive erosion. PWP/TREP improvements that involve landform alteration, significant ground disturbance, and vegetation removal could create or contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area. Slope instability could cause severe damage to surface and near-surface improvements as well as risks to public safety; however, slope instability can generally be mitigated with planning and design.

5.8.2.2 Drainage and Flood Areas

Portions of the PWP/TREP study area are subject to flooding and other drainage concerns. As the proposed PWP/TREP program would involve rail and highway corridor improvements to existing facilities, potential safety and stability impacts associated with project implementation within the NCC would be similar to those that exist today. However, new rail and highway corridor improvements that encroach on floodplains could potentially reduce the flood-carrying capacity and increase flood elevations. In addition, existing and proposed waterbody crossings, particularly culvert crossings, if not properly designed may be subject to overtopping during high-flood events and/or due to debris reducing water conveyance, and, over the years, may be undercut by stream flow, eventually causing scouring around the structure undermining the foundation, and, thus, facilitating structural collapse.

5.8.2.3 Shoreline Erosion/Sea Level Rise

Portions of the PWP/TREP study area are subject to shoreline erosion. Through Del Mar, as well as a limited portion of Encinitas, existing and proposed rail corridor improvements would occur along and adjacent to coastal bluffs and therefore would be subject to shoreline/coastal bluff erosion and retreat. Portions of the rail corridor in Del Mar are protected by shoreline protective devices that are in need of ongoing repair and maintenance. In Encinitas, the rail improvement options would be located east of Pacific Coast Highway, which would provide an ample setback and buffer area between the alignment options and the coastal bluffs thereby ensuring that the rail facility would not be subject to potential site stability issues associated with bluff failure or shoreline erosion. In addition, many of the rail and highway facility bridges cross waterbodies that could also be subject to shoreline erosion, particularly the corridor's lagoons and river systems where bridge abutments and/or piles may be located in areas subject to flooding, storm surge or wave action.

The character of the coastline is the result of various natural processes, one of which is rising sea levels due to global climate change, which is a growing concern among coastal communities. The rising sea level has the potential to expose the coastline to increased storm surge, wave uprush, and flooding, and could affect existing NCC improvements, particularly where the improvements would be near the shoreline or subject to tidal influences such as bluffs, beach areas, and lagoons. Rising water levels would have a direct impact on shoreline erosion, which, in turn, could undermine foundations and shoreline protection structures for rail facilities along the coastal bluffs of Del Mar and Encinitas and/or rail and highway bridge structures across lagoons.

Potential impacts associated with shoreline erosion, and the exacerbating effects of sea level rise on shoreline erosion, storm surge and flooding, can be mitigated by siting and designing the proposed rail and highway improvements in a manner that minimizes the frequency with which structures are subject to wave action, tidal inundation and flooding. Such siting and design options include minimizing development encroachment into drainage and flood areas as much as feasible, locating development as far landward as feasible from areas subject to shoreline erosion (particularly coastal bluffs and beaches), elevating bridge structures above drainage and flood areas, widening and deepening channels at facility crossings to allow for more flow through the lagoon, streams and drainage waterbodies, and, where avoiding development in areas subject to shoreline erosion, tidal inundation and flooding is infeasible, designing improvements to withstand significant storm events and erosion.

5.8.2.4 Hazardous Wastes

Environmental documentation and analysis prepared for the PWP/TREP rail and highway improvements indicate that portions of the study area contain hazardous wastes.

Worker health and safety and public safety are key issues when dealing with hazardous materials that could affect human health and the environment. Proper disposal of hazardous material is vital if it is disturbed during project construction.

In addition, potential chemical spills and other hazards from truck, auto, and train accidents could occur along the NCC, posing a risk to adjacent land uses. Furthermore, construction activities have the potential for hazardous materials' release, spill, or leakage from construction demolition of existing structures and/or from construction vehicles and equipment.

5.8.2.5 LOSSAN Rail Corridor Impact Assessment

Geology, Soils, Seismicity and Topography

The proximity of the rail corridor to active fault systems establishes the potential for the area to be affected by a major seismic event. In general, seismic activity in the study area could include strong ground motion, liquefaction, seismically induced settlement, and embankment spreading.

Active seismicity represents a key constraint on design and construction for proposed rail improvements, including existing and proposed station sites, proposed tunneling alternatives, and planning for potential train derailment during a peak event. Some of the alignment options would require special design, including additional structural ductility and redundancy to withstand severe ground shaking as well as the potential for liquefaction and/or other types of seismically induced ground failure.

Standard engineering practice requires that the stability of project soils be evaluated for an appropriate safety factor and soil conditions must meet minimum safety factors for both static and seismic cases. Available data indicates that soils susceptible to erosion are located in a number of areas along the rail corridor. Erosion potential is not expected to be a substantial construction or operation issue; however, without the appropriate engineering, on-site soils and/or seismic activity could adversely affect the structural project section, predispose slope faces to erosion, and/or compromise slope stability.

Potential slope stability problems are of particular concern along the coastal bluff areas in Del Mar. In addition, proposed improvements that would involve landform alteration, significant ground disturbance, and vegetation removal could potentially create or contribute to erosion, geologic instability, or destruction of the site or surrounding area.

Drainage and Flood Areas

Drainage and floodplain impacts for proposed rail improvements are expected to be low overall, as the majority of proposed improvements would be done within the established LOSSAN rail right-of-way and would be designed to accommodate floodplain functions. Many of the proposed rail improvements (e.g., San Dieguito Double-Track and Bridge Replacement, Sorrento Valley Double-Track) will elevate the track over existing drainage and flood areas to address drainage and flooding concerns. It is expected that crossings over the corridor's waterbodies would be spanned either by bridges or culverts or, in the case of Del Mar and University Town Center, by improvements involving deep tunnels that would avoid surface floodplains; however, the placement of structures along the shoreline and/or within the floodplain of a waterbody, if not designed to minimize fill and the alteration and channelization of shorelines and/or floodplains, could adversely affect the ability of the system to convey flood waters and/or could contribute to increased erosion.

Shoreline Erosion/Sea Level Rise

In Del Mar, the existing LOSSAN rail alignment is constructed across the top of the relatively flat mesa, generally at or near the elevation of the bluff top, 40 to 65 feet above sea level. This rail alignment and its associated riprap protection provide a buffer from wave action; thus, the coastal bluff is predominantly subject to subaerial (surface water and wind) erosional processes in this location. A number of remedial or stabilization measures exist along the railway in the Del Mar area, including older improvements along the coastal bluff face that are in need of ongoing repair and maintenance. Wooden and concrete seawalls along portions of the bluff are currently protecting portions of the base of the bluff against erosion due to typical wave impact; however, these walls are occasionally of insufficient height to block heavy storm surf and require periodic maintenance to remain effective.

Coastal bluff areas along the existing rail corridor in Del Mar have the potential for slope instability due to shoreline erosion and retreat. While proposed PWP/TREP improvements could have a beneficial impact to shoreline processes with an option to remove the existing rail corridor from the coastal bluff areas in Del Mar, discussed below, ongoing maintenance activities and the possibility of having to extend or expand the existing shoreline protection system in consideration of sea level rise to maintain the existing rail right-of-way could adversely affect the long-term stability of the shoreline and rail corridor due to additional landform alteration and/or erosional impacts caused by new or extended shoreline protection devices. Section 30235 of the Coastal Act provides, in part, that shoreline protection devices shall be permitted to protect existing structures or public beaches in danger from erosion, when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Consistent with previous Commission actions to approve installation and ongoing maintenance activities for the existing shoreline protection system at Del Mar Bluffs (CDP 06-01-081, CDP 06-96-156 and CC-048-04), future stabilization and maintenance activities for the shoreline protection system will be required to further demonstrate that the improvements are necessary to protect the existing rail facility from bluff erosion, and that the improvements are the least environmentally damaging feasible alternative.

In addition, many of the rail bridges cross waterbodies that could also be subject to internal shoreline or bank erosion, particularly the corridor's lagoons and river systems. The placement of structures along the internal shorelines and/or within the floodplain of these waterbodies could cause excessive erosion and result in structural failure if not designed to minimize the alteration and channelization of shorelines and/or floodplains, and with full consideration of the potential for sea level rise to expose the corridor waterbodies to increased ocean water levels and flooding. As discussed above, siting and design options to mitigate for these potential adverse impacts include minimizing development encroachment into drainage and flood areas as much as feasible, locating development as far landward as feasible from areas subject to shoreline erosion (whether along the open coast or internal at lagoons), elevating bridge structures above drainage and flood areas, and, where avoiding development in areas subject to shoreline erosion, tidal inundation and flooding is infeasible, designing improvements to withstand significant storm events and long-term erosion.

Table 5.8-1 summarizes the NCC rail bridge risk assessment for the complete range of sea level rise scenarios assessed in the San Diego Region Coastal Sea Level Rise Analysis (September 2013), included as Appendix D of the PWP/TREP. As indicated in Table 5.8-1, it is anticipated that the PWP/TREP Phase 1 San Elijo Lagoon and Batiquitos Lagoon rail bridges would not be affected by sea level rise, with the exception of the San Elijo Lagoon bridge, which would have some potential for short-term flood risk to rail facility operations under the 36-inch' and 66-inch' sea level rise with fluvial flood scenario, and assuming the selected San Elijo Lagoon Restoration Project alternative does not include an option for a new lagoon inlet. Given the short duration of the potential flood risk (a matter of hours) it is anticipated that any risk to facility operations could be managed via storm monitoring and operational restrictions.

Given that final design of the rail bridge for San Elijo Lagoon depends on the selected alternative for the San Elijo Lagoon Restoration Project, additional site-specific risk analysis will be conducted to inform final design of the bridge and determine if the bridge may be designed to fully accommodate 1) worst-case scenario sea level rise projects, 2) the maximum amount of sea level rise projections feasible in conjunction with future adaptation, if constrained by competing economic and environmental impact factors, or 3) operational considerations necessary to address episodic, low-frequency operational constraints such as short-term (hours) bridge closures when freeboards are insufficient, if it is determined infeasible to accommodate sea level rise. Bridges to be built in subsequent phases will be reassessed in the future and, consistent with the Design/Development Strategies and Implementation Measures identified in Sections 5.8.3.3 and 5.8.3.4, such assessment will be done in the context of the best available science and guidance for future sea level rise projections available at that time.

TABLE 5.8-1: LOSSAN RAIL BRIDGE SEA LEVEL RISE RISK ASSESSMENT

Waterbody/Bridge Location	Construction Timeline	Flood Risk Under SLR Without Fluvial Flood	Flood Risk Under Current Sea Level With Fluvial Flood	Flood Risk Under Sea Level Rise With Fluvial Flood			Risk Assessment
		66" SLR	0" SLR	18" SLR	36" SLR	66" SLR	
San Dieguito River Bridge Replace & Double-Track (South Abutment)/MP 243.2	2021–2030	✓ (green)	✓ (green)	✓ (green)	✓ (green)	✓ (green)	Built in 1916. SLR is not expected to pose any risk to the proposed bridge.
San Dieguito River Bridge Replace & Double-Track(North Abutment)/MP 243	2021–2030	✓ (green)	✓ (green)	✓ (green)	✓ (green)	✓ (green)	Built in 1916. SLR is not expected to pose any risk to the proposed bridge.
San Elijo Lagoon Bridge Replacement & Double-Track (New Inlet Scenario)/MP 240.6 (blue)	2010–2020	✓ (green)	✓ (green)	✓ (green)	✓ (green)	✓ (green)	SLR is not expected to pose any risk to the proposed bridge.
San Elijo Lagoon Bridge Replacement & Double-Track/MP 240.4 (blue)	2010–2020	✓ (green)	✓ (green)	✓ (green)	✓ (yellow)	✓ (red)	Built in 1942. Short duration (a matter of hours) flood risk to rail facility remaining operational; flood risk can be managed via storm monitoring and operational restrictions.
Batiquitos Lagoon Bridge Replacement & Double-Track/MP 234.8 (blue)	2010–2020	✓ (green)	✓ (green)	✓ (green)	✓ (green)	✓ (green)	SLR is not expected to pose any risk to the proposed bridge.
Buena Vista Lagoon Bridge Replacement Double-Track/MP 228.6	2010–2020	✓ (green)	✓ (yellow)	✓ (yellow)	✓ (red)	✓ (red)	Bridge currently under design but is expected to be designed such that SLR is not expected to pose any risk to the proposed bridge based on the March 2013 CO-CAT SLR values. Assuming a proposed soffit elevation similar to existing soffit elevation (a worst-case design outcome), a short-duration risk to the operation of the facility could be projected to occur during fluvial event and has been used in the presentation herein.
San Luis Rey River/MP 225.4	2010–2020	✓ (green)	✓ (green)	✓ (green)	✓ (green)	✓ (green)	SLR is not expected to pose any risk to the proposed bridge due to height of bridge.

Source: San Diego Region Coastal Sea Level Analysis, September 2013 (included as Appendix D of the PWP/TREP).

Blue indicates PWP/TREP Phase 1 bridge.

✓ (green) No risk; projected water surface elevation below top of rail subgrade

✓ (yellow) Short duration (matter of hours) risk to operation of transportation facility; projected water surface elevation above top of rail subgrade but below top of rail

✓ (red) Short duration (matter of hours) risk to operation of transportation facility; projected water surface elevation above top of rail

Hazardous Wastes

The analysis contained within the *LOSSAN Final Program EIR/EIS* was limited to searches of standard databases listing known sites and did not incorporate information on other smaller sites that could contribute to risk on a local basis and would be studied at the project-specific level. Because neither site-specific investigations nor on-site fieldwork was performed, little information is available about the nature and severity of contamination at the sites identified, or the schedule or program for cleanup, if any, so the information in this section represents a “site-count” approximation and may not fully divulge potential risk levels. Finally, all of the rail improvement alignment options would be within or adjacent to existing rights-of-way, and these alignments have a land use history under which additional unknown contamination (e.g., spills or accidental releases) would be a possibility.

Proposed implementation of LOSSAN rail corridor improvements could result in the discovery of contaminated materials, such as creosote-treated wood from LOSSAN bridge replacement. In addition, there is the potential for hazardous materials release into the environment during construction activities. As such, site-specific investigation and project-specific mitigation for future rail development activities would be necessary to adequately address potential impacts associated with hazardous wastes within the rail corridor improvement areas.

5.8.2.6 I-5 Highway Corridor Impact Assessment

Geology, Soils, Seismicity and Topography

The proximity of the highway project area to active fault systems establishes the potential for the area to be affected by a major seismic event, although ground-surface rupture is unlikely as there are no known active fault traces that cross the corridor. In general, seismic activity in the study area could include strong ground motion, liquefaction, seismically induced settlement, and embankment spreading, which could result in lateral spreading, cracking, slumping, or settlement of existing and proposed embankments causing structural failure. Caltrans Office of Earthquake Engineering is responsible for assessing the seismic hazard for Caltrans projects. The current policy is to use the anticipated Maximum Credible Earthquake (MCE) from young faults in and near California. The MCE is defined as the largest earthquake expected to occur on a fault over a particular period of time.

Caltrans’ standards require that the stability of project soils be evaluated for an appropriate safety factor and that soil conditions meet minimum safety factors for both static and seismic cases. Available data indicates that soils susceptible to erosion are located in a number of areas along the NCC. Most erosion potential could be controlled and contained through proper design, pollutant prevention plans, and mitigation. Erosion potential is not expected to be a substantial construction or operation issue; however, appropriate project-specific engineering must consider on-site soils and/or seismic activity that could adversely affect the structural project section, predispose slope faces to erosion, and/or compromise slope stability.

Drainage and Flood Areas

Drainage and floodplain impacts for proposed highway improvements are expected to be low, as the majority of proposed improvements would be done within the established highway corridor and proposed highway bridge crossings would not result in incompatible floodplain development. The *I-5 NCC Project Final EIR/EIS* includes a detailed impact assessment including the results of Location Hydraulic Studies performed for the following floodplains potentially affected by proposed highway improvements. FEMA Floodway/Floodplain ratings, existing and proposed highway bridge or culvert infrastructure improvements, and associated floodplain impacts for the corridor’s stream and rivers are identified in Table 5.8-2.

Table 5.8-2: Stream/River Waterbodies and Freeway Crossings (I-5 Highway Corridor)

Waterbody	City Location	FEMA Rating	Existing I-5 Crossing Type	Proposed I-5 Crossing Type	Water Surface Elevation Change
Cottonwood Creek	Encinitas	No FEMA Floodplain	Culvert	No Change	No Change
Encinas Creek	Carlsbad	No FEMA Floodplain	Culvert	Extend Culvert	0.22-foot Increase
Loma Alta Creek	Oceanside	FEMA Zone AE Floodway	Bridge	Widen Bridge	0.04-foot Increase
San Luis Rey River	Oceanside	FEMA Zone A99 Floodplain	Bridge	Widen Bridge	0.03-foot Increase

Source: I-5 NCC Project Final EIR/EIS (Section 3.9), October 2013.

The *I-5 NCC Project Final EIR/EIS* Location Hydraulic Studies for the corridor's stream and rivers conclude that 100-year flood events would continue to be contained within the existing floodplain boundaries at each crossing location in the corridor with the proposed highway improvements. Proposed bridge and culvert improvements would result in a slight increase in water surface elevation within the floodplain of the stream and river crossing locations; however, these increases are negligible (all less than 3 inches) and would not result in substantial impacts to on-site or off-site locations associated with drainage and flooding.

Shoreline Erosion/Sea Level Rise

Many of the highway bridges in the NCC cross waterbodies that could be subject to internal shoreline/bank erosion, particularly the corridor's lagoons and river systems. The placement of structures along the lagoon shorelines and/or within the floodplain of these waterbodies could experience undermining and structural failure if not designed to minimize the alteration and channelization of internal shorelines and/or floodplains, and with full consideration of the potential for sea level rise to expose the corridor waterbodies to increased ocean water levels and flooding. Siting and design options to mitigate these potential adverse impacts have been evaluated in the *I-5 NCC Project Final EIR/EIS* and supporting technical studies to minimize development encroachment into drainage and flood areas as much as feasible, to elevate bridge structures above drainage and flood areas, and to design improvements to withstand significant storm events and erosion.

Table 5.8-3 summarizes the NCC I-5 bridge risk assessment for the complete range of sea level rise scenarios assessed in the San Diego Region Coastal Sea Level Rise Analysis (September 2013), included as Appendix D. As indicated in Table 5.8-3, it is anticipated that the PWP/TREP Phase 1 San Elijo Lagoon and Batiquitos Lagoon highway bridges would not be affected by sea level rise, with the exception of the Batiquitos Lagoon bridge, which would have some potential for short-term flood risk to the I-5 facility operations under the 66-inch sea level rise with fluvial flood scenario. Given the short-term, episodic, and low-frequency operational constraints posed by the risk, the risk would be managed via storm monitoring and operational restrictions, such as short-term (matter of hours) bridge closures should the freeboard insufficient. I-5 bridges to be built in subsequent phases will be reassessed in the future and, consistent with the Design/Development Strategies and Implementation Measures identified in Sections 5.8.3.3 and 5.8.3.4, such assessment will be done in the context of the best available science and guidance for future sea level rise projections available at that time.

TABLE 5.8-3: I-5 BRIDGE SEA LEVEL RISE (SLR) RISK ASSESSMENT

Waterbody/Bridge Location	Construction Timeline	Flood Risk Under Sea Level Rise Without Fluvial Flood	Flood Risk Under Current Sea Level With Fluvial Flood	Flood Risk Under Sea Level Rise With Fluvial Flood			Risk Assessment
		66" SLR	0" SLR	18" SLR	36" SLR	66" SLR	
Los Peñasquitos Creek Bridge Widening	2010-2020	✓	✓	✓	✓	✓	Built in 1970. Proposed bridge is upstream of tidal influence. SLR is not expected to pose any risk to the proposed bridge.
Carmel Creek Bridge Widening	2021–2030	✓	✓	✓	✓	✓	Project requires only nominal widening of existing bridge. Bridge profile set by existing 12-lane facility. SLR in the absence of a flood event is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is expected to be at risk during flood events, which are of short duration. A flood occurring with higher sea levels is expected to pose some short duration risk to the proposed bridge. These risks will be managed via storm monitoring and operational restrictions.
Carmel Creek Bike Bridge (Culvert Replacement)	2021–2030	✓	✓	✓	✓	✓	As a bike bridge there is minimal risk associated with periodic closure during large storm events. SLR in the absence of a flood is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is not expected to be at risk under a flood. A flood occurring with higher sea levels is expected to pose some short-duration risk to the proposed bridge. This risk will be managed via storm monitoring and operational restrictions.
San Dieguito Lagoon Bridge Widening	2021–2030	✓	✓	✓	✓	✓	Built in 1964 and widened in 1994. Project requires nominal widening of existing bridge. Bridge profile set by existing 12-lane facility. SLR in the absence of a flood is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is not expected to be at risk under a flood. A flood occurring with higher sea levels is expected to pose some short-duration risk to the proposed bridge. This risk will be managed via storm monitoring and operational restrictions.

Table 5.8-3: I-5 Bridge Sea Level Rise (SLR) Risk Assessment (continued)

Waterbody/Bridge Location	Construction Timeline	Flood Risk Under Sea Level Rise Without Fluvial Flood	Flood Risk Under Current Sea Level With Fluvial Flood	Flood Risk Under Sea Level Rise With Fluvial Flood			Risk Assessment
		66" SLR	0" SLR	18" SLR	36" SLR	66" SLR	
San Elijo Lagoon Bridge Replacement	2010–2020	✓	✓	✓	✓	✓	SLR is not expected to pose any risk to the proposed bridge.
Batiquitos Lagoon Bridge Replacement	2010–2020	✓	✓	✓	✓	✓	SLR in the absence of a flood is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is not expected to be at risk under a flood. A flood occurring with higher sea levels is expected to pose some short-duration risk to the proposed bridge. This risk will be managed via storm monitoring and operational restrictions.
Agua Hedionda Lagoon Bridge Replacement	2031-2040	✓	✓	✓	✓	✓	SLR in the absence of a flood event is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is expected to be at risk during flood events, which are of short durations. A flood occurring with higher sea levels is expected to pose some short-duration risk to the proposed bridge. These risks will be managed via storm monitoring and operational restrictions.
Buena Vista Lagoon Bridge Replacement	2031-2040	✓	✓	✓	✓	✓	SLR in the absence of a flood event is not expected to pose any risk to the proposed bridge. Under existing sea level the proposed bridge is expected to be at risk during flood events, which are of short durations. A flood occurring with higher sea levels is expected to pose some short-duration risk to the proposed bridge. These risks will be managed via storm monitoring and operational restrictions.

Source: San Diego Region Coastal Sea Level Analysis, September 2013 (included as Appendix D of the PWP/TREP).

Blue indicates PWP/TREP Phase 1 bridge.

✓ No risk; projected water surface elevation below soffit by two feet or more

✓ Short duration (matter of hours) risk to operation of transportation facility; projected water surface elevation above bridge soffit elevation, but not impacting travel lanes

✓ Short duration (matter of hours) risk to operation of transportation facility; projected water surface elevation above soffit and potential short duration impact to travel lanes

To further address potential internal shoreline/bank and channel erosion and to ensure I-5 facilities are designed and constructed to minimize the alteration and channelization of shorelines and/or floodplains, Caltrans has determined that shoreline armoring at I-5 replacement bridge crossings would only occur on the slopes of bridge abutments. Any necessary rock slope protection would not encroach into the proposed channel dimensions as identified in the Lagoon Bridge Optimization Studies. Rock slope protection in the form of energy dissipaters at new or replacement culverts would be installed only where culvert outlet velocities are determined to be erosive during the design phase for the facilities and would be included in the relevant drainage plans.

Hazardous Wastes

Implementation of proposed highway improvements could result in the discovery or release of contaminated materials, primarily during construction activities. Soil along and adjacent to the shoulders of I-5 is generally non-hazardous with respect to Aerial Deposited Lead (ADL); however, if excess soil from the shoulders that contain ADL is exported, further characterization would be necessary to evaluate proper disposal criteria. Hazardous waste with respect to petroleum hydrocarbons concerns include service stations located at intersections. Petroleum hydrocarbons could be encountered in soil and groundwater at intersections during trenching to move utilities and during bridge reconstruction/widening at abutments and bents, particularly at Via de la Valle, Birmingham Drive, Brooks Street, Palomar Airport Road, Carlsbad Village Drive, and Mission Avenue. Caltrans would comply with the National Pollutant Discharge Elimination System (NPDES) permit for handling and disposing of groundwater for intersections, and further characterization for petroleum hydrocarbons, volatile organic compounds, or semi-volatile organic compounds as to the proper disposal.

Two landfills were identified within the project footprint: Olympus Street Landfill at the intersection of Piraeus Street and Olympus Street in Leucadia; and Maxson Street Landfill at Maxson Street in Oceanside. Olympus Street Landfill is a burn ash site and is occupied mostly by residential housing. Soil sampling at Olympus Street Landfill contained non-hazardous concentrations of lead within Caltrans right-of-way and adjacent properties. Maxson Street Landfill included municipal solid wastes now covered by a park, baseball fields, residential housing, a golf course, and retail businesses. Investigations within the existing Caltrans' right-of-way along Maxson Street Landfill did not encounter wastes associated with the landfill.

Nurseries and farmland occur along both sides of I-5 from the Manchester Avenue interchange to the Palomar Airport Road interchange. The shallow soils on and around these nurseries contain pesticides and herbicides; however, testing of soil for pesticides and herbicides indicates that soil containing these pesticides are not considered a hazardous waste.

Chemical spills from truck and auto accidents have historically occurred along I-5. These spills mainly consist of petroleum hydrocarbons, but other chemicals may be present. In addition, there is the potential for hazardous materials release into the environment during construction activities.

Asbestos could be found in bridge joint and piping material. These materials could pose a health hazard if workers are exposed to them during construction activities. Lead-based paint could have been used on metal guardrails, piping, or in structures to be demolished. If yellow paint or yellow thermal plastic paint is to be removed during construction activities, these materials could pose a health hazard if workers are exposed to them during construction activities. The wood guardrail posts and signposts on-site have been treated with creosote. If these posts were removed, a safety and health work practices plan must be submitted to the resident engineer prior to removal. The wood must then be handled and disposed in accordance with Caltrans' treated wood nonstandard special provision.

5.8.3 PWP/TREP Opportunities, Design/Development Strategies and Policies/Implementation Measures

Proposed rail and highway improvements would be located in areas potentially subject to various hazards as discussed above; however, public safety would be improved throughout the corridor as proposed rail and highway improvements would be designed and implemented according to current design practices to better withstand potential seismic, flooding, and erosional events. The corridor is located in a seismically active area due to several nearby faults; however, proposed PWP/TREP improvements would serve to maintain or improve existing and future transportation facilities and operations in the corridor and provide facility compliance with current code requirements that ensure long-term, safe, and efficient operations. The proposed improvements would reduce risk to life and property in the NCC.

5.8.3.1 Corridor Opportunities

Proposed PWP/TREP improvements would involve rail and highway facility upgrade and replacement projects that would provide compliance with current design and code requirements, which would ensure long-term safety and stability for highway facilities and operations. Furthermore, I-5 has been identified as a Strategic Highway Network link, providing defense access, continuity, and emergency capabilities for movement of personnel and equipment in both peace and war times. Overall safety for users of the corridor (and for purposes of emergency evacuation and increased accessibility for emergency vehicles) would be improved with reduced congestion on the transportation facilities.

In addition to implementing rail and highway improvements to increase service and ridership and comply with current design and code requirements (which, in turn, would ensure long-term safety and stability for transportation facilities and operations), proposed bridge improvements have been designed in some locations to reduce existing fill areas and to minimize stream alterations at bridge abutments and pilings, where feasible. These proposed bridge improvements would result in increased and improved drainage across the facility and reduced erosion potential where bridge structures intersect with the waterbody. In particular, the proposed highway improvements would result in a beneficial impact to drainage and flooding where an existing culvert at Sorrento Valley Road would be removed, thus eliminating an existing constriction in Carmel Creek. Overall project benefits to floodplains and system hydrology (decreases in flood water surface elevation) are also anticipated for Batiquitos, Buena Vista, and San Elijo Lagoons with the bridge optimization designs planned for these waterbodies.

Furthermore, the proposed rail improvements would provide a unique opportunity to improve the coastal bluff area in Del Mar with an option to remove the existing rail service from the bluff area, thereby alleviating the need for ongoing maintenance of shoreline protection devices previously permitted to ensure stability of the bluffs and rail operations. Should the rail service be removed from the coastal bluffs in this area, there could be an additional opportunity to remove the existing shoreline protective system and restore the coastal bluff and thus reduce long-term shoreline erosion impacts associated with those shoreline structures.

5.8.3.2 PWP/TREP Policies

Caltrans and SANDAG would implement the following policy to ensure that proposed improvements are designed, implemented, and maintained to provide for maximum site stability and minimization of hazards:

- **Policy 5.8.1:** All highway, rail, bicycle and pedestrian projects, and community and resource enhancement improvements shall be designed and implemented to minimize risks to life and property in areas of high geologic, flood, and fire hazard, and to minimize risk associated with potential hazardous materials release or spillage. Site-specific project design shall~~should~~ be based on the results of detailed (design-level) engineering geologic and geotechnical studies.

5.8.3.3 PWP/TREP Design/Development Strategies

The following design and development strategies provide guidance for designing and implementing specific PWP/TREP rail projects and Caltrans/SANDAG shall utilize the following design and development strategies for all projects subject to Notice of Impending Development (NOID) procedures, consistent with the site stability and management policies of PWP/TREP Policy 5.8.1, amended local coastal programs (LCPs) and the Coastal Act.

1. The requirements of the most current Standard Specifications for Caltrans and/or LOSSAN shall~~should~~ be applied to all proposed improvements to ensure that geotechnically stable slopes are planned and created. Seismic design for the structures shall~~should~~ be based on Seismic Design Criteria.
2. The potential for structural damage and resulting traffic hazard as a result of liquefaction shall~~should~~ be mitigated through site-specific methods such as ground modification methods (soil densification) to prevent liquefaction, or structural design (e.g., deep foundations) to accommodate/ resist the liquefiable zones.
3. The appropriate technical personnel shall~~should~~ be present during project construction of all improvements to observe cuts, foundation subgrade, and embankment subgrade to assure that all design-level provisions are enforced consistent with Caltrans Standard Plans and Specifications and SANDAG requirements. If unanticipated subsurface conditions are encountered, a geotechnical representative shall~~should~~ be notified to make additional recommendations to the resident engineer, who in turn, would direct the contractor to comply with Caltrans Standard Plans and Specifications and SANDAG requirements. Instrumentation for measuring settlement or slope distress, and periodic surveying for ground movement shall~~should~~ be included during construction in areas where the potential for ground movement or failure exists.
4. Project implementation shall~~should~~ include Storm Water Pollution Prevention Plans (SWPPP) and NPDES permit requirements. An SWPPP shall~~should~~ be developed and implemented during construction to reduce pollutants in storm water discharges and the potential for erosion and sedimentation. The SWPPP would include Best Management Practices (BMPs) to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for all stream and lake/lagoon crossings. These may include measures to provide permeable surfaces where feasible and to retain and treat stormwater on-site using catch basins and treatment (filtering) wetlands, especially in areas around existing stations if the areal extent of surface parking is expanded or at new stations where new parking surface is constructed. Measures to manage the overall amount and quality of stormwater runoff to regional systems would be detailed as part of the SWPPP.

5. Where there is no practicable alternative to avoid construction in the floodplain, the footprint of facilities within the floodplain shall~~should~~ be minimized to the extent feasible (e.g., by use of aerial structures or tunnels), and floodplains impacted by construction shall~~should~~ be restored.
6. Shoreline armoring (internal to the lagoon) shall~~should~~ only be allowed to protect existing, legal structures, or where necessary to protect replacement structures across waterbodies, that are proven to be in danger from erosion, and where proposed to improve fish and wildlife habitat only if (a) less-environmentally damaging alternatives to armoring are not feasible (including relocation of endangered structures); and (b) the armoring has been sited, designed, and accompanied by feasible measures to proportionately mitigate any unavoidable negative coastal resource impacts (on views, sand supply, public access, etc.). The limitations of this measure shall~~should~~ not apply to minor runoff control/dissipater features where located and designed to convey and discharge runoff to waterways in a non-erosive manner.
7. As part of the future project-level analysis, all opportunities to minimize flooding risk and potential harm to or within the floodplain shall~~should~~ be assessed and incorporated into project design as applicable.
8. Analysis of how proposed improvements would contribute to total additional impervious surface and the subsequent potential additional impacts on surface runoff shall~~should~~ be conducted. This analysis shall~~should~~ also identify potential mitigation measures to minimize runoff and thereby reduce erosion, including on-site bioswales and retention facilities.
9. All soils proposed for disturbance for improvements shall~~should~~ be investigated for contamination and Phase I Environmental Site Assessments shall~~should~~ be prepared when necessary. When indicated by project-level Phase I Environmental Site Assessments, a Phase II Environmental Site Assessments (e.g., hydrogeologic investigation) shall~~should~~ be prepared to identify specific mitigation measures. The Phase II Environmental Site Assessments shall~~should~~ be prepared in conformance with the ASTM Standards Related to the Phase II Environmental Site Assessment Process (E1903-01). Phase II Environmental Site Assessments mitigations shall~~should~~ be implemented as appropriate.
10. The potential impact of local sea level rise associated with global climate change shall~~should~~ be considered in the design and/or refurbishment of all corridor infrastructure. NOID, federal consistency review and coastal development permit submittals for proposed transportation, bike and pedestrian improvements that may be subject to internal shoreline/bank erosion, tidal inundation and flooding, shall~~should~~ include an analysis of improvement location and design in relation to projected future changes in sea level rise to ensure new development is located and designed to eliminate or minimize, to the maximum extent feasible, hazards associated with anticipated sea level rise over the expected design life of the structure (75 years).
11. The full range of projected sea level rise scenarios utilizing the best available science shall~~should~~ be considered during project-specific alternative design analysis. An analysis of future impacts of erosion related to sea level rise shall be conducted in areas where facilities would be expected to be exposed to storm surge and wave run up during their design life, or where applicable. ~~and, w~~Where feasible, projects shall~~should~~ be designed to accommodate the highest sea level rise projections at 2100, or beyond 2100 if the anticipated design life of the structure extends beyond this date, consistent with the following planning, design, and risk assessment criteria:
   - **Design**
     a. Incorporate consideration of the risks posed by sea level rise into all decisions regarding project elements potentially affected by sea level rise; for the purposes of planning, consider a range of sea level rise scenarios for the years 2050 (2 feet) and 2100 (5.5 feet)

in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. Extrapolation of sea level rise projections beyond 2100 may eventually be necessary for bridges planned for replacement in future phases of the PWP/TREP to address their design lives.

b. Use the ranges provided by the agreed upon best available science, which as of the 2014 date of adoption of the PWP/TREP, is from the NRC.

c. For highway bridges the design life is 75 years.

d. For rail bridges the design life is 100 years.

e. The timeframe identified for a structure is important for sea level rise assessments and will affect the approach for assessing impacts. Up to the horizon year of 2050, there is better agreement among the various climate models for the amount of sea level rise that is likely to occur. After mid-century, projections of sea level rise become more uncertain, because the modeling results diverge and the sea level rise projections vary depending on multiple factors including the rates of glacial volume loss and reductions in greenhouse gas emissions. Therefore, for projects with timeframes beyond 2050, it is especially important to consider adaptive capacity, impacts, and risk tolerance to guide decisions of whether to use low, medium, or high sea level rise projections.

f. Assess potential impacts and vulnerability over a range of sea level rise projections, including analysis of the highest sea level rise values presented in the NRC document, or as presented by the best available science existing at the time of the project combined with site-specific alternatives analysis.

g. Based on the results of the alternatives analysis, the preliminary design shall~~should~~:

   1) Accommodate the maximum sea level rise projection of 5.5 feet by 2100 if feasible; or

   2) Be designed with adaptation strategies for a sea level rise rate that is as high as can be accommodated; where feasible; if the maximum project cannot be accommodated, adaptive strategies shall~~should~~ allow bridge structures and approaches to be raised in the future should the sea level rise projections occur; or

   3) Be designed according to site-specific analysis of local conditions and needs, environmental impacts, and risks involved with closing bridges for very short time periods on an infrequent basis; should facilities be at risk during certain frequency events, the facilities shall~~should~~ be designed to ensure functionality once the event is over.

h. Design parameter decisions shall~~should~~ consider and balance expenditure of public funds and environmental constraints, level of risk and potential consequences. Risk assessment shall~~should~~ consider life expectancy of facility, construction timeframe, availability of alternative routes, and potential level of delay, evacuations/emergencies, and importance as interstate facility (see Caltrans guidelines).

i. Typically rail or highway bridges will be constructed on piles. Consequently, bridge columns will not be subject to flood or tsunami scour and therefore slope protection around the columns will not be required. Abutments however may require slope protection to address flood or tsunami scour. The specifics of the slope protection design shall~~should~~ be site-specific and subject to projected scour velocities and final bridge design.

– **Site-Specific Design Sea Level Rise Analysis –** As the PWP/TREP will be implemented over a 40-year period, for those bridges in the later phases of the PWP/TREP Phasing Plan (beyond Phase 1) the effect of sea level rise shall~~should~~ be reassessed based on updated information from the NRC, or the best agreed upon available science, at the time of the project-specific NOID, Federal Consistency Certification, or Coastal Development Permit, and shallshould include the following:

a. Establish a range of future regional/local relative mean sea level change projections that is consistent with the latest scientific information on regional/local sea level, and land subsidence and uplift. This can be done by either updating the San Diego Region Coastal Sea Level Rise Analysis Report (Appendix D) to the current scientific estimates, or following the steps listed below:

    1) Review the latest scientific literature on global/regional mean sea level rise to identify the most relevant scientific information for the project area.

    2) Review the latest governmental guidance related to global/regional mean sea level rise from federal, state, and local agencies with regulatory responsibilities for the project.

    3) Establish a range of future global/regional mean sea level rise projections that is consistent with the most relevant scientific information and governmental agency guidance from Steps “a” and “b” above, respectively.

    4) Review the latest scientific literature on regional/local land subsidence and uplift to better assess how land elevations relative to sea level elevations may change over the life of the project.

b. For bridges and embankments located far enough from the ocean such that ocean waves do not directly impact structures, the high water level to be used for design is controlled by the fluvial process. The high water level can be established by conducting fluvial hydraulic modeling using design storm events (e.g., 50-year and 100-year flows) at the upstream boundary and a high water level at the downstream boundary (e.g., Mean Higher High Water or the 50-year ocean water level, or following design guidelines by Caltrans or railroad agencies), which would be either the ocean or lagoon. This step shallshould be repeated across the range of future regional/local, relative mean sea level change projections established under Step “a” above. This could be done by analyzing only the design condition if the only issue of concern for design is the design water level or it could entail analyzing the highest and lowest condition to bracket the full range of potential water levels that the project may experience in the future under higher mean sea level conditions. Intermediate conditions may be analyzed if such information would be useful for conducting optimization analyses for such issues as potential environmental impacts and economic considerations (e.g., Step “d” below).

c. For bridges and embankments located close enough to the ocean such that ocean waves may directly impact structures, the high water level to be used for design may need to be based on both fluvial or coastal processes. These structures are subject to both coastal and fluvial storm impacts and, therefore, the project design needs to consider both fluvial and coastal processes. The bridge design shallshould use the higher of design water levels determined in these two independent processes.

    1) The Fluvial Process: Use procedures described in Step “b” above to determine the design water level under the fluvial process.

    2) The Coastal Process: The high design water level shallshould include contributions from astronomical tide, barometric pressure, wave crest elevation, wave set-up, El Niño Southern Oscillation, and Pacific Decadal Oscillation. Depending on the situation, wave run-up on the structure (e.g., embankment) may also need to be considered in establishing the extreme high ocean water level. This step shallshould be repeated

across the range of future regional/local, relative mean sea level change projections established under Step "a" above. This shall~~should~~ be done by analyzing only the design conditions if the only issue of concern for design is the design water level, or it could entail analyzing the highest and lowest condition to bracket the full range of potential water levels that the project may experience in the future under higher mean sea level conditions. Intermediate conditions may be analyzed if such information would be useful for conducting optimization analyses for such issues as potential environmental impacts and economic considerations (e.g., cost-benefit analysis).

d. Conduct analyses to evaluate trade-offs related to bridge and embankment design. This would include consideration of environmental impacts (e.g., visual and habitat impacts), constructability, construction and maintenance costs, and economic (e.g., cost-benefit) considerations. In addition, a risk assessment shall~~should~~ be performed to determine the consequences of failing to address sea level rise adequately for a particular project and the potential impacts to public health and safety, public investments, and the environment. For example, the risk assessment could evaluate the consequences to fully accommodate the combined "worst possible case" scenario of the highest sea level rise condition in combination with a 100-year river or stream flood event. The actual duration of freeboard exceedance at bridges during such an event is likely to be very short, and the analysis shall~~should~~ compare water levels with criteria other than bridge soffits, such as the ballast for the railroad and travel lanes for I-5 to determine actual effects to transportation operations. At this step, facility designs shall~~should~~ consider whether to 1) design a structure such that it is above the highest future projected water level; 2) design a structure such that it is above a lower future projected water level but allows for adaptive strategies to address higher future projected water levels; or 3) establish a design water surface elevation for use based on an acceptable risk assessment.

5.8.3.4 Implementation Measures

Caltrans/SANDAG would utilize the following implementation measures for all projects subject to NOID procedures:

- **Implementation Measure 5.8.1:** Grading and roadway work shall be performed in accordance with Caltrans Standard Plans and Specifications. Drainage for proposed improvements shall be constructed in accordance with the Caltrans Highway Design Manual and SANDAG requirements. Where groundwater is present, subsurface drainage devices shall be installed where necessary.
- **Implementation Measure 5.8.2:** Project affected areas within 100 feet of the blufftop edge shall be protected and enhanced through removal of non-natives and invasives and revegetation with native bluff species, where feasible.
- **Implementation Measure 5.8.3:** Caltrans Environmental Engineering and SANDAG shall be kept informed of parcel takes and changes in scope or design as further hazardous waste investigation may be necessary on individual parcels if acquired/ utilized. Since there are known chemical constituents present in soil and groundwater within the corridor, soil excavation activities shall be performed under the guidelines of a site-specific Soil Management Plan and Health and Safety Plan.
- **Implementation Measure 5.8.4:** The Department of Toxic Substances Control (DTSC) lead variance shall be followed for ADL soil excavated in the proposed improvement area. Soil excavated as a whole along the shoulders may be reused as clean material with regard to ADL, unless soil adjacent to the shoulder is segregated from the whole. The DTSC lead variance shall

apply for segregated soil from the shoulder. Otherwise, the disposal of ADL soil to a Class I landfill shall be required. Handling or disposal of contaminated groundwater shall comply with NPDES permit requirements.

- **Implementation Measure 5.8.5:** Soils located in the immediate vicinity of service stations in the corridor shall be tested for petroleum hydrocarbons, volatile organic compounds, or semi-volatile organic compounds in order to evaluate the proper handling and/or disposal methods should such contaminants be discovered. Soil excavation activities shall be performed under the guidelines of a site-specific Soil Management Plan and Health and Safety Plan and handling or disposal of contaminated groundwater shall comply with NPDES permit requirements.
- **Implementation Measure 5.8.6:** Improvements and construction activities in the vicinity of the landfills shall be avoided to the extent feasible. If parcels are acquired at historic landfill locations and/or if landfill deposits are encountered, soil excavation activities shall be performed under the guidelines of a site-specific Soil Management Plan and Health and Safety Plan and excavated soil shall be subject to further characterization to evaluate potential risk and proper disposal method consistent with Caltrans Standard Plans and Specifications.
- **Implementation Measure 5.8.7:** If soil from locations containing farmland and nurseries is exported or consider for re-use on-site, further characterization for pesticide/herbicides shall be conducted to evaluate potential risks and proper disposal method.
- **Implementation Measure 5.8.8:** Hazardous Materials Contingency Plans to address chemical spills along the NCC alignment shall be written into the construction contract to deal with hazardous waste issues consistent with Caltrans Standard Plans and Specifications and SANDAG requirements.
- **Implementation Measure 5.8.9:** Where wood guardrail posts, signposts, and/or railroad ties are to be removed/demolished during construction, a safety and health work practices plan shall be submitted to the resident engineer prior to removal. As necessary, wood shall be handled and disposed in accordance with the Caltrans' treated wood nonstandard special provision, including disposal at a composite-lined solid-waste landfill facility permitted to accept such wastes.
- **Implementation Measure 5.8.10:** Prior to demolition of any buildings or existing structures such as bridges for project construction, a survey for lead-based paint and asbestos-containing materials shall be prepared. Should lead-based paint and asbestos-containing materials be discovered, a safety and health work practices plan shall be submitted to the resident engineer prior to removal. All lead-based paint and asbestos-containing materials shall be handled and disposed in accordance with applicable Caltrans/SANDAG policies.
- **Implementation Measure 5.8.11:** A Site Management Program/Contingency Plan shall be prepared prior to construction/demolition of improvements to address known and potential hazardous material issues. All highway, rail station and pedestrian crossings, and community and resource enhancement improvement projects shall prepare and implement construction staging plans with designated areas to accommodate equipment and vehicles fueling a minimum of 50 feet away from waterbodies over paved or impervious surfaces, and any fuel or petroleum products used for project equipment and vehicles shall be stored a minimum of 50 feet from waterbodies and within the staging area paved or impervious surfaces. Equipment and vehicles shall be inspected daily for fuel or fluid leaks, and leaking equipment or vehicles shall be repaired or replaced immediately. The contractor shall have available at each staging area adequate spill containment equipment (e.g., absorbent materials, containment booms, etc.) to respond to potential fuel or oil spills or leaks from project-related vehicles and equipment.

- **Implementation Measure 5.8.12:** SANDAG and Caltrans acknowledge and agree: (i) that the site of the proposed project may be subject to hazards from seismic events, tsunamis, liquefaction, storms, floods, erosion, and toxic contaminants; (ii) to assume the risks to employees and assigns of Caltrans/SANDAG, including contractors and subcontractors and their officers, agents, and employees, and to the public utilizing the proposed project during and after construction, and to the property that is the subject of this permit of injury and/or damage from such hazards in connection with this permitted development; (iii) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (iv) to indemnify and hold harmless the Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense against such claims), expenses, and amounts paid in settlement arising from any injury or damage due to such hazards.

5.8.4 Coastal Act Consistency

Coastal Act Section 30253 addresses the need to ensure long-term stability and structural integrity, minimize risk, and avoid landform-altering devices. Section 30253 provides, in applicable part:

> Section 30253. New development shall:
>
> (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.
>
> (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.
>
> Section 30235. Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fish kills should be phased out or upgraded where feasible.

Coastal Act Section 30232 requires that hazardous spill risks be minimized and that appropriate containment and cleanup facilities and procedures be in place should spills accidentally occur.

Section 30232 states:

> Section 30232. Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.

Coastal Act Section 30236 requires that modifications to rivers and stream incorporate feasibly mitigation measures, and limits development in such waterways to water supply and certain flood control projects, or for purposes of improving fish and wildlife habitat.

> 30236. Channelizations, dams, or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (1) necessary water supply projects, (2) flood control projects where no other method for protecting existing structures in the

floodplain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.

5.8.4.1 Corridor Consistency Analysis

Geology, Soils, Seismicity, and Topography

Proposed corridor improvements would be designed and developed to avoid and minimize potential impacts associated with geologic hazards, unstable soils, seismicity, and topography, as demonstrated through environmental documentation and technical studies for the proposed improvements.

To avoid the risks associated with seismic hazards during construction of the proposed improvements, the PWP/TREP includes design/development strategies and implementation measures that direct appropriate technical personnel to be present during project construction of all improvements to observe cuts, foundation subgrade, and embankment subgrade to assure that all design-level provisions are enforced. If unanticipated subsurface conditions are encountered, the PWP/TREP requires that a geotechnical representative would be notified to make additional recommendations to the resident engineer, who in turn, would direct the contractor. To avoid these risks during rail development, future site-specific project LOSSAN design could be based on the results of detailed (design-level) engineering geologic and geotechnical studies and could include measures such as ground modification methods (soil densification) to prevent liquefaction, or structural design (e.g., deep foundations) to accommodate/ resist the liquefiable zones.

Site and soil stability would be addressed further through developing and implementing SWPPP and NPDES permit requirements. As the program improvements would be contained primarily within existing facility corridor and/or improvement areas, proposed improvements would avoid construction of undisturbed, and potentially unstable steep topography. Other potential impacts associated with topography, excessive erosion, and construction activities would be addressed with construction-phase BMP requirements, which would serve to minimize uncontrolled site runoff and erosion and ensure site stability, discussed in more detail in Section 5.4, Marine Resources: Water Quality and Wetlands.

It is unlikely that train derailment during a potential peak event could be mitigated by designing a track-wheel system capable of withstanding the ground motions in most of the project area. Existing train systems throughout California, including the existing service along the LOSSAN rail corridor, face the same challenge; however, a network of strong-motion instruments has been installed throughout California and additional monitoring stations are proposed. These stations provide ground-motion data that could be used with the rail instrumentation and controls system to temporarily shut down the LOSSAN rail operations during or after an earthquake. The system would then be inspected for damage due to ground motion and/or ground deformation and then returned to service when appropriate. This type of seismic protection is already used for many transit systems in seismically active areas and has been proven effective.

Drainage and Flooding

Potential impacts associated with drainage and flooding have been addressed, in large part, through design of corridor facilities, including both rail and highway bridge facilities.

As noted previously, many of the proposed rail improvements (e.g., San Dieguito Double-Track and Bridge Replacement, Sorrento Valley Double-Track) will elevate the track over existing drainage and flood areas to address drainage and flooding concerns. It is expected that crossings over the corridor's waterbodies would continue to include bridges or culverts or, in the case of Del Mar and University Town Center, by improvements involving deep tunnels that would avoid surface floodplains. To reduce potential flood hazards associated with new or upgraded rail and highway facility crossings, lagoon optimization studies were conducted to evaluate and determine the optimal crossing design. In addition, design and development strategies provide that future project-level analysis for proposed improvements would assess floodplain hydrology/hydraulics and evaluate the impacts of specific designs on water surface elevations, flood conveyance, and potential flooding risk. Where feasible, construction of facilities within floodplains would be avoided, or the footprint of facilities within the floodplain would be minimized.

Pursuant to Section 30236 of the Coastal Act, certain types of channelization projects and other developments resulting in the alteration of rivers and streams may be allowed when necessary for a required flood control project, where no other method for protecting existing structures in the floodplain is feasible, and where such protection is necessary for public safety or to protect existing development and only when such development incorporates the best mitigation measures feasible. The proposed improvements would not include new pipes, box culverts, or other structures that would result in significant alteration of natural stream courses or drainages. PWP/TREP improvements that would occupy areas within floodways (i.e., bridges) in the corridor potentially resulting in alteration of rivers and streams are permitted pursuant to Section 30236, as the improvements are necessary to upgrade and protect existing structures for continued public safety. Improvements would not create an unreasonable, unnecessary, undesirable, or dangerous impediment to the flow of floodwaters, and would be designed to minimize necessary stream alternations, and to provide new opportunities to improve stream flow and fish and wildlife habitat.

Environmental documentation and technical studies for proposed highway improvements concluded that highway improvements would have a negligible effect on drainage and floodplains in the corridor and would result in improved drainage and flood conveyance at Carmel Creek, Batiquitos, Buena Vista, and San Elijo Lagoons. Proposed highway improvements would not include construction of new pipes, box culverts, or underground channels that would adversely affect natural stream courses or cause drainage or floodplain impacts. Highway bridge improvements that would occupy areas within floodways in the corridor would be necessary to upgrade and protect existing or replacement crossing structures for continued public safety. Improvements would not create an unreasonable, unnecessary, undesirable, or dangerous impediment to the flow of floodwaters, and would be designed to minimize necessary stream alternations. Other than placing necessary bridge support structures (abutments and/or pilings) and extending existing culverts, proposed highway improvements would not involve the construction of new structures that would alter significant drainage patterns.

Shoreline Erosion/Sea Level Rise

Drainage and flooding impacts associated with the proposed NCC improvements would be negligible, which would in turn minimize potential adverse impacts associated with alteration and channelization of shorelines and/or floodplains and associated erosion. Other than necessary protection structures placed at the base of bridge support structures (abutments and/or pilings), proposed highway improvements would not involve the construction of new or expanded internal shoreline/bank protective devices that would alter natural landforms or shorelines and result in associated shoreline erosion. In locations where bridge structures would be replaced and lengthened (San Elijo, Batiquitos, and Buena Vista Lagoons) and where culvert removal is proposed at Carmel Creek, removal of existing bridge abutment and culvert structures would result in restoring a more natural shoreline at the facility crossing.

To ensure that necessary protection structures for bridge supports (abutments and/or pilings) are developed consistent with the Coastal Act, PWP/TREP design/development strategies require that internal shoreline/bank armoring be allowed only to protect existing legal structures, or where necessary for replacement structures across waterbodies that are proven to be in danger from erosion, and only if (a) less-environmentally damaging alternatives to armoring are not feasible (including relocation of endangered structures); and (b) the armoring has been sited, designed, and accompanied by feasible measures to mitigate any unavoidable negative coastal resource impacts (on views, sand supply, public access, etc.). The PWP/TREP further provides that policy limitations on shoreline structures should not apply to minor runoff control/dissipater features where located and designed to convey and discharge runoff to waterways in a non-erosive manner.

The PWP/TREP includes rail improvement options in Encinitas that would be set back east of Pacific Coast Highway, thereby providing an ample buffer between the rail alignment and the coastal bluffs. The proposed rail improvements provide a unique opportunity to improve the coastal bluff area in Del Mar with an option to remove the existing rail service from the bluff area, thereby alleviating the need for ongoing maintenance of shoreline protection devices previously permitted to ensure stability of the bluffs and rail operations. Should the rail service be removed from the coastal bluffs in this area, there could be an additional opportunity to remove the existing shoreline protective system and restore the coastal bluff and thus reduce long-term shoreline erosion impacts associated with those shoreline structures; however, it is also recognized that there is a need for the existing, permitted shoreline protection system at the Del Mar Bluffs to protect the existing rail facility, and that this system could require maintenance to maintain site stability and rail operations in this area. It is also recognized that some shoreline alteration at bridge abutments and piles could be required where rail facility bridges cross waterbodies throughout the corridor.

In addition, SANDAG prepared the San Diego Region Coastal Sea Level Rise Analysis (Appendix D of the PWP/TREP), which assesses potential drainage and flooding impacts to transportation infrastructure crossing those waterbodies throughout the region potentially subject to sea level rise. The results of this study, when considered for planning and design of the PWP/TREP infrastructure improvements, ensure that both rail and highway facility crossings are considered together in terms of identifying design options and, where necessary, adaptive strategies, that address the possible long-term effects of sea level rise and related drainage, flooding and shoreline erosion impacts. As such, the proposed PWP/TREP bridge replacement projects are designed to accommodate the anticipated increase in mean sea level rise through the year 2100 through design and/or adaptive strategies, which would minimize structure exposure to increased ocean water levels and flooding.

In addition, PWP/TREP design/development strategies and implementation measures specify that submittals for proposed rail, highway, and community enhancement improvements that may be subject to internal shoreline/bank erosion, tidal inundation and flooding should include an analysis of improvement location and design in relation to projected future changes in sea level rise to ensure new development is located and designed to eliminate or minimize, to the maximum extent feasible, hazards associated with anticipated sea level rise over the expected design life of the structures (75 years). These design strategies and implementation measures would ensure that the proposed improvements are analyzed according to the best available scientific information throughout the course of the 40-year PWP/TREP program, and are thus located and designed to address potential hazards associated with the anticipated increase in mean sea level rise, based on the most current sea level rise projections and data available at the time of project implementation.

Hazardous Wastes

Proposed corridor improvements would be designed and developed to avoid and minimize potential impacts associated hazardous material release into the environment. Design and development strategies provide for implementation of Site Management Program/Contingency Plans, when applicable, to address known and potential hazardous material issues, which could include contaminated soil and groundwater, lead-based paint, and asbestos-containing materials. The NCC PWP/TREP includes numerous implementation measures to ensure that potential on-site hazardous materials along the improvement areas be properly identified and that plans be developed for the handling and disposal of such materials in a safe and legal manner. To avoid and minimize hazardous materials risks, soils proposed for disturbance for rail improvements would be investigated for contamination and Phase I and/ Phase II Environmental Site Assessments prepared, when necessary. Design and development strategies for future, project-specific improvements also include preparation and implementation of construction staging plans, which would require that construction refueling/staging occur in pre-designated areas away from waterbodies (a minimum of 50 feet away from waterbodies) and adequate spill containment equipment (e.g., absorbent materials, containment booms, etc.) to respond to potential fuel or oil spills or leaks from project-related vehicles and equipment. In addition, the PWP/TREP requires that equipment be inspected and maintained at regular intervals, and that appropriate cleanup facilities and procedures be in place should spills accidentally occur.

5.8.4.2 Coastal Act Consistency Analysis Summary

Based on available project and environmental data, and policies, strategies, and implementation measures included herein, the proposed PWP/TREP improvements would minimize risks to life and property in areas of high geologic hazards, assure project stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area, consistent with Section 30253 of the Coastal Act. PWP/TREP improvements would not result in construction of new shoreline protection structures that would substantially alter natural shoreline processes. Shoreline protection structures associated with the proposed improvements would be minor and would consist only of protection measures necessary to support existing and/or replacement facility crossings, where designed, to eliminate or minimize impacts to shoreline processes. As such, proposed PWP/TREP improvements are consistent with Section 30235 of the Coastal Act. Finally, the PWP/TREP would provide for protection against spillage of crude oil, gas, petroleum products, or hazardous substances and would require that effective containment and cleanup facilities and procedures be in place for accidental spills that could occur. The PWP/TREP is therefore also consistent with Section 30232 of the Coastal Act.

Assumption of Risk

The PWP/TREP NOID and phased Federal Consistency review processes, when applicable, will include appropriate, detailed environmental information and technical studies required to address issues associated with potential hazards in the corridor prior to project implementation to ensure consistency with Sections 30253, 30235 and 30232 of the Coastal Act; however, the proposed project would be subject to potential geologic and hazardous materials risks. Furthermore, the location of the proposed project would render it subject to the additional natural hazards posed by storms and floods, as would be true of any project constructed in this portion of the coast.

Although PWP/TREP policies, strategies, and implementation measures would be applied to specific PWP/TREP improvements, which are anticipated to withstand the predictable hazards associated with development in the corridor, it is not possible to remove all risk associated with the uncertainties of natural hazards. Residual risks remain. For these reasons, even though Caltrans/SANDAG has and/or would minimize predictable risks by engineering the proposed project to avoid, mitigate, and/or withstand the impacts described above, a degree of risk from natural hazards would remain and could not be fully mitigated. To protect the Coastal Commission and its employees from liability for the hazards posed by the subject structures and project features designed and managed by Caltrans/SANDAG, the PWP/TREP provides that SANDAG/Caltrans acknowledge and accept these risks.

5.8.5 Local Coastal Program Consistency

The corridor's local coastal programs (LCPs) for natural hazards, shoreline protection, and hazardous materials policies are summarized with brief city-specific consistency analyses below, which also integrate and supplement the above consistency analysis for Sections 30253, 30235 and 30232 of the Coastal Act.

5.8.5.1 Local Coastal Program Consistency Analysis Summary

Most of the corridor LCPs include policies that mirror, in part, the requirements of Sections 30253, 30235 and 30232 of the Coastal Act; however, the LCPs for Del Mar, Encinitas, Carlsbad and Oceanside also include a variety of additional, detailed and city-specific policies and development standards that address potential impacts associated with natural hazards, shoreline development and protection and erosion and, to a lesser extent, hazardous materials. Common policy requirements within the NCC LCPs include:

- Requiring site-specific geologic and/or geotechnical studies to identify potential site hazards and appropriate mitigation measures.
- Limiting construction in floodplains and shoreline protection devices pursuant to Sections 30235 and 30236 of the Coastal Act.
- Imposing bluff setback requirements.
- Avoiding grading and development on steep slopes, where feasible, and limiting the duration and timing of grading activities.
- Implementing drainage and stormwater runoff control plans to minimize site erosion.
- Minimizing grading and removal of vegetation.
- Revegetating graded and disturbed areas with native, drought-tolerant plant species to minimize erosions.
- Implementing drainage and stormwater runoff control plans to minimize site erosion.

It should be noted that many of the City's LCP policies that address natural hazards through grading, drainage, and stormwater runoff controls are also relied upon to address marine resources and water quality concerns. As such, LCP policies that focus on grading, drainage, and stormwater runoff measures are also addressed in more detail in Section 5.4, Marine Resources.

City of San Diego

The City of San Diego LCP and the corridor's five individual Community Plans contain a comprehensive set of policies to address potential hazards very similar to those listed above as common policies within the NCC LCPs. While San Diego's LCP may vary to some degree in the details of its policy requirements, the most significant deviation in policies that address potential hazards from the other corridor LCPs relates primarily to restrictions on development encroachment onto steep slopes (25% or more grade); however, the Community Plans provide exemptions from this rule for major roads.

City of Del Mar

The City of Del Mar LCP includes policies that speak to requiring and implementing geotechnical and civil engineering studies and site-specific drainage, planting and irrigation systems to ensure site stability, in addition a number of policies that specifically address the city's fragile coastal bluffs and lagoon floodplains. The following policies provide guidance in analyzing potential visual resource issues associated with proposed rail improvements:

- Review all proposed drainage and irrigation systems for their ability to control runoff and seepage into downstream areas and to ensure that no significant erosion or the associated siltation of downstream resources will occur.
  - For purposes of this Land Use Plan, "significant erosion" shall mean the likelihood of removal of soil or the cutting, scarring, or rilling of slopes, canyons, or bluff faces, or the silting of lower slopes brought about by runoff from surfaces during irrigation or from rainfall of an intensity and duration less than or equal to that of the 100-year period design storm.
- A minimum setback of 40 feet from the edge of the coastal bluff top shall be provided in the construction of all principal structures and all accessory structures, such as, but not limited to: pools, spas, storage sheds, gazebos and above grade decks or patios...No grading or construction activities shall be allowed on the face of a coastal bluff unless approved as part of a Shoreline Protective Permit or Setback Seawall Permit issued in accordance with the provisions of this Land Use Plan and when such activity on the bluff face has been minimized to the maximum extent feasible necessary to provide the authorized shoreline protection.
- Native and other drought-tolerant plant species shall be utilized in all new blufftop construction projects so as to minimize irrigation requirements and to reduce potential slide hazards due to over watering of the bluffs. The construction of irrigation systems shall be prohibited within 40 feet of the edge of the coastal bluff top. In review of new construction projects, the removal of existing irrigation systems within the 40-foot setback shall be required as a condition of development.
- Areas to be retained in their natural state pursuant to the coastal bluff regulations shall be subject to conditions to ensure the future protection of the designated area(s) from encroachment, disturbance or degradation. Said conditions shall include the recordation of an open space deed restriction or open space easement to assure protection of the designated area and to serve notice to the property owner, subsequent owners or interested parties of the restrictions in effect on such property.
- Enhance public safety within the San Dieguito River Floodway by:
  - Prohibiting the construction of permanent structures or the placement of fill on either a temporary or permanent basis within designated floodway areas.
  - Prohibiting uses in the floodway that would constitute an unreasonable, unnecessary, undesirable, or dangerous impediment to the flow of floodwaters, or that would cause a cumulative increase in the water surface elevation of the base flood or more than 1 foot at any point.
  - Requiring proposed development to be located so as to eliminate the need for protective devices such as seawalls, riprap, retaining walls, or other flood control devices.
- Ensure that the development of real property that is subject to floodwaters will not obstruct flood flow; will not create a hazard to life, health, safety, or the general welfare; will reduce the need for

the construction of flood control facilities that would be required if unregulated development occurs; and will minimize the cost of flood insurance to Del Mar residents.

City of Encinitas

The City of Encinitas LCP includes policies that address flooding, drainage, site stability, shoreline/bluff development and hazardous materials impacts similar to Coastal Act policy requirements, and in some cases provides specific development standards within designated overlays to achieve the LCP's policy goals:

- Development and grading or filling in drainage courses, floodways and floodplains shall be prohibited except as provided by Land Use Element Policy 8.2. Exceptions may also be made for development of circulation element roads; necessary water supply projects; flood control projects where no other method for protecting existing structures in the floodplain is feasible and where such protection is necessary for public safety or to protect existing development; developments where the primary function is the improvement of fish and wildlife habitat; and other vital public facilities, but only to the extent that no other feasible alternatives exist, and minimum disruption to the natural floodplain, floodway or drainage course is made. When flood/drainage improvements are warranted, require developers to mitigate flood hazards in those areas identified as being subject to periodic flooding prior to actual development.
- Restrict development in those areas where slope exceeds 25% as specified in the Hillside/Inland Bluff overlay zone regulations of the zoning code. Encroachment into slopes as detailed in the Hillside/Inland Bluff overlay may range from 0% ~~percent~~ to a maximum of 20% ~~percent…~~ upon the discretionary judgment that there is no feasible alternative siting or design that eliminates or substantially reduces the need for such encroachment, and it is found that the bulk and scale of the proposed structure has been minimized to the greatest extent feasible and such encroachment is necessary for minimum site development and that the maximum contiguous area of sensitive slopes shall be preserved. Within the Coastal Zone and for the purposes of this section, "encroachment" shall constitute any activity that involves grading, construction, placement of structures or materials, paving, removal of native vegetation including clear-cutting for brush management purposes, or other operations that would render the area incapable of supporting native vegetation or being used as wildlife habitat. Exceptions may also be made for development of circulation element roads, local public streets, or private roads and driveways, which are necessary for access to the more developable portions of a site on slopes of less than 25% grade, and other vital public facilities, but only to the extent that no other feasible alternatives exist, and minimum disruption to the natural slope is made.
- The City shall provide for the reduction of unnatural causes of bluff erosion, as detailed in the Zoning Code, by:
  - Requiring new structures and improvements to existing structures to be set back 25 feet from the inland blufftop edge, and 40 feet from coastal blufftop edge with exceptions to allow a minimum coastal blufftop setback of no less than 25 feet. For all development proposed on coastal blufftops, a site-specific geotechnical report shall be required. The report shall indicate that the coastal blufftop setback will not result in risk of foundation damage resulting from bluff erosion or retreat to the principal structure within its design life and with other engineering evidence to justify the coastal blufftop setback.
- Standards for the justification of preemptive erosion control devices and limits on location of shoreline devices shall be as detailed in the Zoning Code.

- Land uses involved in the production, storage, transportation, handling, or disposal of hazardous materials will be located a safe distance from land uses that may be adversely impacted by such activities.

City of Carlsbad

The City of Carlsbad LCP incorporates Section 30253 of the Coastal Act into the LCP and recommends several actions to address potential natural hazard, flooding and drainage, and shoreline development issues within the city. In particular, the Carlsbad LCP focuses on grading restrictions and drainage requirements as a means of minimizing erosion and ensuring site stability:

- City's Grading Ordinance, Storm Water Ordinances, Standard Urban Storm Water Mitigation Plan (SUSMP), Master Drainage Plan, and the following additional requirements. The SUSMP, dated April 2003 and as amended, the Master Drainage Plan (1994) are hereby incorporated into the LCP by reference. Development must also comply with the requirements of the Jurisdictional Urban Runoff Management Program (JURMP) and the San Diego County Hydrology Manual to the extent that these requirements are not inconsistent with any policies of the LCP.
- Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. As a condition of Coastal Development Permit approval, permitted shoreline structures may be required to replenish the beach with imported sand. Provisions for the maintenance of any permitted seawalls shall be included as a condition of project approval.
- Any development proposal that affects steep slopes (25% inclination or greater) shall be required to prepare a slope map and analysis for the affected slopes. Steep slopes are identified on the PRC Toup maps. The slope mapping and analysis shall be prepared during the California Environmental Quality Act environmental review on a project-by-project basis and shall be required as a condition of a Coastal Development Permit.
- Slopes of 25% grade and over shall be preserved in their natural state, unless the application of this policy would preclude any reasonable use of the property, in which case an encroachment not to exceed 10% of the steep slope area over 25% grade may be permitted. This policy shall not apply to the construction of roads on the City's Circulation Element or the development of utility systems.
- Development shall continue to be restricted in 100-year floodplain areas. Continuing the policy of zoning 100-year floodplains as open space will permit natural drainage to occur without the need for flood control channels. No permanent structures or filling shall be permitted in the floodplain and only uses compatible with periodic flooding shall be allowed.

City of Oceanside

The City of Oceanside LCP includes policies that mirror the requirements of Sections 30253 and 30235 of the Coastal Act, and additional policies with an emphasis on development along and within the shoreline and San Luis Rey River area:

- Coastal bluff development shall be permitted if the design and setbacks are adequate to ensure stability for the expected design life of the development, and measures are taken to control runoff, foot traffic, irrigation, or other activities that could aggravate erosion problems.
- In order to protect life and property in the river area from flood hazards, the City shall:
  - Prevent encroachment of permanent structures into the floodway.

  - Allow only flood compatible uses and structures, per the Federal Flood Insurance Agency's regulations, within the 100-year floodplain.
  - Cooperate with Army Corps of Engineers to ensure completion of the flood control project, as proposed.
- To protect life and property in the river area from geologic hazards:
  - Stabilize or remove the vertical cut-slope in the northwestern corner of Lawrence Canyon, in conjunction with development of that site.
- Require new blufftop development in the river area to maintain an adequate setback from the bluff edge and, where necessary, erect barriers along the bluff to maintain public safety

Corridor LCP policies regarding site and soil stability for proposed rail and highway improvements would be addressed by the PWP/TREP through developing and implementing SWPPP and NPDES permit requirements. As the program improvements would be contained primarily within existing facility corridor and/or improvement areas, proposed improvements would minimize construction of undisturbed, and potentially unstable steep topography. Other potential impacts associated with topography, excessive erosion, and construction activities would be addressed with construction-phase BMP requirements, which would serve to minimize uncontrolled site runoff and erosion and ensure site stability.

Potential impacts associated with drainage and flooding would be addressed, in large part, through appropriate design of rail and highway facilities. As noted previously, many of the proposed rail improvements (e.g., San Dieguito Double-Track and Bridge Replacement, Sorrento Valley Double-Track) will elevate the track over existing drainage and flood areas to address drainage and flooding concerns. It is expected that crossings over the corridor's waterbodies would be spanned either by bridges or culverts or, in the case of Del Mar and University Town Center, by improvements involving deep tunnels that would avoid surface floodplains. Future project-level analysis for proposed rail improvements would assess floodplain hydrology/hydraulics and evaluate the impacts of specific designs on water surface elevations, flood conveyance, and potential flooding risk. Where feasible, construction of facilities within floodplains would be avoided, or the footprint of facilities within the floodplain would be minimized. Other than necessary protection structures placed at the base of bridge support structures (abutments and/or pilings), proposed highway improvements would not involve the construction of new or expanded shoreline protective devices that would alter natural landforms or shorelines and result in associated shoreline erosion. In cases where bridge structures would potentially be replaced and lengthened (San Elijo, Batiquitos, and Buena Vista Lagoons) and where culvert removal is proposed at Carmel Creek, removal of existing bridge abutment and culvert structures would result in restoring a more natural shoreline at the facility crossing.

Furthermore, environmental documentation and technical studies for proposed highway improvements concluded that highway improvements would have a negligible effect on drainage and floodplains in the corridor and would result in improved drainage and flood conveyance at Carmel Creek, Batiquitos, Buena Vista, and San Elijo Lagoons. The proposed bridge widening at the San Luis Rey River would widen the channel, and replace columns in their existing locations along the edge of the channel. Proposed highway improvements would not include construction of new pipes, box culverts, or underground channels that would adversely affect significant natural stream courses or cause drainage or floodplain impacts. Highway bridge improvements that would occupy areas within floodways in the corridor would be necessary to upgrade and protect existing or replacement crossing structures for continued public safety. Improvements would be designed to minimize necessary stream alternations.

Other than placing necessary bridge support structures (abutments and/or pilings) and extending existing culverts, proposed highway improvements would not involve the construction of new structures that would alter drainage patterns.

Shoreline protection structures associated with the proposed improvements would be minor and would consist only of protection measures necessary to support existing and/or replacement facility crossings, where designed, to eliminate or minimize impacts to shoreline processes. It is recognized that there is a need for the existing, permitted shoreline protection system at the Del Mar Bluffs to protect the existing rail facility, and that this system could require maintenance to maintain site stability and rail operations in this area. It is also recognized that some shoreline alteration at bridge abutments and piles could be required where rail facility bridges cross waterbodies throughout the corridor. To ensure this development continues to be maintained and developed consistent with applicable LCP policies, the PWP/TREP specifies that shoreline armoring should only be allowed to protect existing, legal structures, or where necessary for replacement structures across waterbodies, that are proven to be in danger from erosion, and only if: (a) less-environmentally damaging alternatives to armoring are not feasible (including relocation of endangered structures); and (b) the armoring has been sited, designed, and accompanied by feasible measures to proportionately mitigate any unavoidable negative coastal resource impacts (on views, sand supply, public access, etc.).

The NCC PWP/TREP specifies that the potential impact of sea level rise associated with global climate change be considered in the design and/or refurbishment of all transportation corridor infrastructure. Caltrans and SANDAG have demonstrated that the proposed bridge replacement projects are designed to accommodate the anticipated increase in mean sea level rise through the year 2100, which would minimize the structures' exposure to increased storm surge, wave uprush, and flooding. The PWP/TREP further specifies that future project-specific rail, highway and community enhancement improvements that may be subject to shoreline erosion, tidal inundation and flooding should include an analysis of improvement location and design in relation to projected future changes in sea level rise to ensure new development is located and designed to eliminate or minimize, to the maximum extent feasible, hazards associated with anticipated sea level rise over the expected design life of the structures (75 years). These analyses would ensure that the proposed improvements are located and designed to address potential hazards associated with the anticipated increase in mean sea level rise, based on the most current sea level rise projections and data available at the time of project implementation.

In addition, the PWP/TREP calls for protection against the spillage of crude oil, gas, petroleum products, or hazardous substances, and that effective containment and cleanup facilities and procedures be in place for accidental spills that could occur during construction activities.

As discussed above, PWP/TREP improvements would minimize risks to life and property in areas of high geologic hazards, assure project and site stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of shoreline protective devices that would substantially alter natural landforms along bluffs and cliffs. As such, the PWP/TREP is consistent with applicable LCP policies addressing geology, soils, seismicity, topography, drainage and flooding, shoreline erosion, and hazardous wastes and, therefore, these policies would not need to be amended for implementation of the proposed transportation facility improvements.