NORTH COAST CORRIDOR
PUBLIC WORKS PLAN/TRANSPORTATION AND
RESOURCE ENHANCEMENT PROGRAM

UPDATED DRAFT MARCH 2013

Appendix A

Safe Access to Transit and Coastal Resources

Pedestrian and Bicycle Mobility Improvements in the North Coast Corridor

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1.0 THE NORTH COAST CORRIDOR VISION

The Interstate 5 (I-5) North Coast Corridor (NCC) Public Works Plan / Transportation and Resource Enhancement Program (PWP/TREP) provides the California Department of Transportation (Caltrans) and the San Diego Association of Governments (SANDAG) with a ground-breaking programmatic approach for implementing the region's multimodal transportation and resource enhancement vision for the 27-mile coastal corridor between the six cities comprising the NCC: San Diego, Del Mar, Solana Beach, Encinitas, Carlsbad, and Oceanside. The vision includes a series of highway, rail, transit, bicycle, pedestrian, and community and environmental enhancement projects to improve and maintain mobility and coastal resources in the NCC through 2030. The PWP/TREP's comprehensive planning, analytical, and implementation mechanism addresses multimodal improvements throughout the entire corridor as one system and links coastal resource and environmental improvements to the transportation projects. This balanced multimodal approach to project development responds to existing infrastructure deficiencies, growing population and travel demand, and access needs to coastal resources and recreational facilities (beaches, lagoons, open spaces), transit, activity centers, and communities.

This report addresses the pedestrian and bicycle component of the corridor's multimodal vision. Consistent with state Senate Bill (SB) 468, this report:

- Identifies the existing and planned pedestrian and bicycle networks in the NCC.
- Presents the pedestrian and bicycle improvements within the I-5 highway and Los Angeles-San Diego-San Luis Obispo (LOSSAN) rail rights-of-way that are proposed to be implemented as part of the I-5 highway and LOSSAN rail projects in the PWP/TREP.
- Looks outside the I-5 highway and LOSSAN rail rights-of-way to identify any additional potential opportunities to improve pedestrian access to regional LOSSAN rail transit stations and coastal resources within a ¾-mile walking distance of these stations that could be permitted independently of the PWP/TREP.

This report is also intended to support SANDAG's broader safe routes to transit analysis and requirements pursuant to SB468 by documenting improvements in the safety and connectivity of the adopted regional bicycle plan in the I-5 highway and LOSSAN rail rights-of-way. The projects and findings in this report are incorporated into the PWP/TREP to be implemented concurrently with the I-5 highway and LOSSAN rail projects. Caltrans will take responsibility for implementing PWP/TREP projects within and parallel to the I-5 highway right-of-way. SANDAG will be responsible for implementing specific projects within the LOSSAN rail right-of-way and will be able to use the focused analysis in this report to support its broader, regional efforts to improve pedestrian and bicycle mobility.

2.0 EXISTING AND PLANNED BICYCLE AND PEDESTRIAN FACILITIES IN THE NCC

Bicycle and pedestrian facilities and routes are critical elements of the multimodal vision and transportation network in the NCC. Local jurisdictions in the corridor have identified pedestrian, bicycle, and trail networks in various community plans, and SANDAG recently adopted a Regional Bicycle Master Plan that defines a bicycle network in the NCC. In addition, Caltrans, in collaboration with the NCC cities, has established the I-5 North Coast Bike Trail plan, and SANDAG, in collaboration with the cities, has established an alignment for the Coastal Rail Trail in the NCC. Within the NCC, elements of these

pedestrian and bicycle networks have been implemented and provide access to the coast and upland areas. However, gaps and barriers exist in these networks, which limit access and circulation and inhibit many local and longer-distance pedestrian and bicycle trips that might otherwise occur. The multimodal transportation vision for the corridor includes upgrading and addressing many of these bicycle and pedestrian barriers, closing gaps in regional and local bicycle and pedestrian networks, and enhancing local trails to provide improved accessibility to coastal resources and recreational facilities (beaches, lagoons, open spaces), transit stations and stops, and local activity centers. The PWP/TREP plans significant pedestrian and bicycle infrastructure enhancements to achieve this vision.

Figures 1A through **6B** display the bicycle networks and pedestrian access in the NCC to show the non-motorized access routes to transit and coastal resources in the corridor. The maps also show, in green, all bicycle and pedestrian projects that are planned in the I-5 highway and LOSSAN rail rights-of-way as part of the NCC program. The following six city-focused maps ("A" maps) cover the entire NCC and include all existing networks and planned improvements, while the six station area maps ("B" maps) home in on a ¾-mile walking radius from each LOSSAN rail station:

- Figure 1A: North San Diego
- Figure 1B: Sorrento Valley Station Area
- Figure 2A: North San Diego, Del Mar, Solana Beach, and South Encinitas
- Figure 2B: Solana Beach Station Area
- Figure 3A: Encinitas
- Figure 3B: Encinitas Station Area
- Figure 4A: North Encinitas and South Carlsbad
- Figure 4B: Carlsbad Poinsettia Station Area
- Figure 5A: North Carlsbad and South Oceanside
- Figure 5B: Carlsbad Village Station Area
- Figure 6A: Oceanside
- Figure 6B: Oceanside Station Area

2.1 PLANNED IMPROVEMENTS ADJACENT TO THE I-5 HIGHWAY CORRIDOR

The proposed highway improvements will expand the existing I-5 highway to provide two managed lanes in each direction between Oceanside and northern San Diego, with Direct Access Ramps (DARs) at key locations. Carpools and bus transit will use the new managed lane facility for free, and single-occupant vehicles will be allowed access for a fee that will support transit operations. Variable pricing based on congestion levels and other Intelligent Transportation Systems (ITS) elements will improve the ability to manage congestion. New auxiliary lanes are also proposed along segments of I-5 to improve the efficiency and safety of the highway facility.

2.1.1 I-5 Highway Local-Road Crossing Projects

To accommodate the managed lanes and new auxiliary lanes, local interchange ramps and lanes will undergo modifications, most highway overcrossings will be replaced, and most undercrossings will be widened. These projects will incorporate improvements to bicycle and pedestrian facilities to create or enhance connections to bicycle paths, sidewalks, and trail networks. Highway bridge improvements across lagoons will integrate similar improvements to non-motorized transportation networks.

Local roads cross I-5 at 32 locations within the NCC, and one new crossing is planned. The I-5 highway improvements will result in the following:

- 20 replacement overcrossings
- 11 widened undercrossings
- 1 new overcrossing (Gilman Drive)
- 1 unmodified undercrossing (Carmel Mountain Road)

Table 1 lists all of these existing and proposed crossings, with specific information on how each bicycle and pedestrian facility will be upgraded. **Figures 1A-6B** mark these planned crossing improvements with light green callout boxes.

In short, pedestrian infrastructure improvements are planned for 20 overcrossings, 8 undercrossings, and the new Gilman Drive overcrossing; 4 undercrossings will maintain existing pedestrian facilities. Additionally, bicycle infrastructure improvements are planned for 9 overcrossings, 6 undercrossings, and the new Gilman Drive overcrossing; 17 will maintain existing bicycle facilities. Taken together, these crossing improvements will significantly improve east-west non-motorized travel across the freeway to access NCC transit stations and coastal resources.

Two of these crossing projects (Gilman Drive and Genesee Avenue) are being permitted separately from the PWP/TREP (see Section 2.3). However, to provide a complete picture of the corridor vision and its ongoing implementation, these projects are included in **Table 1** and **Figures 1A-6B**. Additionally, the overcrossing replacement at Voigt Drive will realign the Voigt Drive roadway between the I-5 highway and Genesee Avenue to accommodate the new bicycle and pedestrian facilities.

2.1.2 Community Enhancements

Beyond the I-5 highway crossings, a package of community enhancement projects is included in the PWP/TREP that will further improve access to coastal resources, recreational facilities, transit stations, and corridor activity centers. Caltrans' *I-5 North Coast Community Enhancement Plan* (2008) and the subsequent *I-5 North Coast Corridor Supplemental Draft EIR/EIS* (2012) identified pedestrian, bicycle, and other community improvements (e.g., trails, parks, and parking) adjacent to the I-5 right-of-way that will be implemented as part of the highway project. Some of these designated community enhancements are located at the I-5 highway crossings discussed previously, while others are parallel to I-5 or outside the highway right-of-way.

Table 2 lists these community enhancement projects by city, describes their scope of improvements, and identifies the highway project associated with each. These projects are also identified by their assigned project numbers in **Figures 1A-6B**.

In summary, 32 pedestrian, bicycle, and trail community enhancement projects are planned (including the segments of the North Coast Bike Trail in the cities of San Diego, Solana Beach, Encinitas, and Carlsbad). Of these, 23 will enhance pedestrian sidewalks, 14 will enhance bicycle facilities, and 13 will enhance trail facilities.[1]

2.1.3 I-5 North Coast Bike Trail

One of the most significant community enhancements included in the PWP/TREP is a new bicycle and pedestrian facility of both corridor and regional significance: the I-5 North Coast Bike Trail. This

[1] The total exceeds 30 because some projects include a combination of pedestrian, bicycle, and trail enhancements.

enhancement will be a new regional bicycle facility generally parallel to I-5 that will provide north-south bicycle commuting options in the corridor. The facility will be divided into separate projects by jurisdiction, with each segment assigned its own community enhancement project number as shown in **Table 2.**

The alignment of the I-5 North Coast Bike Trail was developed in 2012 through collaboration between Caltrans and the corridor cities. It contains a mix of Class I, Class II, and Class III facilities, which (in some parts of the corridor) will overlap the Coastal Rail Trail (see Section 2.2). Caltrans has agreed to implement all segments within the I-5 highway right-of-way, while the cities will be responsible for implementing segments outside the I-5 highway right-of-way. The planned alignment is shown in **Figures 1A-6B.**

2.1.4 San Luis Rey River Trail

The San Luis Rey River Trail is a Class I facility in Oceanside on the south bank of the San Luis Rey River, whose watershed San Diego County has proposed to designate as a 1,700-acre regional park. As shown in **Figures 6A-6B,** the trail's alignment lies just north of, and roughly parallel to, SR76. At I-5, the facility consists of a 10-foot paved trail in a tunnel undercrossing.

Just as local-road crossings will be rebuilt during highway construction, the San Luis Rey River Trail crossing will also be improved, with the paved trail widened to 12 feet within the tunnel undercrossing. This improvement will provide bicyclists and pedestrians with a wider and safer crossing of I-5 and greater access to the recreational area at the river.

2.2 PLANNED IMPROVEMENTS ADJACENT TO THE LOSSAN RAIL CORRIDOR

The *LOSSAN Final Program EIR/EIS* (2007) includes programmatic-level plans for rail improvement projects in the NCC. The *San Diego – LOSSAN Corridor Project Prioritization Analysis* (2009) prioritized these rail projects to optimize phased improvements. The phasing has been further refined in the SANDAG *2050 Regional Transportation Plan* (2011), which identifies LOSSAN rail corridor projects in the NCC across four decades: the immediate term (through 2020), short term (2020-2030), mid term (2030-2040), and long term (2040-2050). These planned improvements in the LOSSAN rail corridor will consist of double tracking, which will allow more trains to run in the corridor each day and eliminate the delays caused by trains having to wait to pass each other, as well as other track enhancements such as crossovers, station "stub" tracks, station pass-through tracks, and rail bridge replacements—all of which will increase operating capacity. In addition, NCC LOSSAN rail stations will benefit from parking expansions and other improvements that will improve travel time and access and will allow for more frequent and reliable service.

These LOSSAN track projects will allow many other peripheral improvements to the corridor, including many improvements to bicycle and pedestrian facilities. SANDAG's process for planning, designing, and constructing projects in the LOSSAN rail corridor includes close coordination with the local transit agencies (North County Transit District and San Diego Metropolitan Transit System), local jurisdictions, and many other stakeholders. As a general rule, existing bicycle and pedestrian facilities at new or upgraded crossings of the LOSSAN rail corridor will be maintained as part of the rail improvement project. However, implementation of new bicycle and pedestrian improvements concurrent with a particular rail project will be determined as each rail project advances.

2.2.1 LOSSAN Crossing Projects

In addition to enhancing vehicle crossings (both at-grade and grade-separated) and maintaining all existing crossings in the LOSSAN project area, the planned improvements also include new pedestrian

and/or bicycle crossings at several locations. **Table 3** lists all of these existing and planned LOSSAN crossing facilities.

At the Carlsbad Poinsettia Station, a new pedestrian overcrossing is planned that will allow for safer pedestrian movement within the station and provide an improved pedestrian access route to the coast. In Del Mar, a new pedestrian crossing is planned for the Coast to Crest Trail—a 55-mile east-west trail facility that is a major feature of the San Dieguito River Park. The majority of the trail system is built, but it lacks a legal way to cross the LOSSAN rail corridor to reach the coast. As part of the PWP/TREP program of improvements, this essential link will be completed, providing improved coastal access from the Coast to Crest Trail.

In Encinitas, four new pedestrian undercrossings of the LOSSAN rail corridor are planned in the near term. As noted in Section 2.3, three of these crossings (at Montgomery Avenue, Santa Fe Drive, and El Portal Street) are being permitted outside the PWP/TREP, with the Santa Fe Drive crossing nearing completion and the Montgomery Avenue crossing under construction. The fourth planned crossing (at Hillcrest Drive) is expected to be permitted via the PWP/TREP.

2.2.2 Coastal Rail Trail

The Coastal Rail Trail is a dedicated bicycle facility in the region's coastal corridor, with most segments in or adjacent to the LOSSAN rail right-of-way. It is partially completed within San Diego County, with varying levels of progress in each NCC city. Once fully completed, the Coastal Rail Trail will provide a continuous north-south bicycle route—mostly comprising Class I facilities—through the NCC with direct access to coastal resources and recreational facilities. Caltrans and SANDAG have identified the following segments of the Coastal Rail Trail within the LOSSAN rail right-of-way as projects to be included in the NCC program of improvements:

- **La Costa Avenue to Chesterfield Drive (Encinitas)** will construct approximately 4.6 miles of dedicated bicycle facility in the LOSSAN right-of way. Portions of this segment overlap with three planned LOSSAN double-track projects (CP Ponto to CP Moonlight, CP Moonlight to CP Swami, and CP Cardiff to CP Craven).
- **Tamarack Avenue to Poinsettia Station (Carlsbad)** will construct approximately 2.8 miles of dedicated bicycle facility in the LOSSAN right-of-way. However, as shown in **Figure 4A,** a small portion of this segment lies outside the rail right-of-way, and therefore its implementation will require further coordination with the city of Carlsbad.

Except for minor deviations, the I-5 North Coast Bike Trail and the Coastal Rail Trail mostly follow the same alignment in the cities of Oceanside and Carlsbad.

2.3 NCC Improvements Being Permitted Outside the PWP/TREP

Bicycle and pedestrian projects in the NCC that are being permitted outside the PWP/TREP are described in this document to provide a comprehensive vision of the pedestrian and bicycle improvements in the corridor.

The following bicycle and pedestrian projects adjacent to the I-5 highway corridor are being permitted separately from the PWP/TREP:

- **Genesee Avenue Overcrossing Replacement (San Diego)** will consist of two parts:
  - **Genesee Avenue Overcrossing** will provide new 8-foot sidewalks and improve bicycle facilities from Class III to Class II lanes.
  - **Sorrento Valley to Voigt Class I Bike Trail** will construct a new Class I trail from Sorrento Valley Road to Voigt Drive at University of California, San Diego (UCSD), eliminating the need for bicyclists to ride on the I-5 highway shoulder.
- **Gilman Drive Overcrossing (San Diego)** will construct an entirely new bridge over I-5 with 8-foot sidewalks and Class II bicycle lanes.

The following bicycle and pedestrian projects adjacent to the LOSSAN rail corridor are being permitted separately from the PWP/TREP:

- **Montgomery Avenue Pedestrian Undercrossing (Encinitas)**
- **Santa Fe Drive Pedestrian Undercrossing (Encinitas)**
- **El Portal Street Pedestrian Undercrossing (Encinitas)**

3.0 TRANSIT AND COASTAL ACCESS BENEFITS OF PLANNED IMPROVEMENTS

The planned bicycle and pedestrian improvements in the NCC will bring benefits to active transportation throughout the corridor, increasing the accessibility not just of coastal resources but also of the adjacent LOSSAN rail corridor. **Figures 1B-6B** identify ¾-mile catchment areas around each LOSSAN rail station, which represent an average person's maximum walking distance to or from transit.[2] Because of the proximity of the LOSSAN rail corridor to the coast, many of these catchment areas also contain state beaches and other coastal resources. The planned PWP/TREP improvements will have the greatest impact on the accessibility of transit and coastal resources within this ¾-mile radius. The benefits that will be realized within each station area are examined in the following sections.

3.1.1 Sorrento Valley Station Area (Figure 1B)

The improvements near Sorrento Valley Station will broaden access to LOSSAN rail services by creating stronger links between the station and several major employment and residential communities of northern San Diego. The ¾-mile station area includes parts of the communities of Sorrento Valley, Torrey Hills, and University City, and also contains the elevated profile of the merging I-5 and I-805 highways. The following three significant projects will provide bicyclists and pedestrians with greater access to the rail corridor, allow for safer connections between UCSD and LOSSAN rail services, and increase access to recreational opportunities:

- **Los Peñasquitos Creek Trail Connection (SD#1)** will construct a trail connection under the merging I-5 and I-805 highway structures in the Caltrans right-of-way from Los Peñasquitos Creek to Sorrento Valley Road. This project will create better linkages among the Sorrento Valley Station, the residential

[2] This assumes that pedestrians are willing to walk about 20 minutes, or approximately ¾ of a mile, to a high-quality rapid transit option such as the COASTER. While the Federal Transit Administration (FTA) has established a "one-half mile de facto catchment area for pedestrians around a transit stations," the FTA also supports investments in and "makes eligible for funding pedestrian improvements beyond the one-half mile catchment area if the improvement is within the distance that people could be expected to safely and conveniently walk to use the particular stop or station" ("Final Policy Statement on the Eligibility of Pedestrian and Bicycle Improvements Under Federal Transit Law," *Federal Register* Vol. 76, No. 161, August 19, 2011).

and commercial developments near Sorrento Valley Road, and the existing recreational trails at Los Peñasquitos Creek.

- **Sorrento Valley to Voigt Class I Bike Trail** will construct a new Class I facility from Sorrento Valley Road to Voigt Drive at UCSD, eliminating the need for bicyclists to make the steep journey while riding on the I-5 highway shoulder. This project will enhance access to the Sorrento Valley Station from the dense housing and employment areas in University City and will provide access to the adjacent trail project SD#1. It will also serve as the southern end of the I-5 North Coast Bike Trail, whose planned alignment will continue north along Sorrento Valley Road. As noted in Section 2.3, this project is being permitted separately from the PWP/TREP.
- **I-5 North Coast Bike Trail in the City of San Diego (SD#5)** will share the Sorrento Valley to Voigt Class I Bike Trail and is then planned to continue north along Sorrento Valley Road. As Sorrento Valley Road is outside the I-5 highway right-of-way, this segment will not be built by Caltrans during highway construction and will instead require future planning coordination with the City of San Diego.

3.1.2 Solana Beach Station Area (Figure 2B)

There is one planned bicycle or pedestrian improvement planned for the ¾-mile area surrounding the Solana Beach Station:

- **I-5 North Coast Bike Trail in the City of Solana Beach (SB#4)** is planned to share Stevens Avenue and San Rodolfo Drive within the station area. The improvement will connect to the Class II bicycle lanes on Lomas Santa Fe Drive that provide access to Solana Beach Station. As this portion of the alignment is outside the highway right-of-way, it will not be built by Caltrans during highway construction, and will instead require future planning coordination with the City of Solana Beach.

3.1.3 Encinitas Station Area (Figure 3B)

With the I-5 highway and LOSSAN rail corridors in close proximity in Encinitas, the following bicycle and pedestrian improvements in the Encinitas Station area are planned:

- **Trail Connecting Santa Fe Drive to Requeza Street with Wetland Revegetation (EN#4)** will connect Santa Fe Drive to Requeza Street and include improved drainage and wetland vegetation restoration. In conjunction with the Santa Fe Drive Undercrossing and community enhancement project EN#3 (Hall Property Park Trail Connecting to Santa Fe Drive, shown in **Figure 3A**), the project will provide bicycle and pedestrian access to the new Hall Property Park. The I-5 North Coast Bike Trail also will share the facility.
- **Encinitas Boulevard Bicycle/Pedestrian Enhancements (EN#5A)** will provide new 10-foot sidewalks on both sides of Encinitas Boulevard and maintain the existing Class II bicycle lanes. This will enhance pedestrian access to Encinitas Station and coastal resources.
- **Trail Connecting Requeza Street to Encinitas Boulevard (EN#5B)** will provide a new trail along the east side of I-5 connecting Requeza Street with Encinitas Boulevard. The I-5 North Coast Bike Trail will share the facility. It will connect to project EN#4 to the south, as well as to the existing Class II regional bicycle route along Encinitas Boulevard.
- **Union Street Pedestrian Overpass (EN#6A)** will construct a new pedestrian and bicycle crossing over I-5, along with a new park on the west side of the bridge in a parcel owned by the City of Encinitas. The I-5 North Coast Bike Trail will share the facility. At its western end, this project will connect to project EN#6B, which will then connect to an existing local trail leading to Encinitas

Boulevard; this will provide a new bicycle and pedestrian route across the highway to Encinitas Station.

- **Cottonwood Creek Park to Union Street Trail Connection with Wetland Revegetation (EN#6B)** will connect Cottonwood Creek Park to Union Street on the west side of I-5. This will connect project EN#6A to the City of Encinitas recreational trail leading to Encinitas Boulevard, creating a new bicycle and pedestrian route across the highway to Encinitas Station.
- **I-5 North Coast Bike Trail in the City of Encinitas (EN#7)** will include dedicated and shared bicycle facilities in the ¾-mile study area. South of Encinitas Boulevard, the facility will be within the I-5 highway right-of-way and overlap with the community enhancement projects EN#4 and EN#5B. North of Encinitas Boulevard, the trail is planned to share Saxony Road and Union Street. As this shared portion of the alignment is outside the I-5 highway right-of-way, it will not be built by Caltrans during highway construction, and will instead require future planning coordination with the City of Encinitas.
- **Requeza Street Overcrossing** will provide widened 10-foot sidewalks on both sides of the street, providing safer pedestrian access across the highway. The existing Class III bicycle route will be maintained.
- **Coastal Rail Trail (La Costa Avenue to Chesterfield Drive)** will construct approximately 7.4 miles of new Class I bicycle facility within or adjacent to the LOSSAN rail right-of way, to include the 1.5-mile segment within the study area surrounding Encinitas Station. This project will provide greater access to both LOSSAN rail services and nearby coastal resources (including Moonlight State Beach). It will also eliminate a major gap in the regional Coastal Rail Trail.
- **Santa Fe Drive Pedestrian Undercrossing** will provide a new grade-separated access route for pedestrians and bicyclists to cross the rail corridor and access coastal resources, including nearby San Elijo State Beach. It will link the Class II bicycle lanes on Santa Fe Drive with the Coast Highway local bicycle route, the California Coastal Trail, and the planned Coastal Rail Trail segment from La Costa Avenue to Chesterfield Drive. As noted in Section 2.3, this project is being permitted separately from the PWP/TREP.
- **El Portal Street Pedestrian Undercrossing** will provide a new grade-separated access route across the rail corridor similar to the Santa Fe Drive undercrossing. It will provide connections to the Coast Highway local bicycle route, the California Coastal Trail, and the planned Coastal Rail Trail segment from La Costa Avenue to Chesterfield Drive. As noted in Section 2.3, this project is being permitted separately from the PWP/TREP.

3.1.4 Carlsbad Poinsettia Station Area (Figure 4B)

The bicycle and pedestrian improvements planned for the ¾-mile vicinity around Poinsettia Station consist of the following one highway crossing, one rail crossing, and two regional bicycle facilities that will share the same alignment:

- **Poinsettia Lane Overcrossing** will widen sidewalks to 12 feet and maintain Class II bicycle lanes on both sides of the roadway. This will increase access to both Poinsettia Station and South Carlsbad State Beach from the dense residential areas just east of the highway.
- **Poinsettia Station Pedestrian Overcrossing** will provide a new grade-separated crossing of the LOSSAN rail corridor adjacent to Poinsettia Station. It will replace the existing at-grade crossing and connect to the existing trail west of the tracks, providing pedestrians with an unimpeded route to South Carlsbad State Beach. This improvement will increase the safety of pedestrians as well as the reliability of LOSSAN rail services, which will no longer have to slow or stop for the at-grade crossing.

- **I-5 North Coast Bike Trail in the City of Carlsbad (CB#4)** will share the alignment of the Coastal Rail Trail within the ¾-mile study area, and will include dedicated and shared bicycle facilities. South of Carlsbad Poinsettia Station, Class II bicycle lanes are already constructed along Avenida Encinas. North of the station, a new Class I facility will be constructed within or adjacent to the LOSSAN right-of-way.
- **Coastal Rail Trail (Tamarack Avenue to Poinsettia Station)** will construct approximately 2.8 miles of new Class I bicycle facility within or adjacent to the LOSSAN rail right-of-way. This will begin near Carlsbad Poinsettia Station—at the end of the existing Class II facility on Avenida Encinas—and will continue north to Tamarack Avenue.

3.1.5 Carlsbad Village Station Area (Figure 5B)

In addition to the planned alignment of the I-5 North Coast Bike Trail near Carlsbad Village Station, three highway crossings also fall within the ¾-mile study area—all of which will receive upgraded bicycle and pedestrian facilities. The planned projects are the following:

- **Chestnut Avenue Undercrossing** will widen existing sidewalks from 5 feet to 10 feet and construct new Class II bicycle lanes on each side of the roadway. This will provide safer routes across the highway for pedestrians and bicyclists, increasing their access to Carlsbad Village Station and nearby coastal resources such as Carlsbad State Beach. It also will provide better linkages to the Class II bicycle lanes that continue along Chestnut Avenue to the east of the highway, and also along nearby Harding Street to the west of the highway.
- **Carlsbad Village Drive Undercrossing** will widen existing sidewalks to 10 feet and construct new Class II bicycle lanes on each side of the roadway. As with the Chestnut Avenue Undercrossing, this project will provide a safer way for pedestrians and bicyclists to cross the highway to access transit and coastal resources.
- **Las Flores Drive Overcrossing** will widen the existing eastbound sidewalk to 10 feet and construct a new 10-foot westbound sidewalk. The existing Class III bicycle route will be maintained, which is consistent with the city's bicycle master plan.
- **I-5 North Coast Bike Trail in the City of Carlsbad (CB#4)** will share facilities with the Coastal Rail Trail in the vicinity of Carlsbad Village Station. Part of this facility (from Oak Avenue to the southern edge of the ¾-mile study area) is already constructed as a Class I bicycle path. The remaining northern portion of the route (currently in the design phase) is planned as a Class III shared facility along State Street.

3.1.6 Oceanside Station Area (Figure 6B)

The following planned bicycle and pedestrian improvements near Oceanside Station are mostly adjacent to the highway, owing to the fact that the Coastal Rail Trail and other facilities adjacent to the LOSSAN rail corridor are already constructed or nearing completion:

- **Division Street Bicycle/Pedestrian Enhancements (OC#3)** will transform the existing 5.5-foot single sidewalk into two 17-foot sidewalks on each side of the overcrossing. It also will provide widened sidewalks on Brooks Street, located just east of the highway, providing a safer connection to Ron Ortega Recreation Park. Existing Class III bicycle facilities will be maintained.
- **Mission Avenue Bicycle/Pedestrian Enhancements (OC#4)** will widen the eastbound sidewalk to 17 feet and the westbound sidewalk to 12 feet, as well as provide Class II bicycle lanes in both directions. In addition, the project will realign the highway on- and off-ramps to allow for signalized

pedestrian crossings. This will provide safer access for bicyclists and pedestrians crossing the highway to access Oceanside Station, and connect to the existing Class II bicycle lanes that extend east on Mission Avenue.

- **Bush Street Bicycle/Pedestrian Enhancements and Community Gardens (OC#5)** will connect the existing community gardens at Civic Center Drive and Witzel Street (west of I-5) with new community garden plots on the east side of I-5. It will also install a paved trail from the east side of the overcrossing to Buena Street, new and improved lighting and landscaping features, and wider sidewalks on Buena Street and Santa Barbara Street.
- **I-5 North Coast Bike Trail in the City of Oceanside (OC#11)** will share facilities with the Coastal Rail Trail in the vicinity of Oceanside Station. East of the station, a Class I facility is under construction. West of the station, both bicycle routes will share city streets as Class III facilities. This will improve connectivity for bicyclists and pedestrians to and from Oceanside Station, which is served by LOSSAN rail services as well as the east-west SPRINTER light-rail transit to Escondido.
- **Fourth Street/Bush Street Overcrossing** will connect the existing community gardens west of the highway to the residential and commercial areas east of the highway, installing new 17-foot (eastbound) and 10-foot (westbound) sidewalks. Class III bicycle facilities will be maintained.
- **Neptune Way Overcrossing** will widen existing sidewalks from 5 feet to 10 feet and maintain a Class III bicycle facility. Neptune Way is the only access route for the residential development east of the highway to reach the rest of Oceanside, including transit and coastal resources. This project will provide improved pedestrian accessibility for this isolated residential community.

4.0 ANALYSIS OF ADDITIONAL OPPORTUNITIES FOR PEDESTRIAN AND BICYCLE IMPROVEMENTS

In addition to the I-5 North Coast Bike Trail, Coastal Rail Trail, and pedestrian and bicycle enhancements within the highway and rail rights-of-way included in the PWP/TREP, this study investigated additional opportunities for improvements to the regional bicycle network (based on SANDAG's 2010 *Regional Bicycle Plan)*, local bicycle networks (based on the cities' bicycle master plans), and in the local pedestrian networks (based on the San Diego Regional Sidewalk Network GIS database of existing sidewalks and local pedestrian plans) across the I-5 highway or LOSSAN rail corridor or within a ¾-mile radius of LOSSAN rail stations.[3]

4.1 IMPROVEMENT OPPORTUNITIES ADJACENT TO THE I-5 CORRIDOR

Pedestrian and bicycle facilities in the I-5 highway corridor will undergo major improvements with very few crossings left unmodified. The few remaining improvement opportunities are analyzed below.

4.1.1 Pedestrian Opportunities

As discussed in Section 2.1 and shown in **Table 1,** local roads cross I-5 at 32 locations in the NCC, and one new crossing is planned. The planned highway improvements will incorporate sidewalk enhancements at most of the overcrossing and undercrossing locations. Of the local-road crossing locations that do not include sidewalk enhancements:

[3] *Generating a Sidewalk Network for San Diego County: Project Documentation,* June 2011, SANDAG and Urban Design for Health, Inc.

- **Carmel Mountain Road Undercrossing (San Diego)** includes 5-foot sidewalks on both sides of the undercrossing. Therefore, it does not present a barrier to pedestrians.
- **Lomas Santa Fe Drive Undercrossing (San Diego)** has 5.5-foot sidewalks on both sides. Therefore, it does not present a barrier to pedestrians.
- **Carmel Valley Road/SR 56 Undercrossing (San Diego)** has 5-foot sidewalks on both sides. Therefore, it does not present a barrier to pedestrians.
- **Cannon Road Undercrossing (Carlsbad)** has 6-foot sidewalks on both sides. Therefore, it does not present a barrier to pedestrians.

No additional pedestrian enhancement project opportunities were identified for I-5 at existing crossings.

4.1.2 Bicycle Opportunities

The PWP/TREP improvements will upgrade Class III bicycle routes to Class II facilities at 15 crossing locations at I-5, will add a Class II facility at the new Gilman Drive overcrossing, and will maintain existing facility classes at the remaining 17 local-road crossings as well as the San Luis Rey River Trail (two Class I, seven Class II and nine Class III). With the exception of the two Class I facilities at Lomas Santa Fe Drive and the San Luis Rey River Trail, the existing and planned bicycle networks in the NCC do not include any additional Class I crossings of the highway. Therefore, additional upgrades of Class II facilities to Class I at I-5 crossings are not proposed since there would be no connecting Class I networks.

Of the nine highway crossings where Class III facilities will be maintained, an analysis was conducted to determine whether there are opportunities to upgrade to Class II facilities. The analysis identified whether the crossings are on the proposed Regional Bicycle Master Plan and whether any were identified as barriers on the regional Bicycle Barriers Model.[4] Further analysis examined whether each crossing is on the existing local bicycle network, whether there is an existing Class II network to connect with, and whether the local jurisdictions' bicycle master plans propose an upgrade or a new Class II facility. The analysis also considered that all PWP/TREP overcrossing and undercrossing projects will provide Class III facilities at a minimum, and therefore will address the barriers identified in the Regional Barrier Model. As a result, the barriers identified in the Regional Barrier Model are not considered to be determining factors in identifying additional opportunities for bicycle projects in the PWP/TREP. Finally, the analysis determined that upgrades to Class II crossings would have little value if there are no existing or planned Class II networks to connect with. The best opportunities for additional bicycle enhancements are those in which an upgrade from a Class III to Class II bicycle crossing would connect with an existing or planned Class II facility. The analysis found that the PWP/TREP has already identified all opportunities for bicycle network improvements and there are no additional opportunities. **Table 4** summarizes the results of this analysis for the nine crossings.

The Carmel Valley Road/SR 56 crossing currently contains Class III facilities and is designated as a regional bicycle route. It facilitates the connection between Carmel Valley Road to the west of I-5 (which contains both Class II and Class III facilities) and a Class I bicycle facility that begins near El Camino Real to the east of I-5. This crossing is not considered a candidate for upgrade to Class II facilities because it will be superseded by community enhancement project SD#2A (Carmel Valley Bicycle/Pedestrian Enhanced Trail Connection). This project will provide a Class I undercrossing just south of Carmel Valley Road, which will allow bicyclists to cross the highway without having to ride on either Carmel Valley Road or El Camino Real.

[4] San Diego Regional Bicycle Plan, Appendix A – Existing Conditions Report, Figure 6-4. "The bicycle barrier submodel reflects indications of 'problem areas' such as relatively high crash locations, roadways with high vehicular traffic volumes and speeds, freeway on/off ramps, and steep slopes."

At Carmel Mountain Road, where there is no project planned, there is a Class II bicycle lane on both sides of the undercrossing. The undercrossing is not on the regional bicycle network. The location, however, was identified as barrier on the Bicycle Barriers Model. Further examination of this site may reveal the reason this is identified as a barrier and identify possible transportation management solutions short of an infrastructure project (such as change in signage, traffic signal or intersection striping) that could eliminate or alleviate this barrier.

4.2 Improvement Opportunities Adjacent to the LOSSAN Rail Corridor

Many pedestrian and bicycle routes adjacent to the LOSSAN rail corridor already contain facilities such as paved sidewalks and Class II bicycle lanes. The few remaining improvement opportunities are analyzed in **Table 3,** but as they are still dependent upon ongoing project scope development, the opportunities identified remain tentative.

Potential pedestrian opportunities include sidewalk enhancements at the following locations:

- **Leucadia Boulevard At-Grade Crossing (Encinitas)** has a low-quality sidewalk on the north side and no sidewalk on the south side, making it a potential opportunity for sidewalk improvement. However, this project is being considered for grade separation, which would render improvements unnecessary.
- **La Costa Avenue Overcrossing (Encinitas)** has a sidewalk only on the south side. This is a potential opportunity for sidewalk improvement.
- **Carlsbad Boulevard (Carlsbad)** has a sidewalk only on the south side. This is a potential opportunity for sidewalk improvement.

Additionally, the following are two potential opportunities for bicycle improvements:

- **Chesterfield Drive At-Grade Crossing (Encinitas)** contains no bicycle lanes, but connects to Class II lanes on Coast Highway that run parallel to the tracks. This is a potential opportunity for bicycle facility improvement.
- **Leucadia Boulevard At-Grade Crossing (Encinitas)** contains a narrow Class II bicycle lane on the north side and no bicycle lane on the south side. It connects to existing Class II lanes on Leucadia Boulevard and Coast Highway, making this crossing a potential opportunity for improvement. However, this project is being considered for grade separation, which would render improvements unnecessary.

Finally, two LOSSAN crossings (Del Mar Scenic Parkway and North Torrey Pines Road) contain potential opportunities for pedestrian or bicycle improvements, but are dependent upon the selection of a project alternative for the Del Mar Tunnel. If the tunnel is approved for construction as planned, these improvements will be unnecessary.

4.3 Other Access Improvement Opportunities Near Transit Stations

The LOSSAN rail corridor is the backbone of the public transit network in the NCC. The success of the rail line is directly related to its convenience and ease of use, and difficulty accessing rail stations serves as a deterrent to potential riders. In addition to access by car or local bus, many people travel between the rail stations and nearby homes, schools or activity centers by bicycle or on foot. Safe, direct, and convenient bicycle and pedestrian infrastructure (such as bicycle lanes, sidewalks, pathways, and roadway crossings) within the vicinity of the rail stations encourages access to the LOSSAN rail corridor.

As noted in Section 3, **Figures 1B-6B** identify ¾-mile catchment areas around each LOSSAN rail station, which represent an average person's maximum walking distance to or from transit. The figures also show the existing sidewalks and other pedestrian facilities within these catchment areas, which were derived from local pedestrian master plans (when available) and the *San Diego Regional Sidewalk Network*. The figures indicate the extent of localized pedestrian access to rail stations as well as adjacent coastal resources; as shown, some NCC communities have more extensive pedestrian networks than others.

The ¾-mile catchment areas include substantial areas outside the I-5 highway and LOSSAN rail rights-of-way. While there may be opportunities to improve pedestrian access in these areas, the implementation of any improvements outside the highway or rail rights-of-way would be the responsibility of local jurisdictions. **Figures 1b-6b** provide a resource for assessing opportunities to improve access to rail stations within the ¾-mile radius.

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TABLE 1: PLANNED PEDESTRIAN AND BICYCLE IMPROVEMENTS AT INTERSTATE 5 LOCAL-ROAD CROSSINGS

I-5 Overcrossing Bridges	Replace Or New	Permitting Document	Existing Sidewalk	Proposed Sidewalk*	Pedestrian Improvements	Existing Bicycle Facility	Proposed Bicycle Facility	Bicycle Improvements
Voigt Dr OC & Realignment	Replace	PWP	Yes	15' sidewalks	• Widen both sidewalks to 15'	Class III/Shared Use	Class II	New Class II bike lanes
Del Mar Heights Rd OC	Replace	PWP	Yes = 5'	12' sidewalks	• Widen both sidewalks to 12'	Class II	Class II	Maintain existing
Birmingham Dr OC	Replace	PWP	Yes (WB) = 5'	12' sidewalks	• Widen WB sidewalk to 12' • New 12' EB sidewalk	Class III/Shared Use	Class III/Shared Use	Maintain existing
Mackinnon Ave OC**	Replace	PWP	Yes = 5.5'	17' sidewalks	• Widen both sidewalks to 17'	Class III/Shared Use	Class II	New Class II bike lanes
Requeza St OC**	Replace	PWP	Yes – EB = 6'. WB = 2'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Leucadia Blvd OC	Replace	PWP	Yes = 5'	12' sidewalks	• Widen both sidewalks to 12'	Class III/Shared Use	Class II	New Class II bike lanes
La Costa Ave OC**	Replace	PWP	Yes = 5'	12' sidewalks	• Widen both sidewalks to 12'	Class II	Class II	Maintain existing
Poinsettia Lane OC	Replace	PWP	Yes = 6'	12' sidewalks	• Widen both sidewalks to 12'	Class II	Class II	Maintain existing
Palomar Airport Rd OC	Replace	PWP	Yes – WB = 6' + EB = 5-6'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class II	New Class II bike lanes
Chinquapin Ave OC	Replace	PWP	Yes – WB = 6'	10' sidewalks	• Widen WB sidewalk to 10' • New EB sidewalk 10'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Tamarack Ave OC	Replace	PWP	Yes = 6'	12' sidewalks	• Widen both sidewalks to 12'	Class III/Shared Use	Class II	New Class II bike lanes
Las Flores Dr OC	Replace	PWP	Yes – EB = 6'	10' sidewalks	• New WB sidewalk 10' • Widen EB sidewalk to 10'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Jefferson St OC	Replace	PWP	Yes – WB = 6'	10' sidewalks	• Widen WB sidewalk to 10' • New EB sidewalk 10'	Class III/Shared Use	Class II	New Class II bike lanes
Cassidy St OC	Replace	PWP	Yes – EB = 5.5'	10' sidewalks	• New WB sidewalk 10' • Widen EB sidewalks to 10'	Class III/Shared Use	Class III/Shared Use	Maintain existing
California St OC**	Replace	PWP	Yes – EB = 5'	17' sidewalks	• New WB sidewalk 17' • Widen EB sidewalks to 17'	Class III/Shared Use	Class II	New Class II bike lanes
Brooks/Division St OC**	Replace	PWP	Yes – WB = 5.5'	17' sidewalks	• Widen WB sidewalks to 17' • New EB sidewalk 17'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Mission Ave OC**	Replace	PWP	Yes – WB = 4.6', EB = 5'	17'S/12'N sidewalks	• Widen WB sidewalk to 12' • Widen EB sidewalk 17'	Class III/Shared Use	Class II	New Class II bike lanes
Fourth St / Bush St OC**	Replace	PWP	Yes = 5'	17'S/10'N sidewalks	• Widen WB sidewalk to 10' • Widen EB sidewalk 17'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Neptune Way / 8th St OC	Replace	PWP	Yes = 5'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class III/Shared Use	Maintain existing
Gilman OC	New bridge	Outside PWP	N/A	8' sidewalks	• New 8' sidewalk	N/A	Class II	New Class II bike lanes
Genesee OC ***	Replace	Outside PWP	No	8' sidewalks	• New 8' sidewalks	Class III/Shared Use	Class II	New Class II bike lanes

*All sidewalk widths include 2' for low-profile barriers at curb.
** Project is associated with a Community Enhancement project (Table 3).
*** Project includes a Class I bicycle facility from Sorrento Valley Road to Voigt Drive, parallel with I-5.
**** Not a local road

TABLE 1: PLANNED PEDESTRIAN AND BICYCLE IMPROVEMENTS AT INTERSTATE 5 LOCAL-ROAD CROSSINGS (CONTINUED)

I-5 Undercrossing	Widening	Part of PWP / Outside of PWP	Existing Sidewalk	Proposed Sidewalk*	Pedestrian Improvements	Existing Bicycle Facility	Proposed Bicycle Facility	Bicycle Improvements
Carmel Mountain Road	No	N/A	Yes = 5'	N/A	• N/A	Class II	N/A	N/A
Carmel Valley Road /SR 56*	Yes	PWP	Yes = 5'	5' sidewalks	• Maintain existing	Class III/Shared Use	Class III/Shared Use	Maintain existing
Via De La Valle UC	Yes	PWP	Yes – WB = 5', EB = 3-4'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class II	New Class II bike lane
Lomas Santa Fe UC	Yes	PWP	Yes – WB & EB = 5.5'	5.5' sidewalks	• Maintain existing	Class I	Class I	Maintain existing
Manchester Ave UC (part of San Elijo lagoon bridge)	Yes	PWP	No	Sidewalk is part of the San Elijo Trail project	• New sidewalk is part of the San Elijo Trail project	Class III/Shared Use	Class II	New Class II bike lanes
Santa Fe Dr UC**	Yes	PWP	Barrier sep. 5' sidewalk	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class II	New Class II bike lanes
Encinitas Blvd UC**	Yes	PWP	No	10' sidewalks	• New 10' sidewalk on both sides	Class II	Class II	Maintain existing
Cannon Rd UC	Yes	PWP	Yes = 6'	6' sidewalks	• Maintain existing	Class II	Class II	Maintain existing
Chestnut Ave UC	Yes	PWP	Yes = 5'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class II	New Class II bike lanes
Carlsbad Village Dr UC	Yes	PWP	Yes = 6'	10' sidewalks	• Widen both sidewalks to 10'	Class III/Shared Use	Class II	New Class II bike lanes
Oceanside Blvd UC**	Yes	PWP	Yes – WB = 5.5', EB = 6'	10' sidewalks	• Widen both sidewalks to 10'	Class II	Class II	Maintain existing
Harbor Drive / Camp Pendleton UC**	Yes	PWP	Yes – EB = 3'	8' EB Sidewalk	• Widen eastbound sidewalk to 8'	Class III/Shared Use	Class II	New Class II bike lanes
San Luis Rey River Trail****	Yes	PWP	10' Tunnel	12' trail & maintain tunnel	• Maintain tunnel • New 12' trail	Class I	Class I	Maintain existing on new 12' trail

*All sidewalk widths include 2' for low-profile barriers at curb.
** Project is associated with a Community Enhancement project (Table 3).
*** Project includes a Class I bicycle facility from Sorrento Valley Road to Voigt Drive, parallel with I-5.
**** Not a local road

TABLE 2: PWP/TREP PEDESTRIAN, BICYCLE AND TRAIL COMMUNITY ENHANCEMENT PROJECTS

Enhancement Project	Project No.	City	TYPE OF IMPROVEMENT			Coordinated with PWP Project
			Pedestrian (Paved Sidewalk)	Bicycle (Class I, II and III)	Unpaved Trail	
Los Peñasquitos Creek Trail Connection*	SD#1	San Diego	Sidewalk connections from the existing sidewalk to the trail below at Vista Sorrento Parkway	NA	• Decomposed 8' granite pedestrian-bicycle trail under Vista Sorrento Parkway, I-805 and I-5 • Trail connections to exiting trails at Los Peñasquitos Creek and on Sorrento Valley Road	• 2 HOV from La Jolla Village Dr to I-5/I-805 • Voigt DAR
Carmel Valley Bicycle/Pedestrian Trail Connection*	SD#2A		• New 12' paved separate bicycles and pedestrian lanes (matching Carmel Valley Restoration Enhancement Project) under the I-5 freeway from existing trail along Los Peñasquitos Lagoon, east, to the existing Carmel Valley trail, leading to the ocean • Connection to Enhanced Park & Ride and Carmel Valley Road		Improved trail connections	• 2 EL from I-5/I-805 to SR 56, I-5/SR-56 Interchange • Carmel Valley Road Enhanced Park & Ride SD#2B
Old Sorrento Valley Road Bicycle/Pedestrian Enhanced Trail Connections from Carmel Valley Road (SR 56) to Carmel Mountain Road	SD#2C		NA	Class I 12' wide bicycle lane	NA	• 2 EL from I-5/805 to SR 56 • I-5/SR-56 Interchange Improvements
Bicycle/Pedestrian Trail & Bridge on West Side of I-5 at San Dieguito Lagoon	SD#3		• Part of the I-5 NC bicycle network, includes pedestrian-bicycle bridge across San Dieguito Lagoon • 12' Class I bike lane connecting Del Mar Heights Road to Via de la Valle		NA	• 2 EL from SR 56 to Manchester • San Dieguito Lagoon Bridge widening
Pedestrian Overpass Connection North of Del Mar Heights Road	SD#4		A new 12' wide pedestrian and bicycle bridge with connecting sidewalks		NA	2 EL from SR 56 to Manchester
I-5 NC Bike Trail in the City of San Diego (in I-5 ROW)	SD#5		Varying pedestrian and bicycle network (Class I, II and III) improvements along I-5 NC		NA	2 EL from SR 56 to Manchester within the city borders

* Source: I-5 North Coast Community Enhancement Plan (January, 2008) refined by Caltrans input
EL = Express Lane

TABLE 2: PWP/TREP PEDESTRIAN, BICYCLE AND TRAIL COMMUNITY ENHANCEMENT PROJECTS (CONTINUED)

Enhancement Project	Project No.	City	TYPE OF IMPROVEMENT			Coordinated with PWP Project
			Pedestrian (Paved Sidewalk)	Bicycle (Class I, II and III)	Unpaved Trail	
Streetscape Enhancements on Ida Avenue*	SB#1	Solana Beach	Concrete sidewalk on the west side of Ida Ave	NA	NA	2 EL from SR 56 to Manchester
Pedestrian Trailhead at Solana Hills Drive*	SB#2		Sidewalk along Solana Hills Drive	NA	Trail head and connection between the north end of Solana Hills Drive trails and San Elijo Lagoon Ecological Reserve	2 EL from SR 56 to Manchester
Gateway Open Space Preservation Site	SB#3		NA	NA	NA	NA
I-5 NC Bike Trail in the City of Solana Beach (in I-5 ROW)	SB#4		Varying pedestrian and bicycle network (Class I, II and III) improvements along I-5 NC		NA	2 EL from SR 56 to Manchester, within the city borders

* Source: I-5 North Coast Community Enhancement Plan (January, 2008) refined by Caltrans input
EL = Express Lane

TABLE 2: PWP/TREP PEDESTRIAN, BICYCLE AND TRAIL COMMUNITY ENHANCEMENT PROJECTS (CONTINUED)

Enhancement Project	Project No.	City	TYPE OF IMPROVEMENT			Coordinated with PWP Project
			Pedestrian (Paved Sidewalk)	Bicycle (Class I, II and III)	Unpaved Trail	
Bicycle/Pedestrian Trail on Both Sides of I-5 at San Elijo Lagoon With Bridge*	EN#1	Encinitas	• Suspended N-S pedestrian bridge across San Elijo Lagoon • E-W paved sidewalk on the south side of Manchester Avenue on the north of the lagoon	Suspended N-S pedestrian bridge across San Elijo Lagoon	• Enhancement of the existing trails on both sides of freeway on the south side of the lagoon • 8' trail under bridge with handrail and retaining wall	• 2 HOV lanes & noise barriers Manchester to SR 78 • San Elijo Lagoon highway bridge replacement
Villa Cardiff Dr & MacKinnon Ave Bridge Enhancements*	EN#2B		• 12' wide bicycle-pedestrian trail on east side of I-5 along west side of Villa Cardiff Drive • 17' wide combined Class II bicycle and pedestrian trail on both sides of the MacKinnon Bridge		NA	• 2 HOV lanes & noise barriers Manchester to SR 78 • MacKinnon Avenue OC reconstruction
Hall Property Park Trail Connecting to Santa Fe Drive*	EN#3		NA	NA	8' wide trail between Santa Fe Drive traffic circle and Hall Property Park on west side of I-5	• 2 EL from Manchester to Palomar Airport Road • Santa Fe Drive UC widening with widening of both sidewalks to 10' and traffic circles on both sides of I-5 on Santa Fe Drive
Trail Connecting Santa Fe Drive to Requeza Street with Wetland Revegetation*	EN#4		NA	NA	12' wide trail between Santa Fe Drive and Requeza Street on the east side of I-5	2 EL from Manchester to Palomar Airport Road
Encinitas Boulevard Bicycle/Pedestrian Enhancements	EN#5A		New 10' sidewalk on both sides of undercrossing	NA	NA	• 2 HOV lanes & noise barriers Manchester to SR 78 • Encinitas Boulevard UC widening
Trail Connecting Requeza Street to Encinitas Boulevard*	EN#5B		NA	NA	12' wide trail between Requeza Street and Encinitas Blvd. on the east side of I-5	2 EL from Manchester to Palomar Airport Road
Union Street Pedestrian Overpass*	EN#6A		New 12' pedestrian-bicycle overcrossing with sidewalk connection to trail			2 EL from Manchester to Palomar Airport Road
Cottonwood Creek Park to Union Street Trail Connection with Wetland Revegetation*	EN#6B		NA	NA	8' wide trail from Cottonwood Creek Park to Union Street on the west side of I-5	2 EL from Manchester to Palomar Airport Road
I-5 NC Bike Trail in the City of Encinitas (in I-5 ROW)	EN#7		Varying pedestrian and bicycle network (Class I, II and III) improvements along I-5 NC		NA	2 HOV lanes & noise barriers Manchester to SR 78 between Manchester Ave and the city border

* Source: I-5 North Coast Community Enhancement Plan (January, 2008) refined by Caltrans input
EL = Express Lane

TABLE 2: PWP/TREP PEDESTRIAN, BICYCLE AND TRAIL COMMUNITY ENHANCEMENT PROJECTS (CONTINUED)

Enhancement Project	Project No.	City	TYPE OF IMPROVEMENT			Coordinated with PWP Project
			Pedestrian (Paved Sidewalk)	Bicycle (Class I, II and III)	Unpaved Trail	
Bicycle/Pedestrian Trail & Bridge on West Side of Batiquitos Lagoon	CB#1A	Carlsbad	NA	NA	Decomposed granite 12' wide trail connecting east to west under I-5 and to existing trails, including a bridge crossing under I-5 connecting north and south sides of the lagoon	• 2 EL from Manchester to Palomar Airport Road • Batiquitos Lagoon Bridge replacement
Park and Ride Enhancement at La Costa Avenue*	CB#1B		NA	NA	Enhanced Park and Ride will serve as trail head	2 EL from Manchester to Palomar Airport Road
Trail on Northeast Side of I-5 at Batiquitos Lagoon*	CB#2		NA	NA	Trail connection to existing trail to hanging bridge	• 2 EL from Manchester to Palomar Airport Road • Batiquitos Lagoon Bridge replacement
Bicycle/Pedestrian Trail & Bridge on East Side of I-5 at Agua Hedionda Lagoon*	CB#3		NA	NA	• Trail under I-5 on south side of Lagoon, trail bridge along the east side of I-5 • 12' wide trail connecting to meet existing trail south of the lagoon	• 2 EL from Palomar Airport Rd to SR 78 • Agua Hedionda Bridge replacement
I-5 NC Bike Trail in the City of Carlsbad (in I-5 ROW)	CB#4		Varying pedestrian and bicycle network (Class I, II and III) improvements along I-5 NC		NA	2 EL from Palomar Airport Rd to SR 78 within the city borders

* Source: I-5 North Coast Community Enhancement Plan (January, 2008) refined by Caltrans input
EL = Express Lane

TABLE 2: PWP/TREP PEDESTRIAN, BICYCLE AND TRAIL COMMUNITY ENHANCEMENT PROJECTS (CONTINUED)

Enhancement Project	Project No.	City	TYPE OF IMPROVEMENT			Coordinated with PWP Project
			Pedestrian (Paved Sidewalk)	Bicycle (Class I, II and III)	Unpaved Trail	
Pocket Park and Pedestrian Path at California Street*	OC#1	Oceanside	Walkway connecting Moreno Way with California Street, enhanced crossings on Soto Street intersections with California and Valencia Streets	NA	NA	• 4 EL from SR 78 to Harbor Dr • California Street OC replacement with 17' Sidewalks on both sides
Oceanside Boulevard Pedestrian Streetscape Enhancement*	OC#2		10' sidewalk on both sides	NA	NA	• 4 EL from SR 78 to Harbor Dr • Oceanside Boulevard UC widening
Division Street Bicycle/Pedestrian Enhancements*	OC#3		• Widen sidewalks on both sides to 17' • New sidewalks on Brooks Street	NA	NA	• 4 EL from SR 78 to Harbor Dr • Brooks/Division Street OC replacement
Enhanced Pedestrian Overpass Connection on Mission Avenue*	OC#4		• Widen WB sidewalk to 12' • Widen EB sidewalk 17'	NA	NA	• 4 EL from SR 78 to Harbor Dr • Mission Avenue OC replacement
Bush Street Bicycle/Pedestrian Enhancements & Community Gardens*	OC#5		• Widen WB sidewalk to 10' • Widen EB sidewalk 17' on Overcrossing • New sidewalk along Witzel Street and Civic Center Drive/Bush Street • Wider sidewalks on Buena Street and Santa Barbara Street	NA	Paved trail from the east side of the bridge along the on-ramp to Buena Street	• 4 EL from SR 78 to Harbor Dr, Bush Street OC replacement • Mission Avenue OC ramp improvements
SR76 Underpass: New Parking & Trailhead*	OC#7		• Realignment and widening of the existing pedestrian-bicycle trail • Bicycle staging area and trailhead		NA	4 EL from SR 78 to Harbor Dr, San Luis Rey River Trail widening, SR-76 UC widening
Pedestrian Underpass Improvements North of San Luis Rey River*	OC#8		Widened sidewalk of underpass under I-5 with stairs and ramp connections that meet American with Disabilities Act requirements, optional sidewalk between San Luis Rey Drive and Monterey Drive	NA	Optional accessible ramp and trail from undercrossing to trail along north shore of river	4 EL from SR 78 to Harbor Dr
Harbor Drive/Camp Pendleton Bicycle/Pedestrian Enhancements	OC#10		Widen EB sidewalk to 8'	New Class II bike lanes	NA	4 EL from SR 78 to Harbor Dr, Harbor Drive Undercrossing widening
I-5 NC Bike Trail in the City of Oceanside (in I-5 ROW)**	OC#11		Varying pedestrian and bicycle network (Class I, II and III) improvements along I-5 NC		NA	2 HOV lanes & noise barriers Manchester to SR 78, between Manchester Ave and the city border

* Source: I-5 North Coast Community Enhancement Plan (January, 2008) refined by Caltrans input
** I-5 NC Bike Trail in the City of Oceanside will be on the same alignment as the Coastal Rail Trail (outside of I-5 ROW)
EL = Express Lane

TABLE 3: PLANNED PEDESTRIAN AND BICYCLE NETWORK IMPROVEMENTS ACROSS LOSSAN CORRIDOR

Existing Local Street Crossings	Existing Crossing Type	Jurisdiction	LOSSAN Project Area	Current Pedestrian Infrastructure	Planned Ped Infrastructure as Part of Rail Project	Current Bicycle Infrastructure	Planned Bike Improvement as Part of Rail Project
Sorrento Valley Blvd	At-Grade Double track	San Diego	No future project planned	Sidewalk on both sides	NA	Class II bike lanes on both sides	NA
Del Mar Scenic Pkwy	UC Single Track		Del Mar Tunnel Analysis	Access road to a parking lot sidewalk on south side only	TBD. Dependent upon tunnel alternatives analysis	No bike lanes	TBD. Dependent upon tunnel alternatives analysis
N. Torrey Pines Road / County Hwy S21	OC Single Track		Del Mar Tunnel Analysis	Sidewalk on East side only	TBD. Dependent upon tunnel alternatives analysis	Class II bike lanes on both sides	NA
Coast Blvd	At-Grade Single Track	Del Mar	Del Mar Tunnel Analysis	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Camino Del Mar (County Hwy S21)	OC Double Track		Del Mar Tunnel Analysis	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Via De La Valle	OC Single Track	Solana Beach	No future project planned	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Dahlia Dr to Rose St	Ped/Bike OC Double Track		No future project planned	Pedestrian-bicycle only OC	NA	Pedestrian-bicycle only OC	NA
Lomas Santa Fe Dr	OC Double Track		No future project planned	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Cliff St	Ped/Bike OC Double Track		No future project planned	Pedestrian-bicycle only OC	NA	Pedestrian-bicycle only OC	NA
Chesterfield Dr	At-Grade Single Track	Encinitas	Cardiff to Craven	• Sidewalk on both sides • Signaled Grade Crossing	NA	No bike lanes Class II network parallels track does not cross	TBD. Could be opportunity
D St	At-Grade Single Track		Moonlight to Swami	• Sidewalk on both sides • Signaled Grade Crossing	NA	No bike lanes	TBD. No current Class II network; future network is Class III
E St	At-Grade Single Track		Moonlight to Swami	• Sidewalk on both sides • Signaled Grade Crossing	NA	No bike lanes	TBD. No current Class II network; not on future local network
Encinitas Blvd	UC Single Track		Moonlight to Swami	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Leucadia Blvd	At-Grade Single Track		Ponto to Moonlight	• Signaled Grade Crossing • Low-quality sidewalk on the north side only	Potential Grade Separation. If not grade-separated then could be opportunity for sidewalk enhancement	Narrow Class II bike lane on north side	Potential Grade Separation. If not grade-separated then could be opportunity for Class II
La Costa Ave	OC Single Track		Ponto to Moonlight	Sidewalk only on south side	TBD. Could be opportunity for sidewalk enhancement	Class II bike lanes	NA
Avenida Encinas	OC Double Track	Carlsbad	Ponto to Moonlight	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Poinsettia Lane	OC Double Track		Ponto to Moonlight	Sidewalks on both sides	NA	Class II bike lanes on both sides	NA
Palomar Airport Rd	OC Double Track		No future project planned	No sidewalks	NA	No bike lanes	NA
Cannon Rd	At-Grade Double Track		No future project planned	• Sidewalks on both sides • Signaled Grade Crossing	NA	Class II bike lanes on both sides Signaled Grade Crossing	NA
Tamarack Ave	At-Grade Double Track		No future project planned	• Sidewalks on both sides • Signaled Grade Crossing	NA	Class II bike lanes on both sides Signaled Grade Crossing	NA
Carlsbad Village Dr	At-Grade Single track		Carlsbad Village Double Track	• Sidewalks on both sides • Signaled Grade Crossing	NA	No bike lanes	TBD. Future Network is Class III
Grand Ave	At-Grade Single track		Carlsbad Village Double Track	• Sidewalks on both sides • Signaled Grade Crossing	NA	No bike lanes	TBD. Future Network is Class III
Carlsbad Blvd	OC Single Track		Carlsbad Village Double Track	Sidewalks on south side only	TBD. Could be opportunity for sidewalk enhancement	Class II bike lanes on both sides	NA

TBD - To Be Determined at Project Level
NA - Not Applicable
Potential opportunities in green

TABLE 3: PLANNED PEDESTRIAN AND BICYCLE NETWORK IMPROVEMENTS ACROSS LOSSAN CORRIDOR (CONTINUED)

Existing Local Street Crossings	Existing Crossing Type	Jurisdiction	LOSSAN Project Area	Current Pedestrian Infrastructure	Planned Ped Infrastructure as Part of Rail Project	Current Bicycle Infrastructure	Planned Bike Improvement as Part of Rail Project
Cassidy Street	At-Grade Double track	Oceanside	No future project planned	Sidewalk on south side only	NA	No bike lanes	NA
Oceanside Blvd	At-Grade Four tracks		No future project planned	Sidewalks on both sides	NA	No bike lanes	NA
Wisconsin Ave	At-Grade Four tracks		No future project planned	Sidewalks on both sides	NA	No bike lanes	NA
Mission Ave	At-Grade Double track		No future project planned	Sidewalks on both sides	NA	No bike lanes	NA
Pier View Way	UC Double track		No future project planned	Pedestrian/bicycle only	NA	Pedestrian/bicycle only	NA
Surf Rider Way	At-Grade Single track		Eastbrook to Shell	Sidewalks on both sides	NA	No bike lanes	NA
San Luis Rey River Trail (Class I)	UC Single track		Eastbrook to Shell	• Paved pedestrian-bicycle shared trail • Grade Separation	Relocate Path	• Class I bike trail • Grade Separation	Relocate Bike Path
Harbor Dr / Camp Pendleton UC / Vandegrift Blvd	OC Double track		No future project planned	Sidewalk on south side only	NA	No bike lanes	NA

NA - Not Applicable

TABLE 3: PLANNED PEDESTRIAN AND BICYCLE NETWORK IMPROVEMENTS ACROSS LOSSAN CORRIDOR (CONTINUED)

New Crossings	New Crossing Type	Jurisdiction	LOSSAN Project Area	Current Pedestrian Infrastructure	Planned Ped Infrastructure as Part of Rail Project	Current Bicycle Infrastructure	Planned Bike Improvement as part of Rail Project
Hillcrest Dr	Ped/Bike UC Single track	Encinitas	Ponto to Moonlight	No crossing	New pedestrian-bicycle only UC	No crossing	New pedestrian-bicycle only UC
El Portal St	Ped/Bike UC Single track		Ponto to Moonlight	No crossing	New pedestrian-bicycle only UC	No crossing	New pedestrian-bicycle only UC
Santa Fe Dr	Ped/Bike UC Double track		No future track project planned	No crossing	New pedestrian-bicycle only UC	No crossing	New pedestrian-bicycle only UC
Montgomery Ave	Ped/Bike UC Double track		No future track project planned	No crossing	New pedestrian-bicycle only UC	No crossing	New pedestrian-bicycle only UC
Poinsettia Station	Ped/Bike UC Double track	Carlsbad	Ponto to Moonlight	At-grade crossing	New pedestrian-bicycle only OC	No crossing	New pedestrian-bicycle only UC
Coast to Crest Trail at San Dieguito Lagoon	Pedestrian trail UC	Del Mar	San Dieguito Lagoon Bridge Replacement	No crossing	New pedestrian-bicycle only UC	No crossing	New pedestrian-bicycle only UC

TABLE 4: ADDITIONAL OPPORTUNITIES FOR BICYCLE IMPROVEMENTS ACROSS I-5 (CLASS III CROSSING LOCATIONS)

I-5 Overcrossing Bridges	City	Included in Regional Bicycle Network	Identified as Barrier on Regional Barrier Map	Identified in Existing Local Bicycle Network	Existing Class II Network for Connection	Local Bicycle Plan Designation	PWP Project	PWP Project Opportunity
Carmel Valley Road/SR 56	San Diego	Yes	Yes	Yes	No	TBD	Maintain existing Class III	No
Birmingham Dr OC	Encinitas	No	Yes	No	No	Future Class III	Maintain existing Class III	No
Requeza St OC		No	No	No	No	Future Class III	Maintain existing Class III	No
Chinquapin Ave OC	Carlsbad	No	No	Class III	No	Remain Class III	Maintain existing Class III	No
Las Flores Dr OC		No	Yes	No	No	Future Class III	Maintain existing Class III	No
Cassidy St OC	Oceanside	No	No	No	No	No bicycle facility recommended	Maintain existing Class III	No
Brooks St OC		No	No	No	No	No bicycle facility recommended	Maintain existing Class III	No
Fourth St / Bush St OC		No	No	No	No	No bicycle facility recommended	Maintain existing Class III	No
Neptune Way / 8th St OC		No	No	No	No	No bicycle facility recommended	Maintain existing Class III	No



Planned Improvements and Opportunities
- PWP/TREP Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement
- Non-PWP/TREP Improvement (Permitted Separately)

Existing Pedestrian and Bicycle Facilities
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

SD# Community Enhancement (Table 2)

Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 1,000 2,000 3,000 4,000 Feet

NORTH

FIGURE 1A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (North San Diego)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities
- PWP/TREP Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement
- Non-PWP/TREP Improvement (Permitted Separately)

Existing Pedestrian and Bicycle Facilities
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- SD# Community Enhancement (Table 2)
- Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 1B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Sorrento Valley Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- PWP/TREP Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement
- Non-PWP/TREP Improvement (Permitted Separately)

Existing Pedestrian and Bicycle Facilities

- City of Encinitas Recreational Trail
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- Coast to Crest Trail
- California Coastal Trail

Existing Parks and Preserves

- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

SB# Community Enhancement (Table 2)

Other Bike/Ped Improvement

SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

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NORTH

FIGURE 2A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (N. San Diego, Del Mar, Solana Beach, and S. Encinitas)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities

- City of Encinitas Recreational Trails
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves

- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- SB# Community Enhancement (Table 2)
- Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 2B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Solana Beach Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities
- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement
- Non-PWP/TREP Improvement (Permitted Separately)

Existing Pedestrian and Bicycle Facilities
- City of Encinitas Recreational Trail
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

EN# Community Enhancement (Table 2)

Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Coastal Rail Trail (SANDAG 2012; City of Encinitas 2012) Local Bike Route, Regional Bike Route, California Coastal Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 1,000 2,000 3,000 4,000 Feet

NORTH

FIGURE 3A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Encinitas)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities
- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement
- Non-PWP/TREP Improvement (Permitted Separately)

Existing Pedestrian and Bicycle Facilities
- City of Encinitas Recreational Trail
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

EN# Community Enhancement (Table 2)

Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Coastal Rail Trail (SANDAG 2012; City of Encinitas 2012) Local Bike Route, Regional Bike Route, California Coastal Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jursidictions, SanGIS
Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 3B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Encinitas Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities
- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail (Constructed or In Progress)
- Coastal Rail Trail (Planned)
- California Coastal Trail

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- CB# — Community Enhancement (Table 2)
- Other Bike/Ped Improvement

SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 1,000 2,000 3,000 4,000 Feet

NORTH

FIGURE 4A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (North Encinitas and South Carlsbad)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities
- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities
- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries
- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- CB# Community Enhancement (Table 2)
- Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jursidictions, SanGIS
Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 4B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Carlsbad Poinsettia Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities

- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail (Constructed or In Progress)
- Coastal Rail Trail (Planned)
- California Coastal Trail

Existing Parks and Preserves

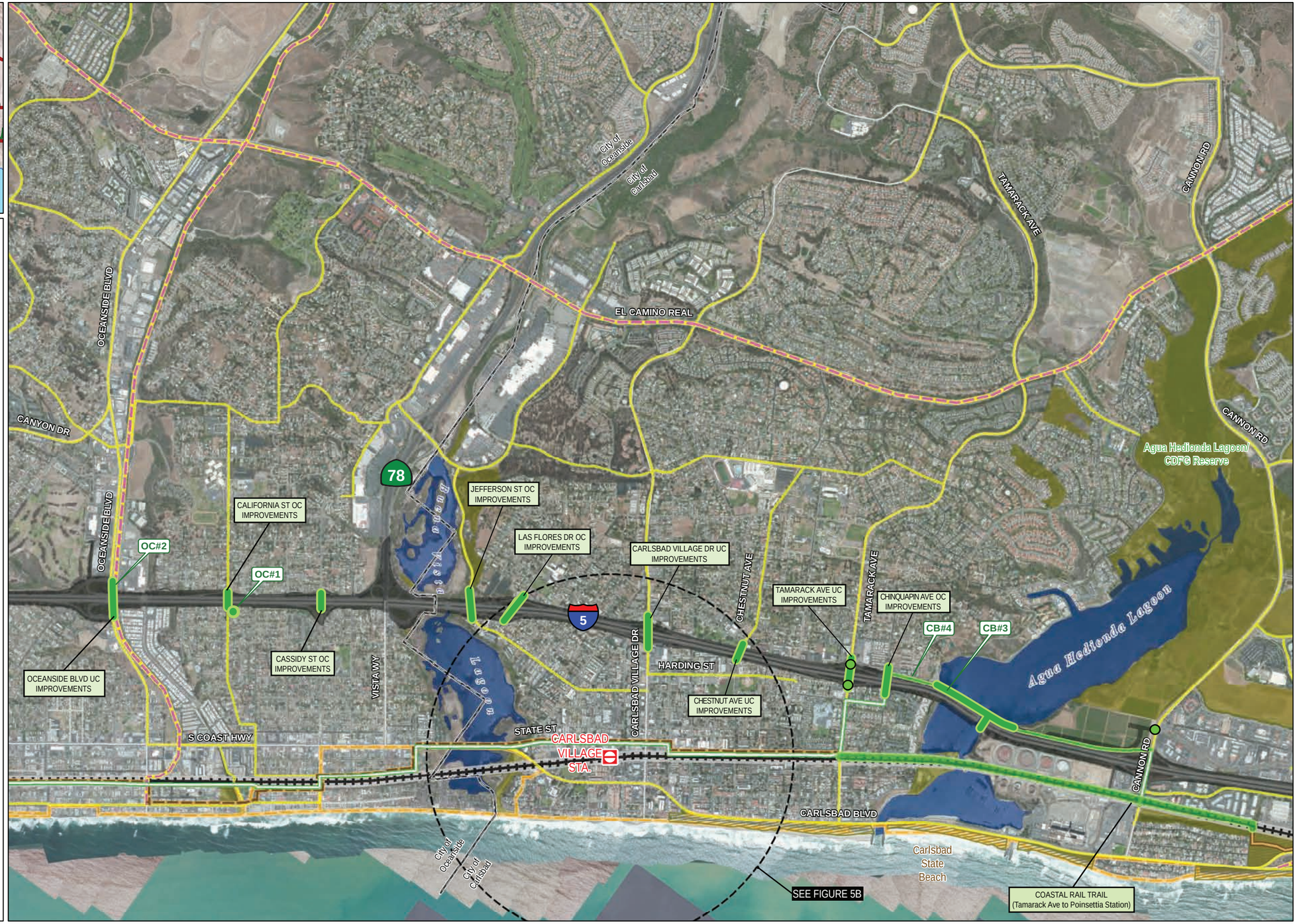
- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- CB# Community Enhancement (Table 2)
- Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 1,000 2,000 3,000 4,000 Feet

NORTH

FIGURE 5A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (North Carlsbad and South Oceanside)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities

- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves

- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- CB# Community Enhancement (Table 2)
- Other Bike/Ped Improvement



SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS
Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 5B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Carlsbad Village Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities

- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail

Existing Parks and Preserves

- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- City Boundary
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- OC# — Community Enhancement (Table 2)
- Other Bike/Ped Improvement

SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS Imagery: Bing Maps (2012)

0 1,000 2,000 3,000 4,000 Feet

NORTH

FIGURE 6A

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Oceanside)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program



Planned Improvements and Opportunities

- Planned Pedestrian and Bicycle Improvement
- I-5 North Coast Bike Trail (I-5 ROW)
- I-5 North Coast Bike Trail (Outside I-5 ROW)
- Traffic Signal/Intersection Improvement

Existing Pedestrian and Bicycle Facilities

- Local Bicycle Route
- Regional Bicycle Route
- Coastal Rail Trail
- California Coastal Trail
- Sidewalk

Existing Parks and Preserves

- State Beach/Park/Preserve
- Open Space & Parks

Project Areas and Boundaries

- I-5 Project Area
- LOSSAN Project Area
- LOSSAN Rail Station
- Pedestrian Access Study Area (0.75 miles)

OC = Overcrossing
UC = Undercrossing

- OC# — Community Enhancement (Table 2)
- Other Bike/Ped Improvement

SOURCE: Planned Improvements (Caltrans 2012); Local Bike Route, Regional Bike Route, California Coastal Trail, Coastal Rail Trail, Existing Parks and Preserves (SANDAG 2012); California Coastal Commission, Local Jurisdictions, SanGIS Imagery: Bing Maps (2012)

0 250 500 750 1,000 Feet

NORTH

FIGURE 6B

Safe Access to Transit and Coastal Resources: Pedestrian and Bicycle Improvements (Oceanside Station Area)

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program

APPENDIX B:

VISUAL RESOURCES PHOTO DOCUMENTATION

This appendix contains current photographs of various locations along the Interstate 5 (I-5) highway corridor in the North Coast Corridor (NCC). Table 1 lists the view locations and the number of photographs that appear for each. Figures 1A through 1G are key maps illustrating the locations of each view. The photographs themselves are lettered sequentially based on their view number (e.g. Figure SD-01A, Figure SD-01B, etc.).

TABLE 1: PHOTO DOCUMENTATION VIEW LOCATIONS

View No.	View Description	No. of Photos
City of San Diego: Los Penasquitos Lagoon/Carmel Valley		
SD-01	Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms	8
SD-02	Southbound View of Los Penasquitos/Natural Landforms of Torrey Pines State Preserve	2
SD-03	Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms	9
SD-04	Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements	14
SD-07	Eastern Looking Views from Carmel Valley Road (CVREP) Across Lagoon Toward I-5	3
City of San Diego: San Dieguito Lagoon		
SD-08	Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms	14
SD-09	One Southbound View of San Dieguito Lagoon/Del Mar Bluffs/Racetrack	** See SD-08*
SD-11	Northern View from Racetrack View Drive (Caltrans Restoration Site)	3
City of San Diego: Local Coastal Program		
SD-12	Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements	14
SD-14	North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas	9
City of Del Mar: San Dieguito Lagoon		
DM-01	Eastern Views from Jimmy Durante Boulevard Across Lagoon Toward I-5	2
DM-02	Western Views from Via de la Valle Across Lagoon Toward I-5	3
City of Solana Beach: San Dieguito Lagoon		
SB-01	Western/Eastern Views from I-5 Including the Pacific Ocean, San Dieguito Lagoon, and Coastal and Inland Natural Coastal Landforms	17
SB-02	Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive	9
City of Solana Beach: San Elijo Lagoon		
SB-03	Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms	17

TABLE 1: PHOTO DOCUMENTATION VIEW LOCATIONS (CONTINUED)

View No.	View Description	No. of Images
	City of Encinitas: San Elijo Lagoon	
EC-01	Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms	** See SB-03*
EC-02	Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements	10
EC-03	Western/Eastern Views from Manchester Ave Across Lagoon Toward I-5	5
EC-04	Western/Northern Views from Existing Scenic Overlook on I-5	3
EC-05	Views from Encinitas Community Park	6
	City of Encinitas: Uplands	
EC-06	Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)	6
EC-07	Western views of Pacific Ocean from Requeza Public Trail	5
EC-08	Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms	13
	City of Encinitas: Batiquitos Lagoon	
EC-09	Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms	12
EC-10	Northwestern Views from La Costa Avenue Across Lagoon Toward I-5	4
	City of Encinitas: Local Coastal Program	
EC-11	San Elijo Lagoon (I-5/Manchester Avenue Intersections)	** See EC-03*
EC-12	Northeast/Northwest Corner of I-5 and La Costa Avenue	8
EC-14	Existing Vista Point on Southbound I-5 (north of Manchester Avenue)	2
	City of Carlsbad: Batiquitos Lagoon	
CB-01	Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Coastal and Inland Natural Coastal Landforms	** See EC-09*
CB-02	Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements	11
CB-03	Eastern Views from Public View Point at the End of Navigator Circle Across Lagoon Toward I-5	4
	City of Carlsbad: Agua Hedionda Lagoon	
CB-04	Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms	10
CB-05	Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements	8
CB-06	Views from Public Recreation Areas (YMCA facilities) in Central/East Basins that Include Proposed I-5 Improvements	** See CB-05*
CB-07	Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5	5
	City of Carlsbad: Buena Vista Lagoon	
CB-08	Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms	** See OC-01*
CB-09	Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5	7
CB-10	Eastern Views from State Street/Carlsbad Boulevard Across Lagoon Toward I-5	3

TABLE 1: PHOTO DOCUMENTATION VIEW LOCATIONS (CONTINUED)

View No.	View Description	No. of Images
City of Carlsbad: Local Coastal Program		
CB-11	Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)	5
CB-12	Batiquitos Lagoon Along the North/South Shore Areas	** See CB-02*
CB-13	Northeast Corner of I-5 and Cannon Road Overlooking Agua Hedionda Lagoon (DAR location)	** See CB-07*
CB-14	Buena Vista Lagoon (at Jefferson or Las Flores)	** See CB-09*
City of Oceanside: Buena Vista Lagoon		
OC-01	Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms	6
OC-02	Southern/Western Views from SR 78 Across Lagoon Toward I-5	6
OC-03	Eastern Views from Carlsbad Boulevard (Public Fishing Area) Across Lagoon Toward I-5	4
OC-04	Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5	5
City of Oceanside: San Luis Rey River Valley		
OC-05	Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms	7
OC-06	Northern/Western Views from SR 76 Across San Luis Rey River Valley Toward I-5	1
OC-07	Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements	8
OC-08	Eastern Views from Pacific Street Across River Valley Toward I-5	2
City of Oceanside: Local Coastal Program		
OC-09	San Luis Rey River (Park & Ride or at Hiking/Biking Trail)	** See OC-02*

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DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

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FIGURE 5.7-4A

Key Map of Visual Simulations and Photo Documentation (City of Del Mar/San Diego)



NORTH

Photo Documentation Locations

Photo Simulation Locations

Permanent Impact Area

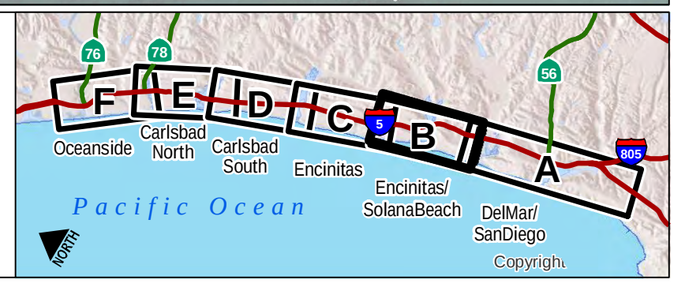
Temporary Impact Area

LOSSAN Proposed Track

LOSSAN Existing Track

Stream/River

0 500 1,000 2,000 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

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FIGURE 5.7-4B

Key Map of Visual Simulations and Photo Documentation (City of Encinitas/Solana Beach)



NORTH

Photo Documentation Locations

Photo Simulation Locations

Permanent Impact Area

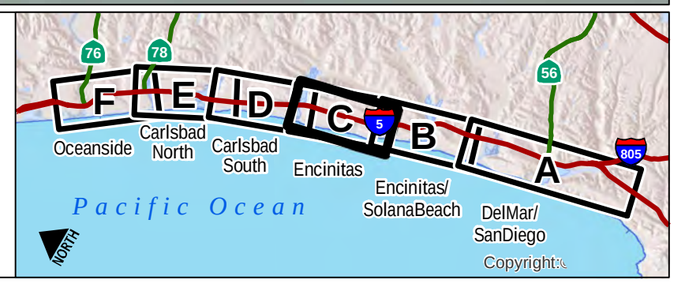
Temporary Impact Area

LOSSAN Proposed Track

LOSSAN Existing Track

Stream/River

0 500 1,000 2,000 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

The Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map are for planning and engineering study purposes only. Data are derived from multiple sources. The digital Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map have not been adopted by the Coastal Commission, and do not supersede the official versions certified by the Coastal Commission as may be amended from time to time. Disclaimer: The State of California makes no representations or warranties regarding the accuracy or completeness of the files or the data from which they were derived. The State shall not be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of these Coastal Zone boundary, jurisdiction and Local Coastal Program files or the data from which they were derived. Because the Coastal Zone boundary, jurisdiction and Local Coastal Program data files are merely representational, they and the data from which they were derived are not binding and may be revised at any time.

FIGURE 5.7-4C

Key Map of Visual Simulations and Photo Documentation (City of Encinitas)



NORTH

Photo Documentation Locations

Photo Simulation Locations

Permanent Impact Area

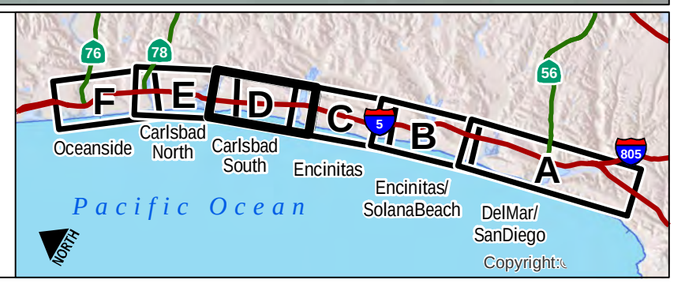
Temporary Impact Area

LOSSAN Proposed Track

LOSSAN Existing Track

Stream/River

0 500 1,000 2,000 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

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FIGURE 5.7-4D

Key Map of Visual Simulations and Photo Documentation (City of Carlsbad [South])



NORTH

0 500 1,000 2,000 Feet

Photo Documentation Locations

Photo Simulation Locations

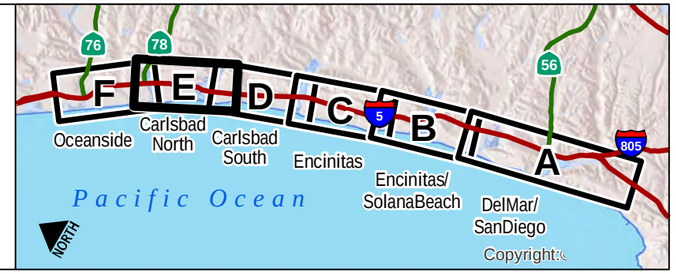
Permanent Impact Area

Temporary Impact Area

LOSSAN Proposed Track

LOSSAN Existing Track

Stream/River

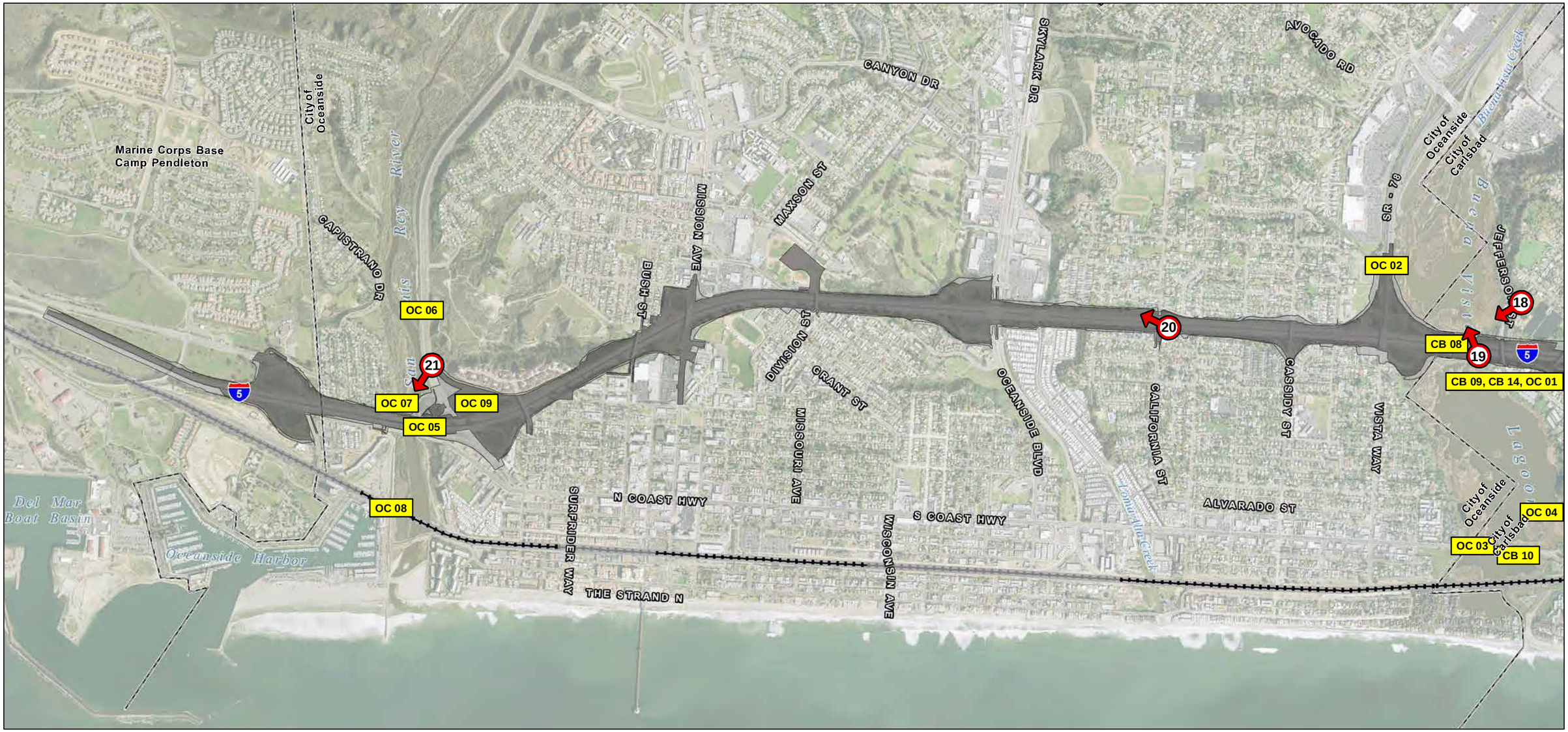


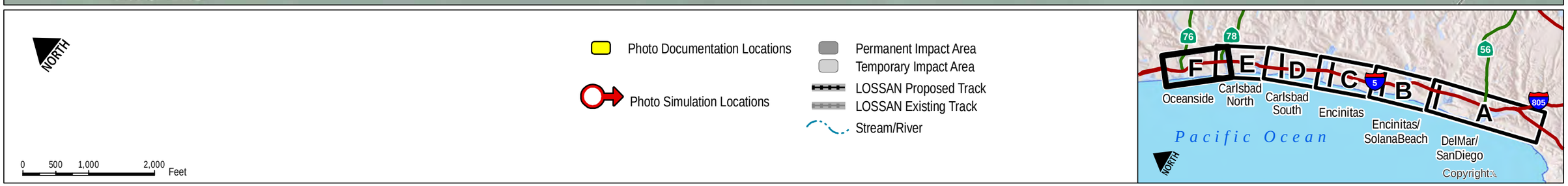
DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

The Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map are for planning and engineering study purposes only. Data are derived from multiple sources. The digital Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map have not been adopted by the Coastal Commission, and do not supersede the official versions certified by the Coastal Commission as may be amended from time to time. Disclaimer: The State of California makes no representations or warranties regarding the accuracy or completeness of the files or the data from which they were derived. The State shall not be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of these Coastal Zone boundary, jurisdiction and Local Coastal Program files or the data from which they were derived. Because the Coastal Zone boundary, jurisdiction and Local Coastal Program data files are merely representational, they and the data from which they were derived are not binding and may be revised at any time.

FIGURE 5.7-4E

Key Map of Visual Simulations and Photo Documentation (City of Carlsbad [North])





DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

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FIGURE 5.7-4F

Key Map of Visual Simulations and Photo Documentation (City of Oceanside)



DATA SOURCES: Google, Caltrans

Figure SD-01A

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01B

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01C

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01D

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01E

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01F

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01G

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-01H

Western Views from I-5 including the Pacific Ocean, Los Penasquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-02A

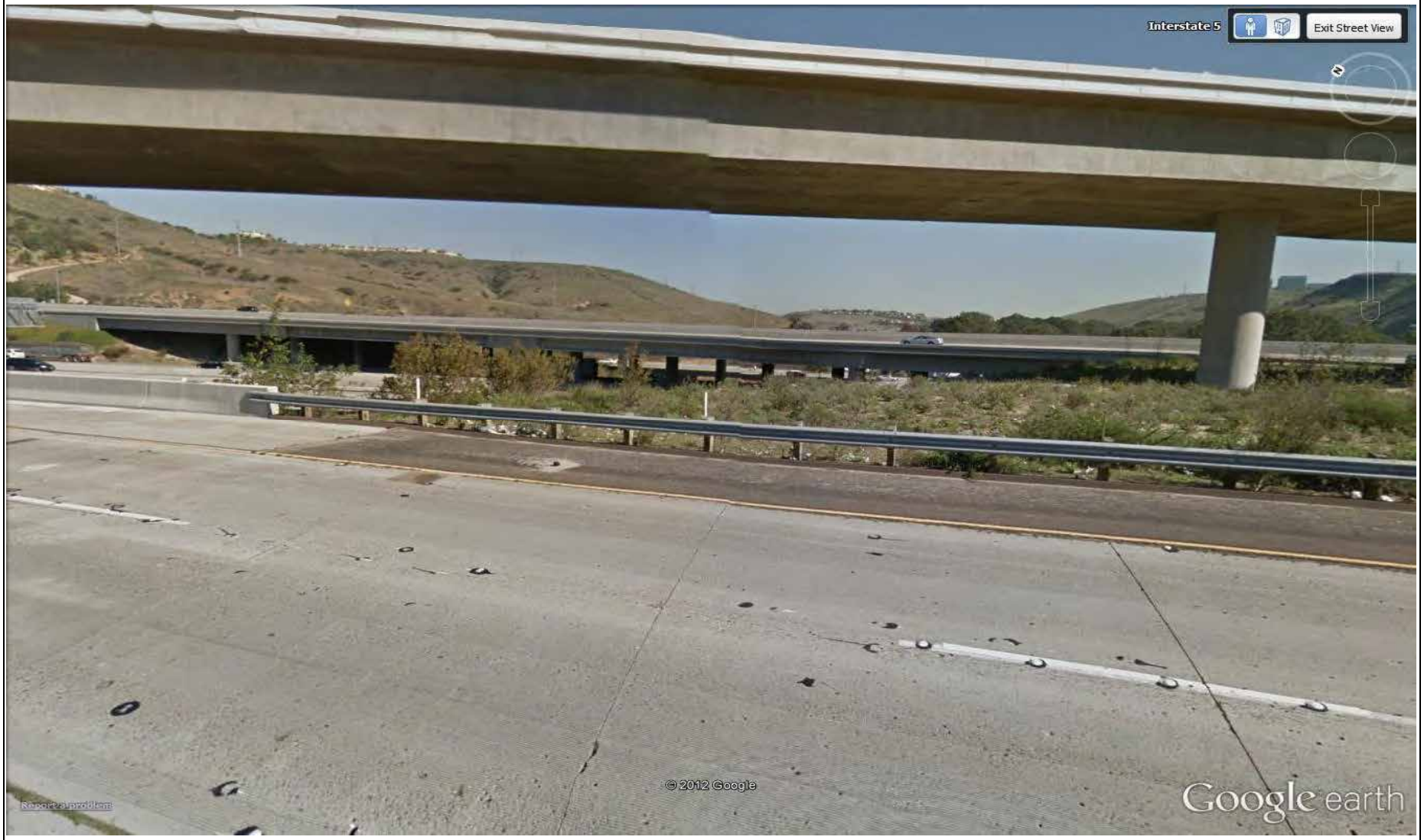
Southbound View of Los Penasquitos/Natural Landforms of Torrey Pines State Preserve



DATA SOURCES: Google, Caltrans

Figure SD-02B

Southbound View of Los Penasquitos/Natural Landforms of Torrey Pines State Preserve



DATA SOURCES: Google, Caltrans

Figure SD-03A

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03B

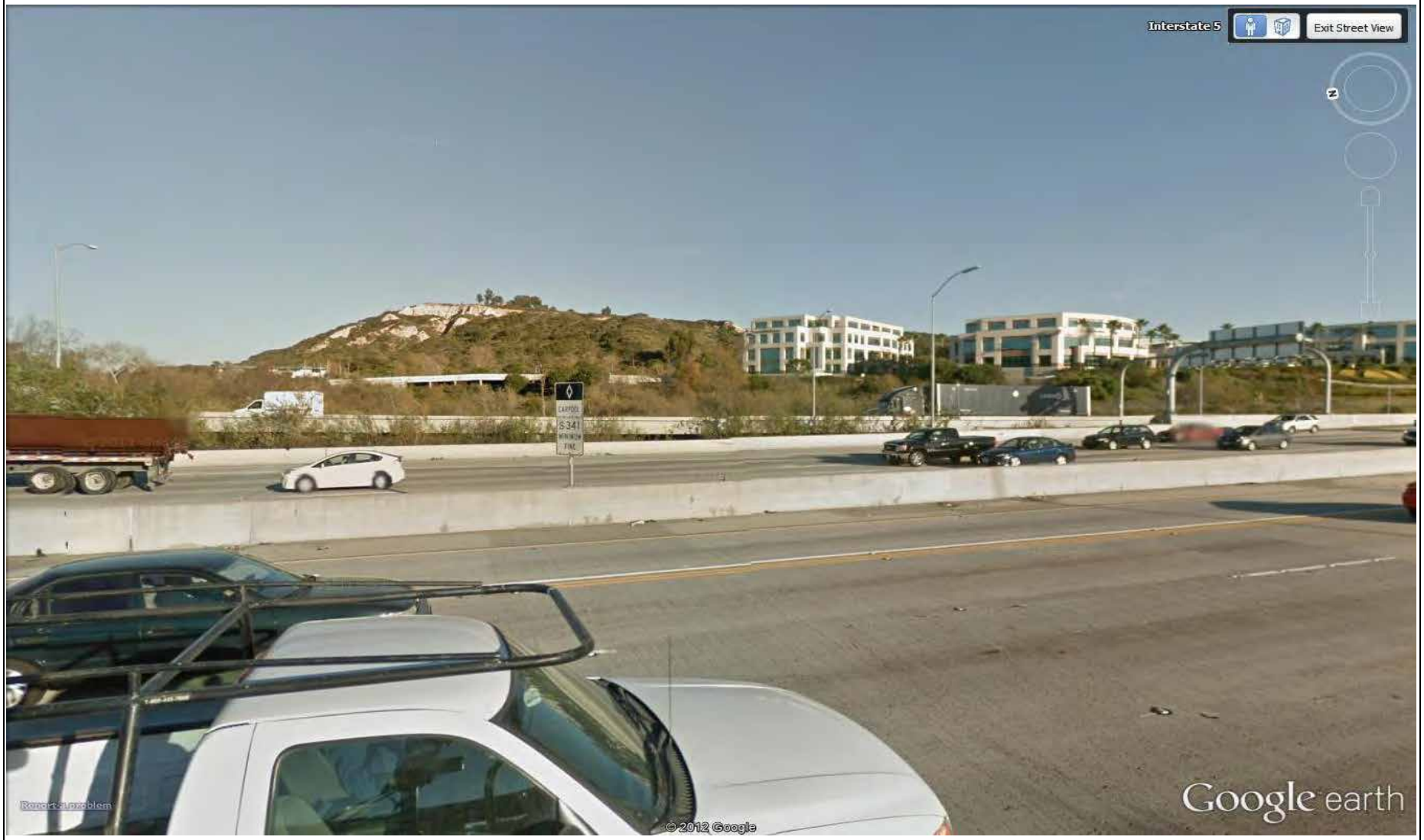
Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03C

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03D

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03E

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03F

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03G

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03H

Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-03I

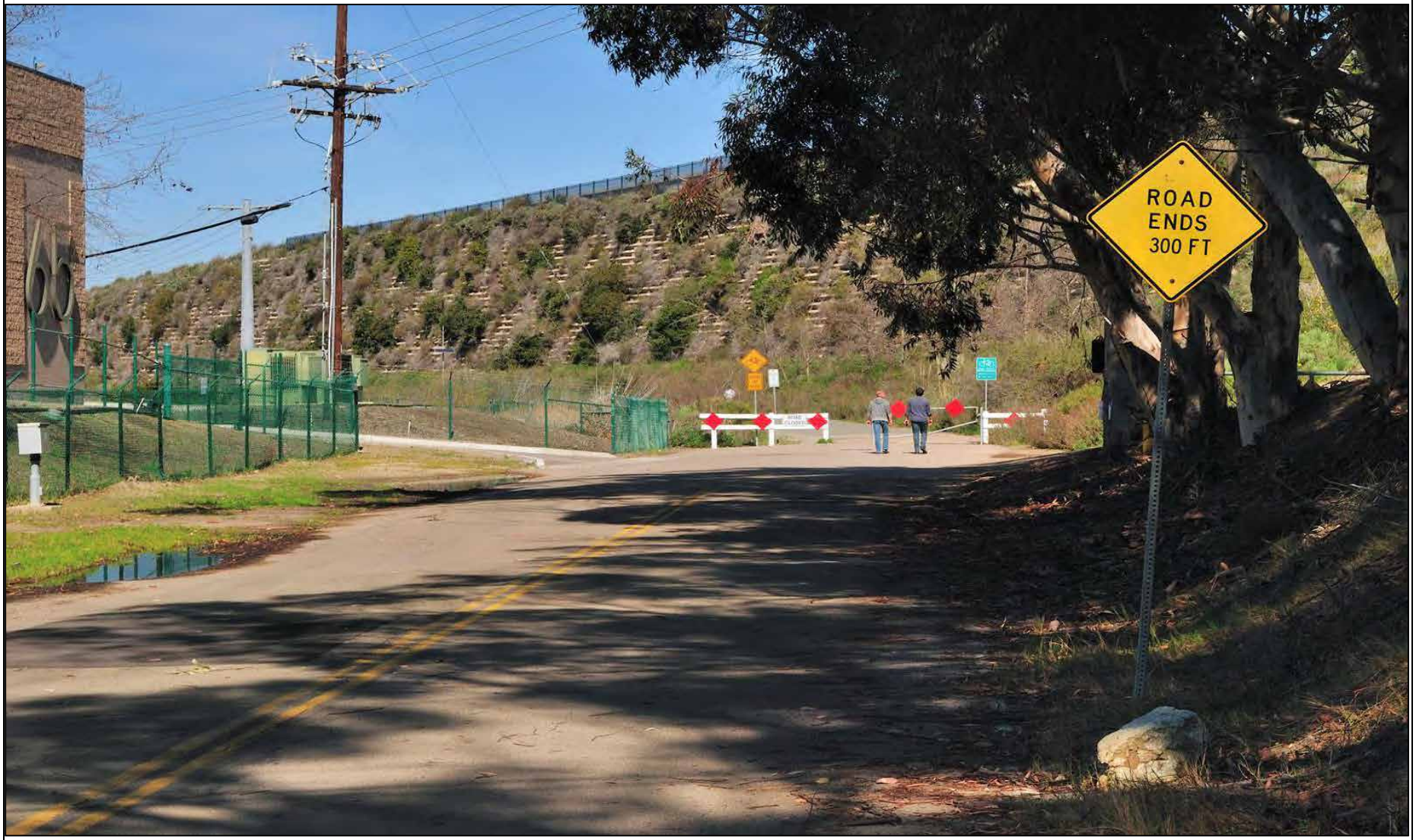
Eastern Views from I-5 Including Los Penasquitos Lagoon and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-04A

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04B

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04C

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04D

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04E

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04F

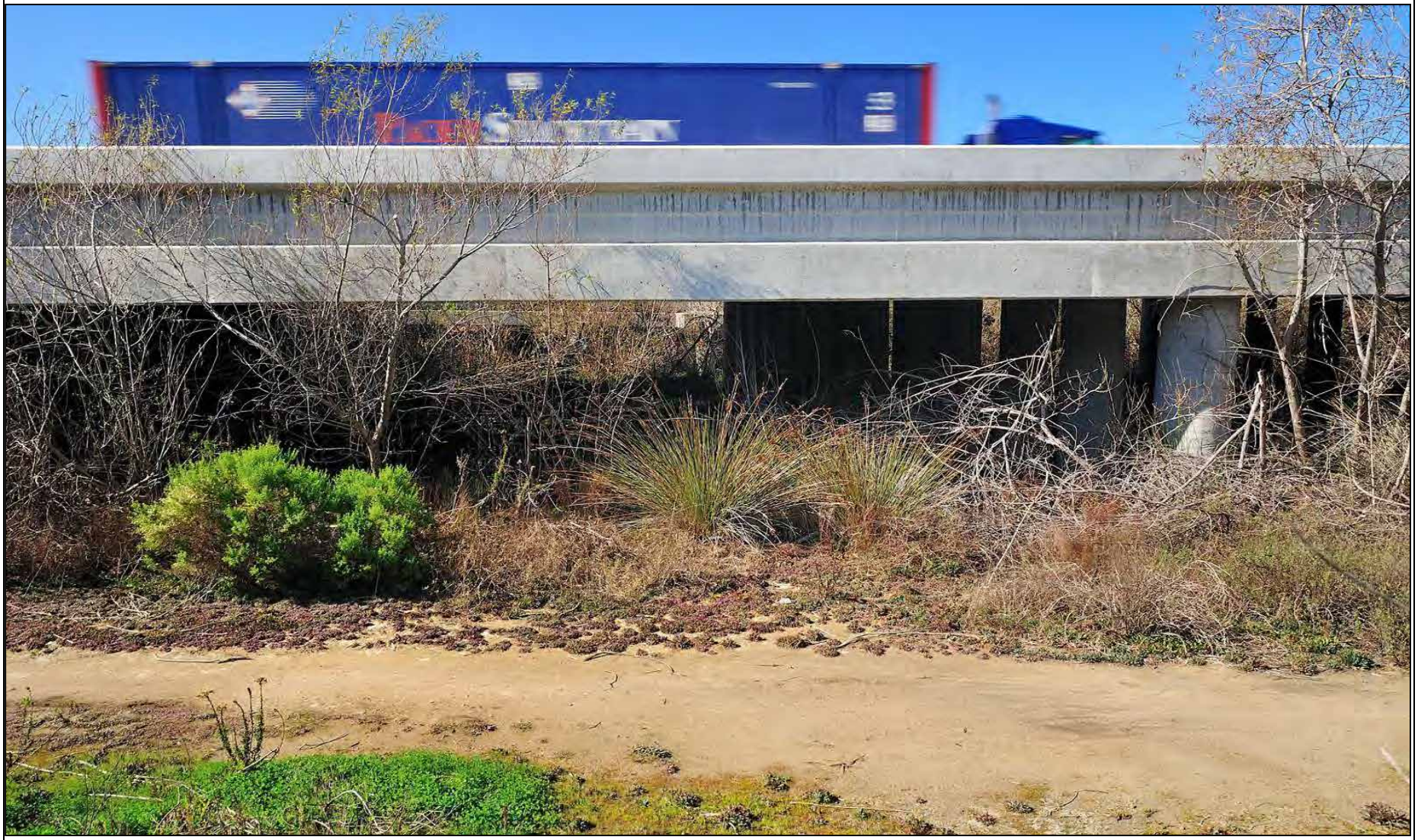
Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04G

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04H

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04I

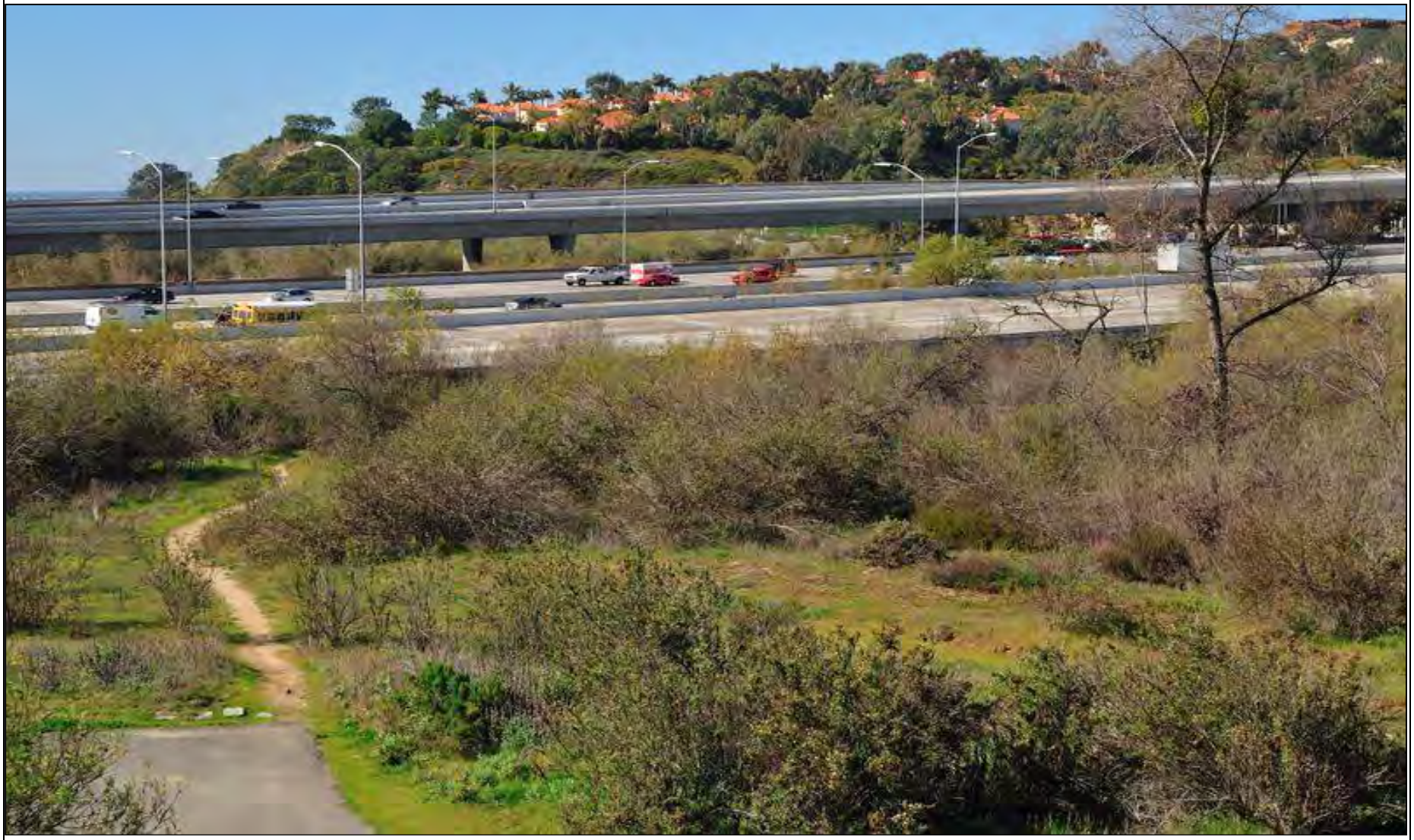
Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04J

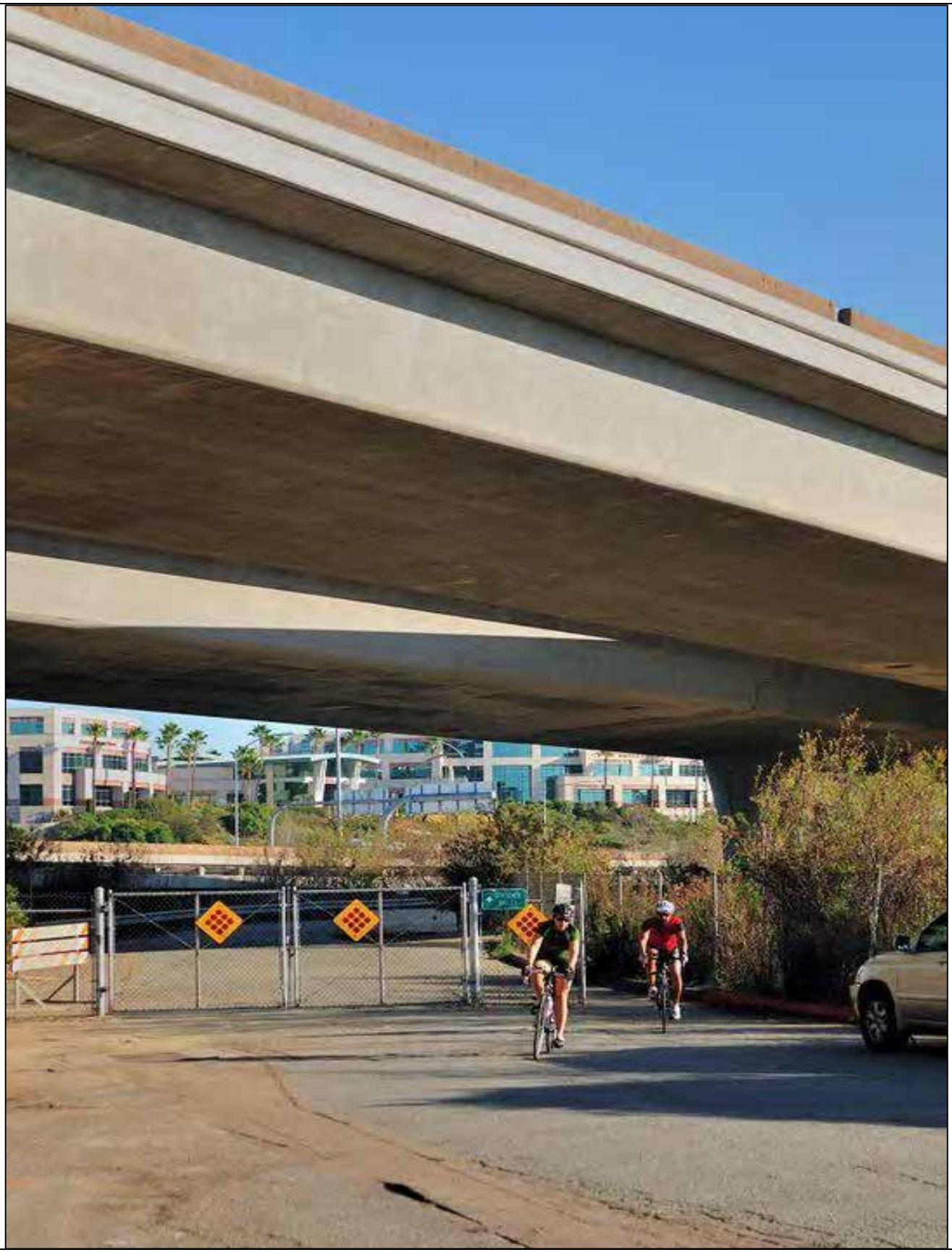
Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04K

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04L

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04M

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-04N

Views from Public Trails Located within Carmel Valley, Including Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-07A

Eastern Looking Views from Carmel Valley Road (CVREP) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure SD-07B

Eastern Looking Views from Carmel Valley Road (CVREP) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure SD-07C

Eastern Looking Views from Carmel Valley Road (CVREP) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure SD-08A

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08B

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08C

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08D

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08E

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08F

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08G

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08H

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08I

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08J

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08K

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08L

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08M

Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-08N

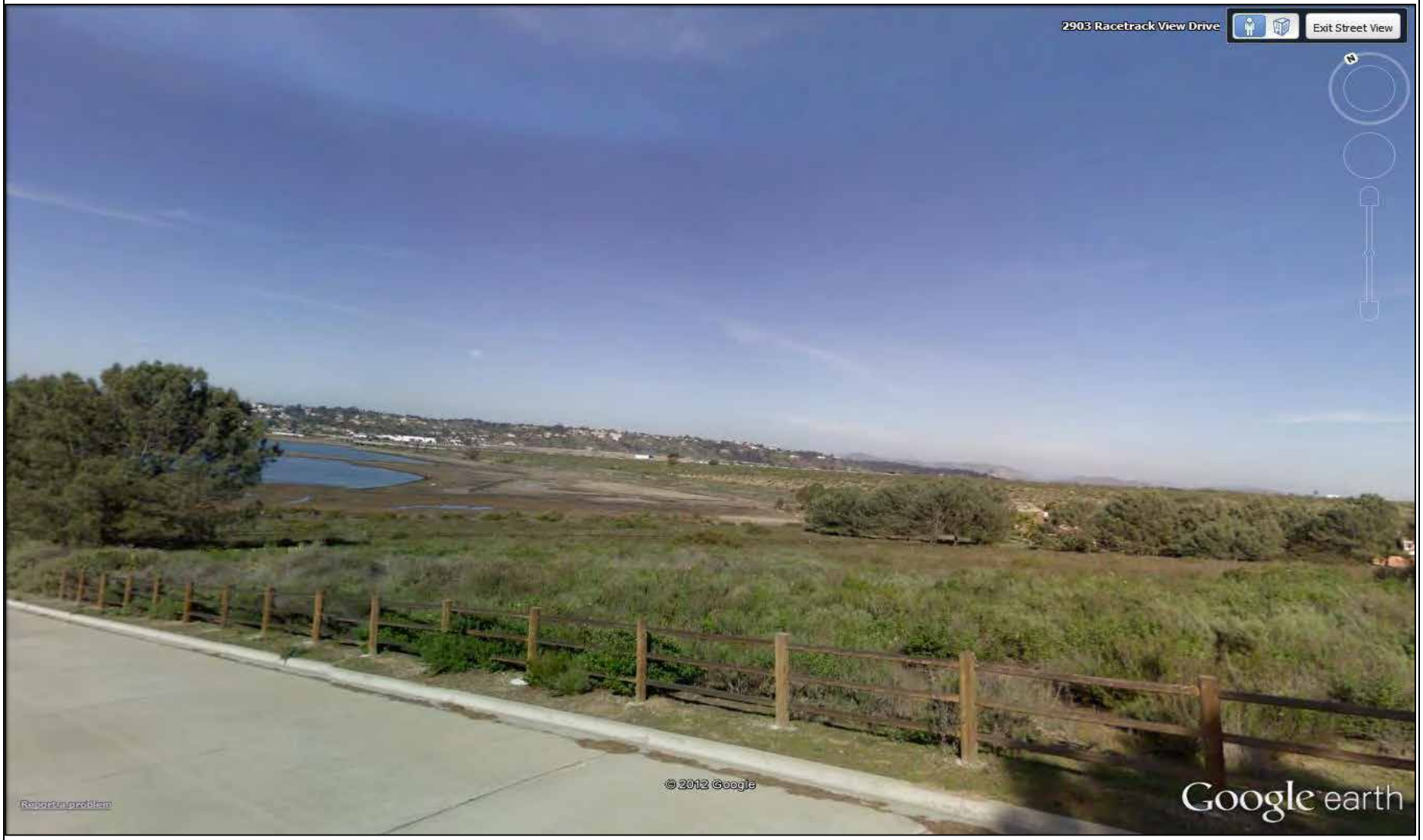
Western/Eastern Views from I-5 including the Pacific Ocean, San Dieguito Lagoon and Seaward and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SD-11A

Northern View from Racetrack View Drive (Caltrans Restoration Site)



DATA SOURCES: Google, Caltrans

Figure SD-11B

Northern View from Racetrack View Drive (Caltrans Restoration Site)



DATA SOURCES: Google, Caltrans

Figure SD-11C

Northern View from Racetrack View Drive (Caltrans Restoration Site)



DATA SOURCES: Google, Caltrans

Figure SD-12A

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12B

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12C

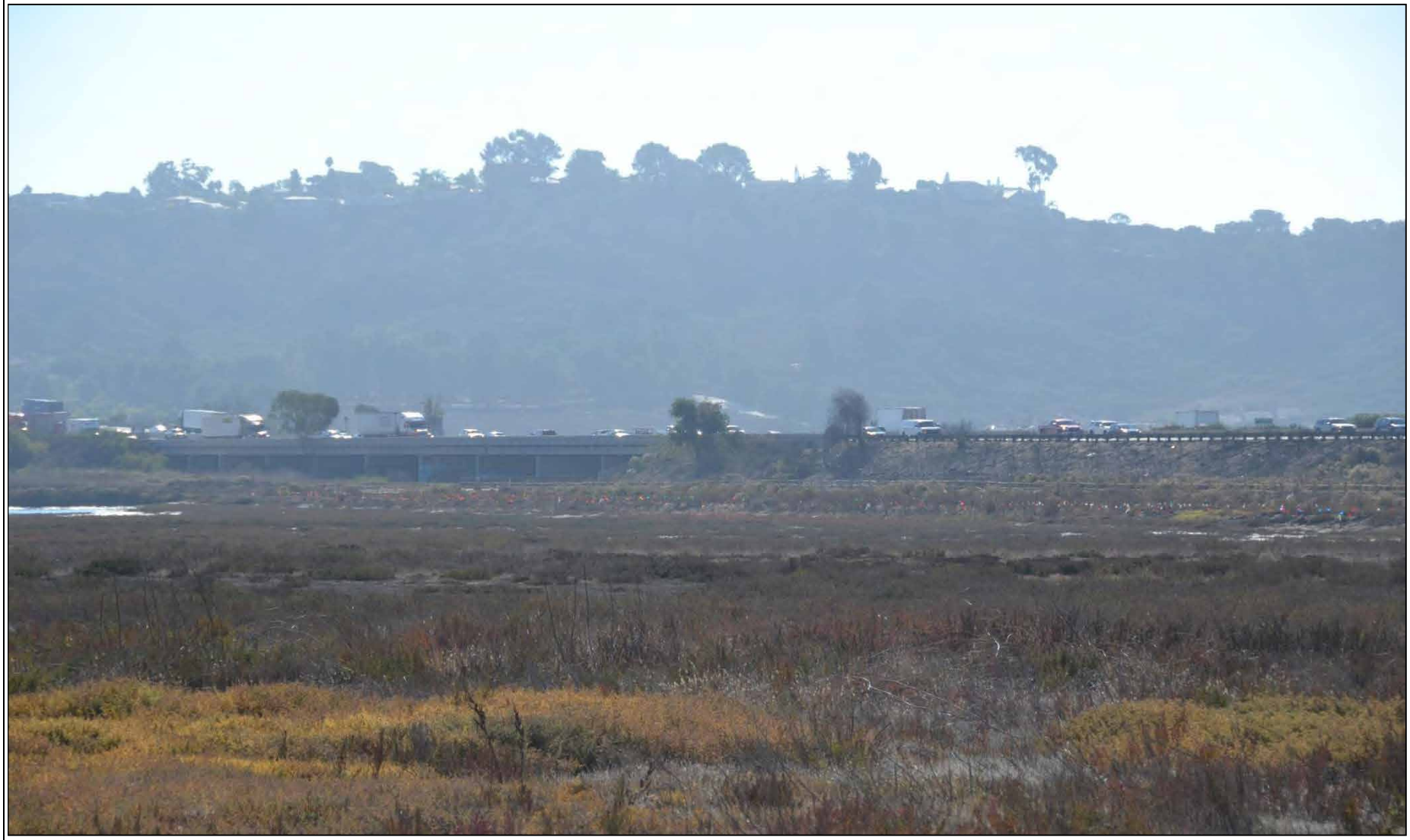
Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12D

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12E

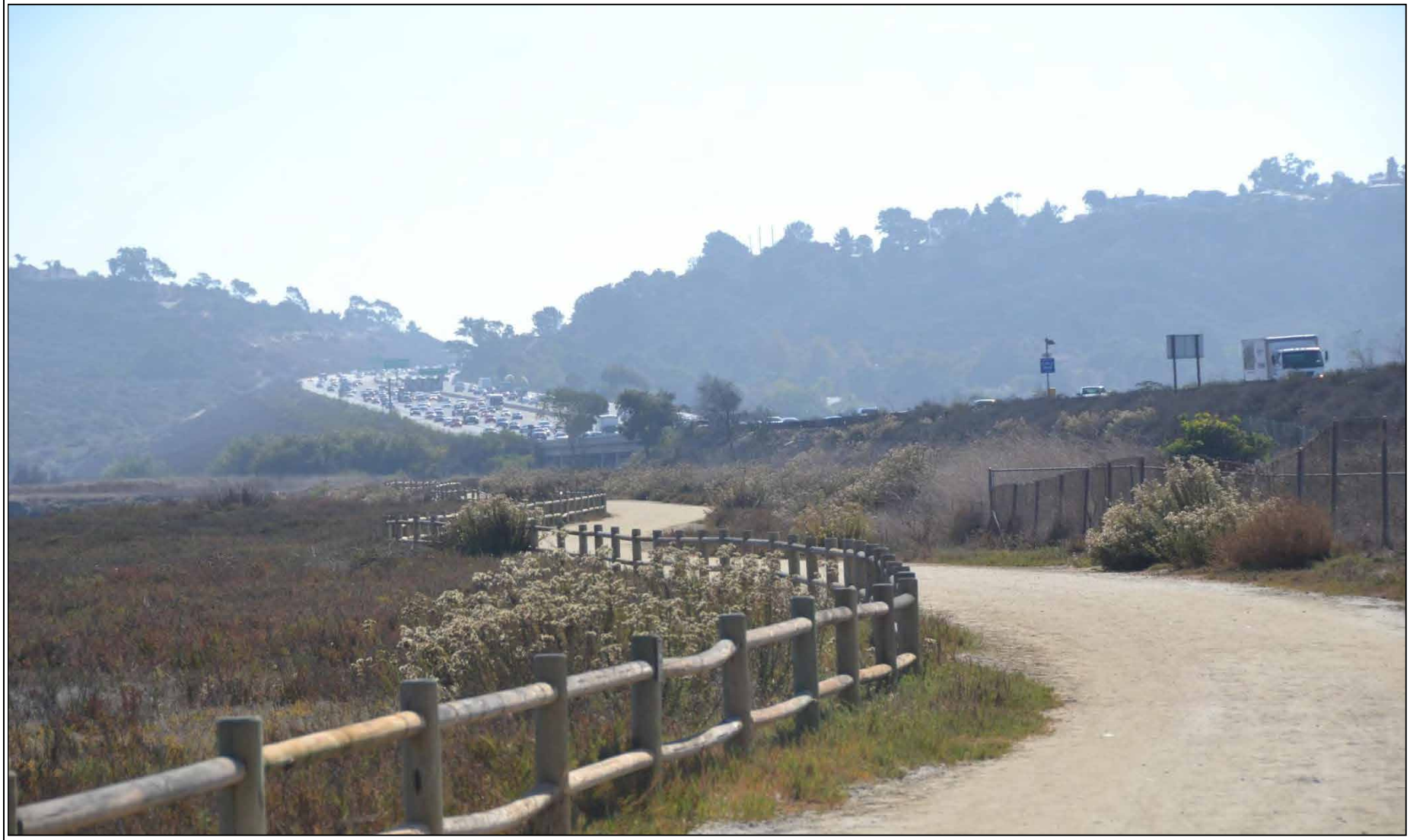
Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12F

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12G

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12H

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12I

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12J

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12K

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12L

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12M

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-12N

Views from San Dieguito and Los Penasquitos Lagoons that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure SD-14A

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14B

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14C

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14D

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14E

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14F

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14G

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14H

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure SD-14l

North Torrey Pines Road, Carmel Valley Road, and Sorrento Valley Road Vistas



DATA SOURCES: Google, Caltrans

Figure DM-01A

Eastern Views from Jimmy Durante Boulevard Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure DM-01B

Eastern Views from Jimmy Durante Boulevard Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure DM-02A

Western Views from Via de la Valle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure DM-02B

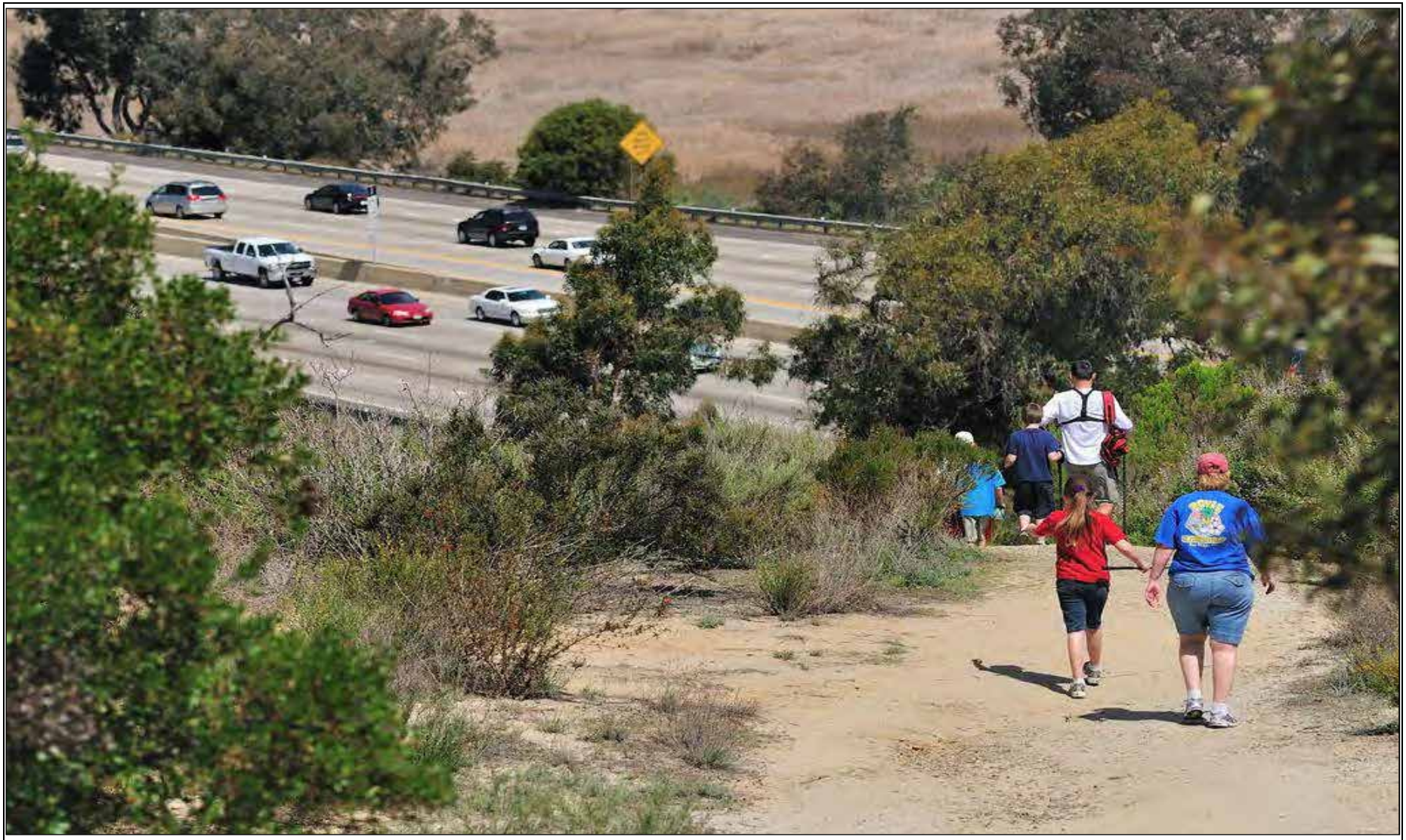
Western Views from Via de la Valle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure DM-02C

Western Views from Via de la Valle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure SB-02A

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02B

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02C

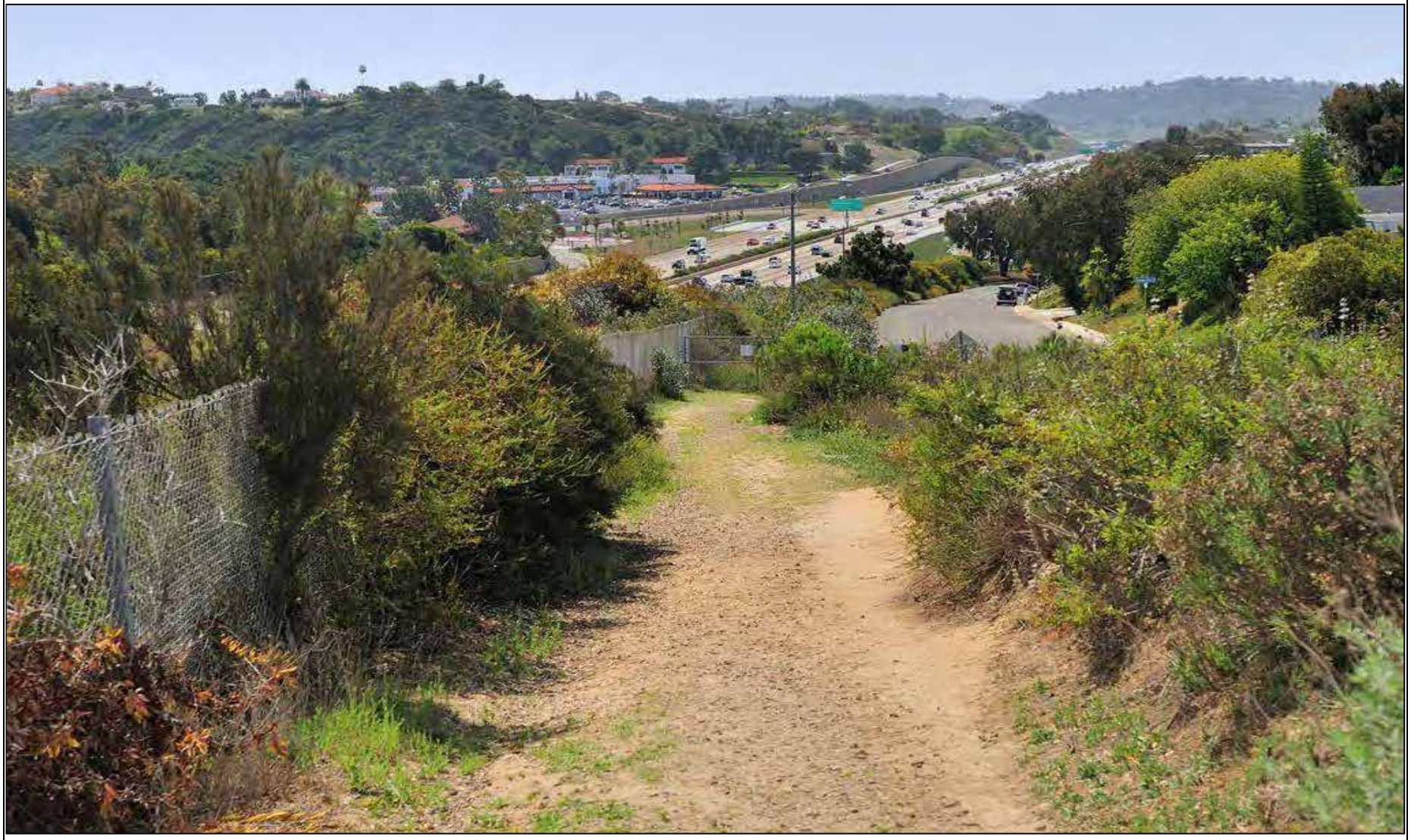
Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02D

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02E

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02F

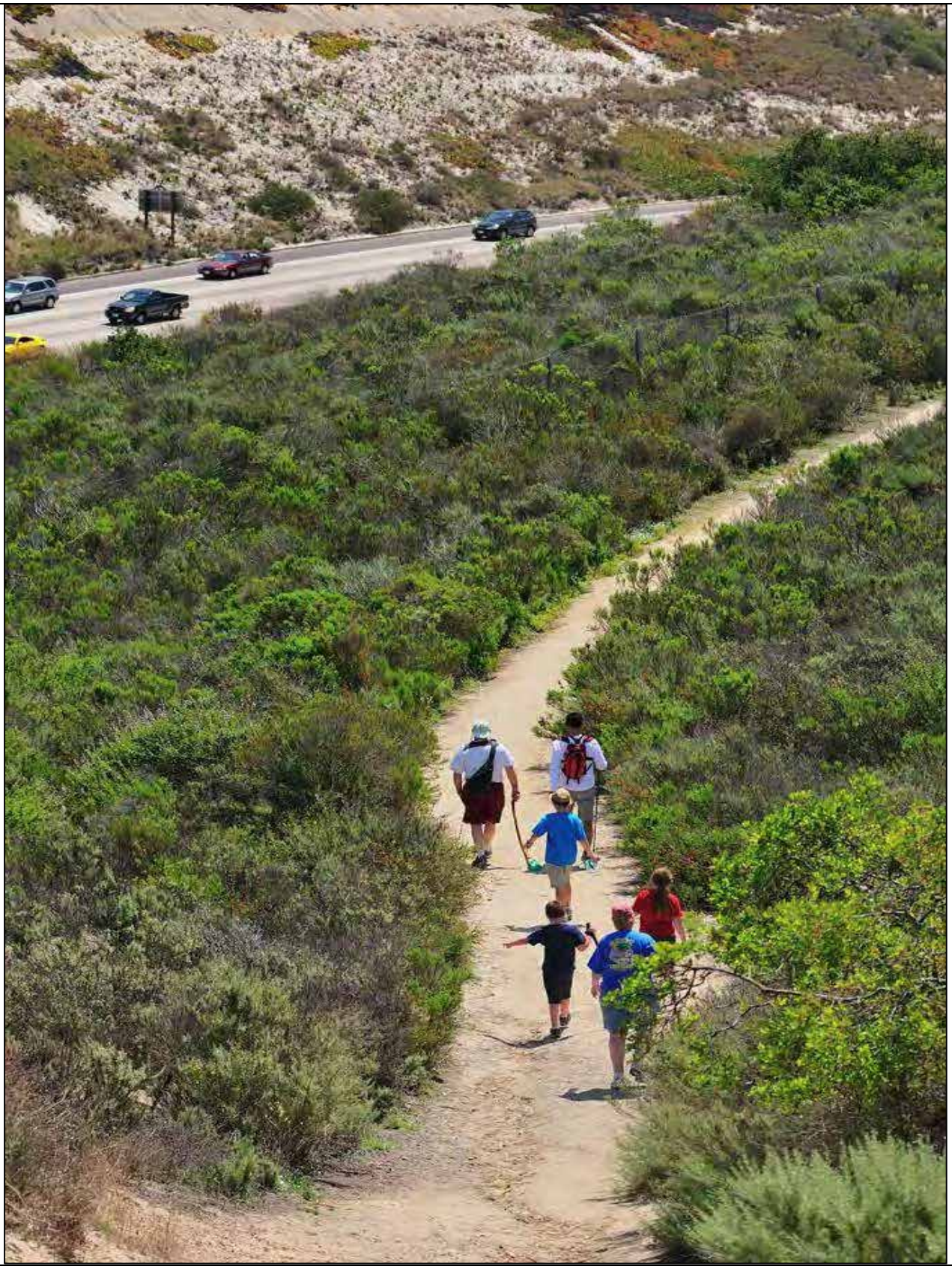
Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02G

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02H

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-02I

Northern View from Public Trail Toward San Elijo Lagoon from Solana Hills Drive



DATA SOURCES: Google, Caltrans

Figure SB-03A

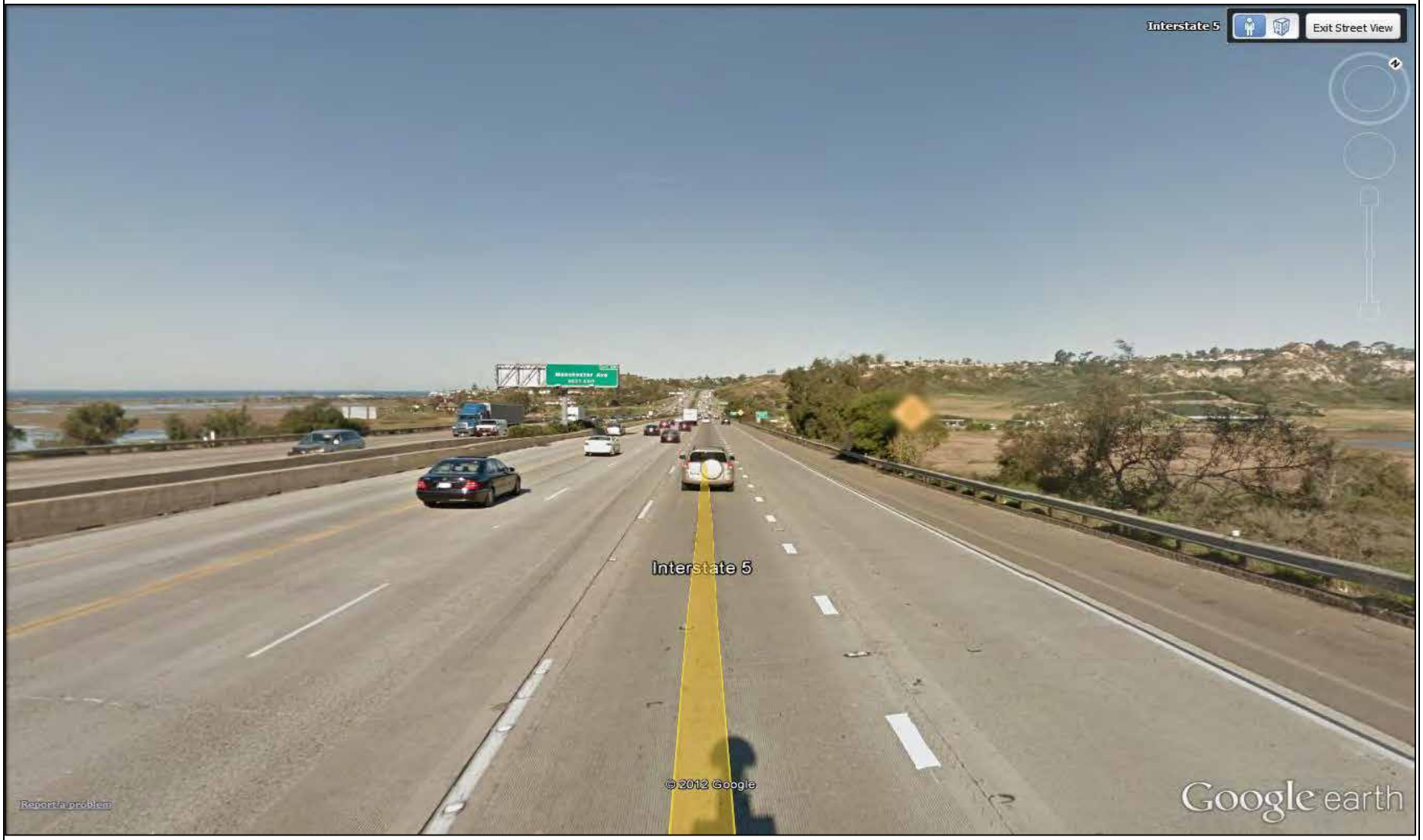
Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03B

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03C

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03D

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03E

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03F

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03G

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03H

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03I

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03J

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03K

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03L

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03M

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03N

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03O

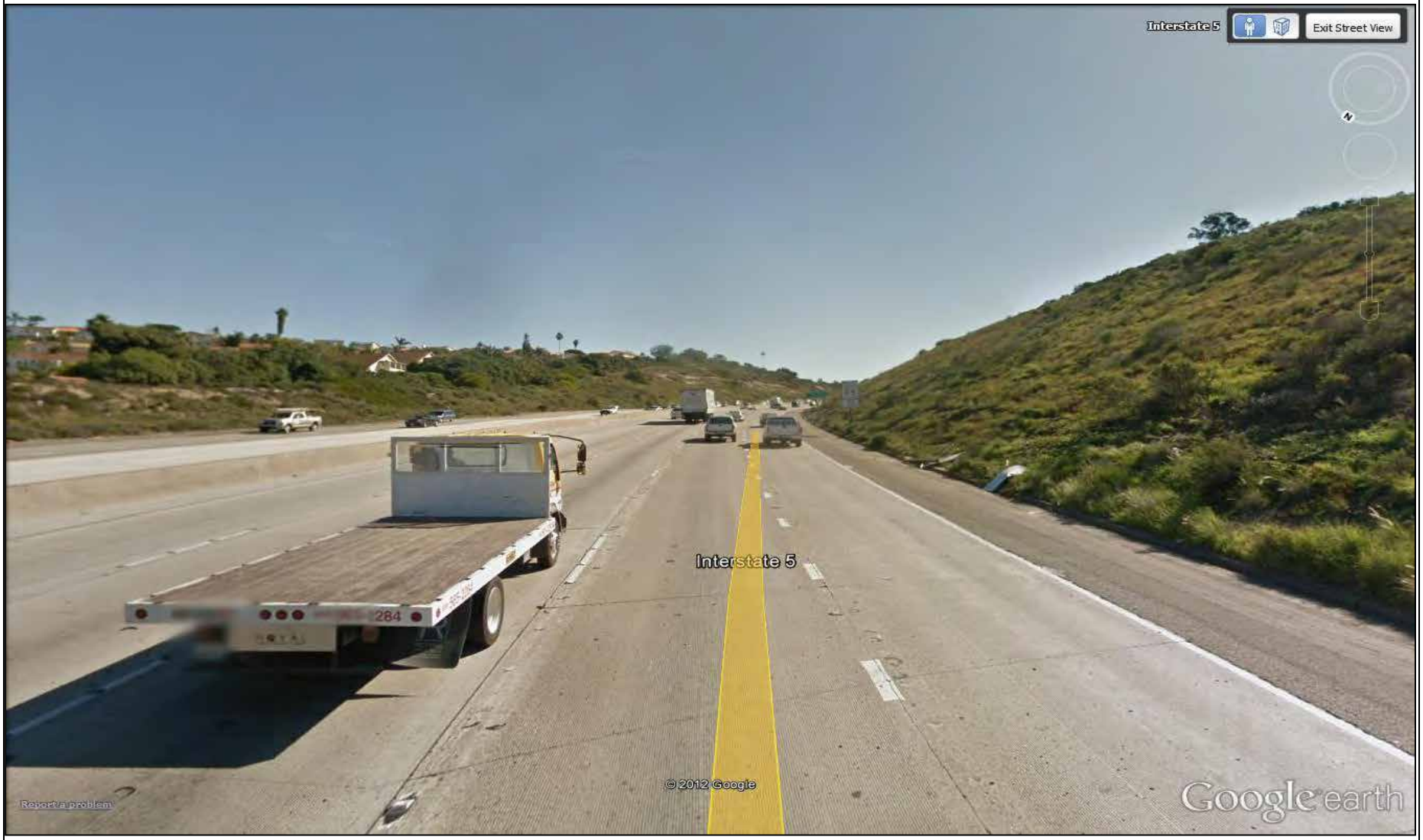
Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03P

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure SB-03Q

Western/Eastern views from I-5 Including the Pacific Ocean, San Elijo Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-02A

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02B

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02C

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02D

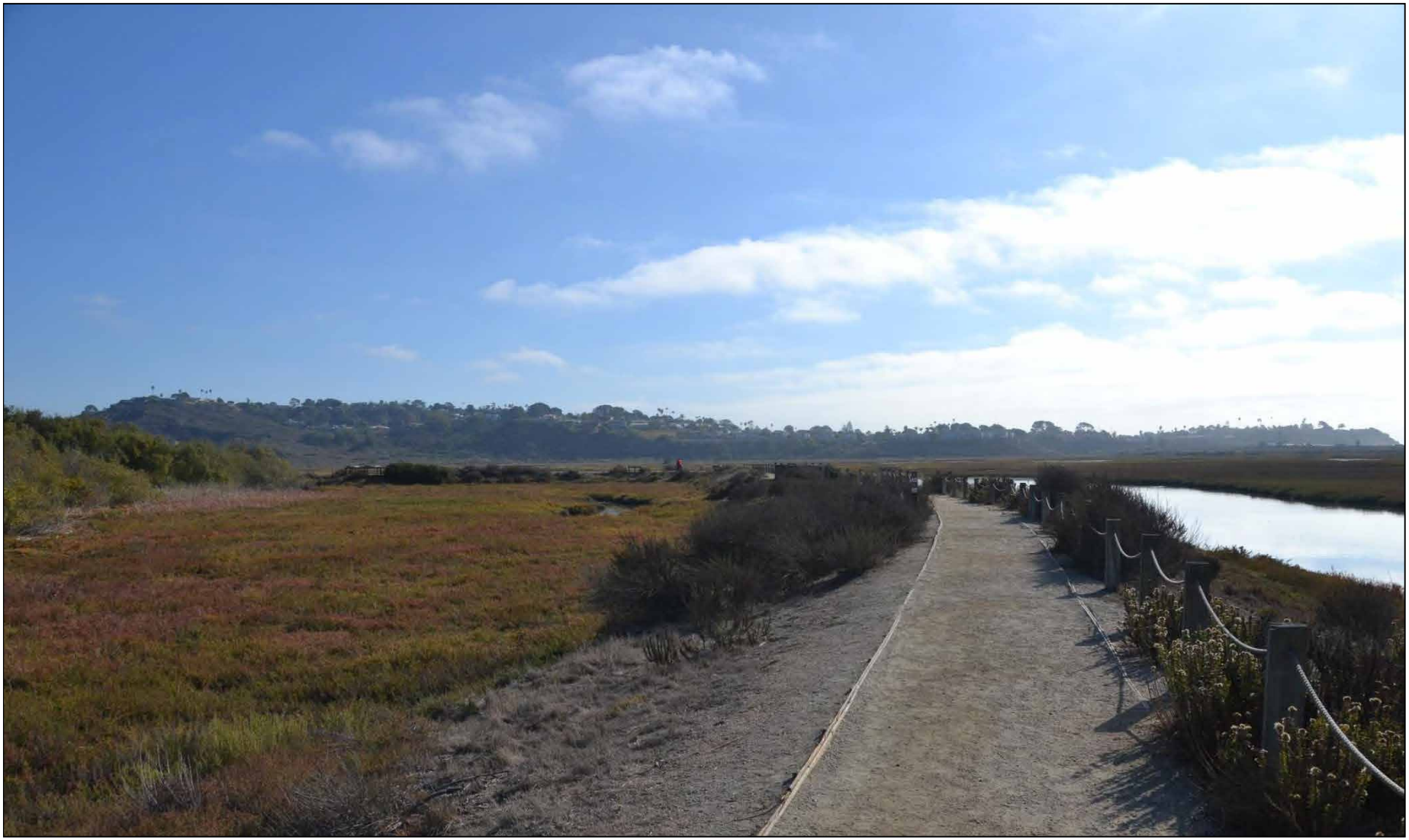
Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02E

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02F

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02G

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02H

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02I

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-02J

Views from Public Trails Located within San Elijo Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure EC-03A

Western/Eastern Views from Manchester Road Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-03B

Western/Eastern Views from Manchester Road Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-03C

Western/Eastern Views from Manchester Road Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-03D

Western/Eastern Views from Manchester Road Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-03E

Western/Eastern Views from Manchester Road Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-04A

Western/Northern Views from Existing Scenic Overlook on I-5



DATA SOURCES: Google, Caltrans

Figure EC-04B

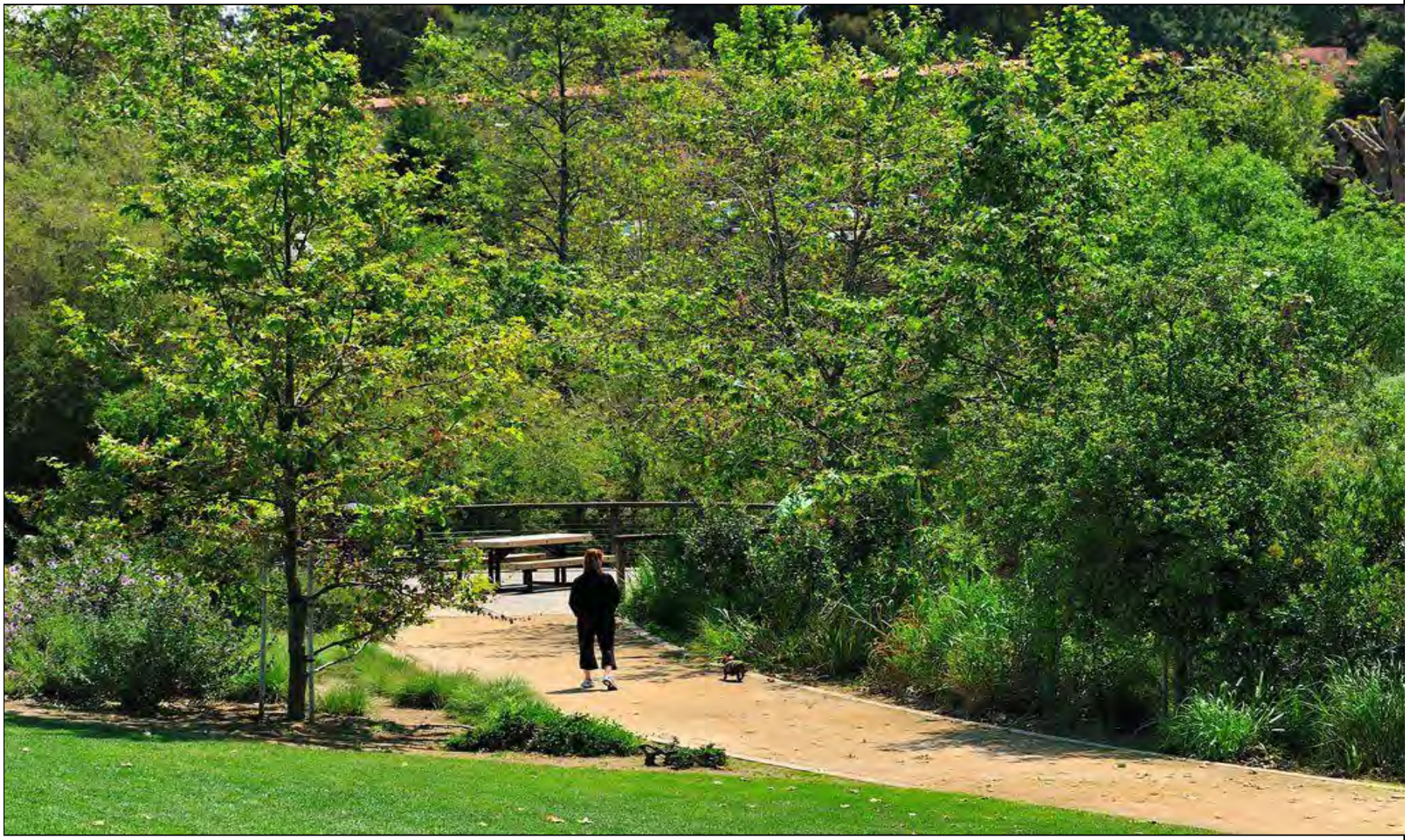
Western/Northern Views from Existing Scenic Overlook on I-5



DATA SOURCES: Google, Caltrans

Figure EC-04C

Western/Northern Views from Existing Scenic Overlook on I-5



DATA SOURCES: Google, Caltrans

Figure EC-05A

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-05B

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-05C

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-05D

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-05E

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-05F

Views from Encinitas Community Park



DATA SOURCES: Google, Caltrans

Figure EC-06A

Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-06B

Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-06C

Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-06D

Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-06E

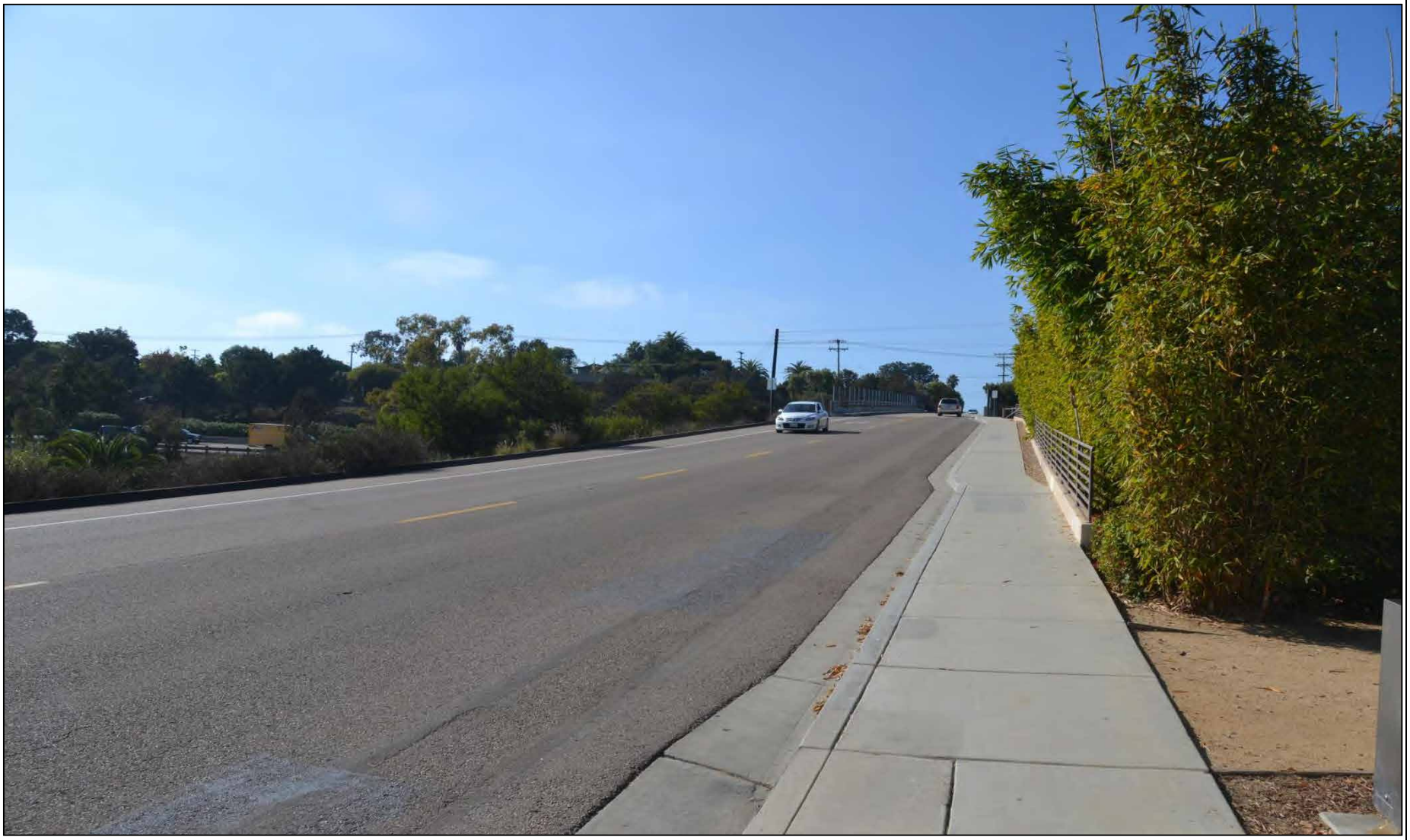
Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-06F

Western Views from I-5 Including the Pacific Ocean (Santa Fe and Encinitas Interchanges)



DATA SOURCES: Google, Caltrans

Figure EC-08A

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08B

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08C

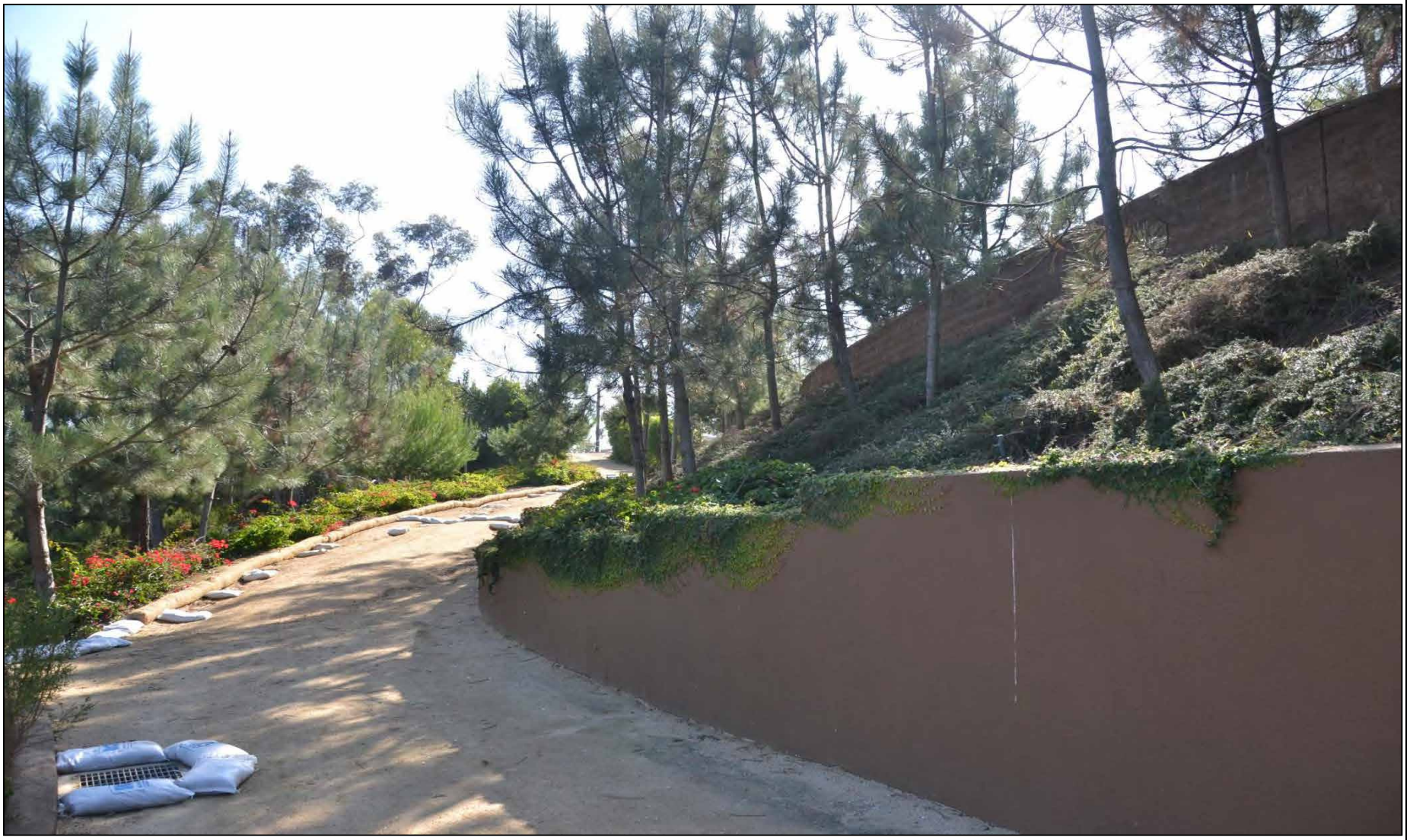
Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08D

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08E

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08A

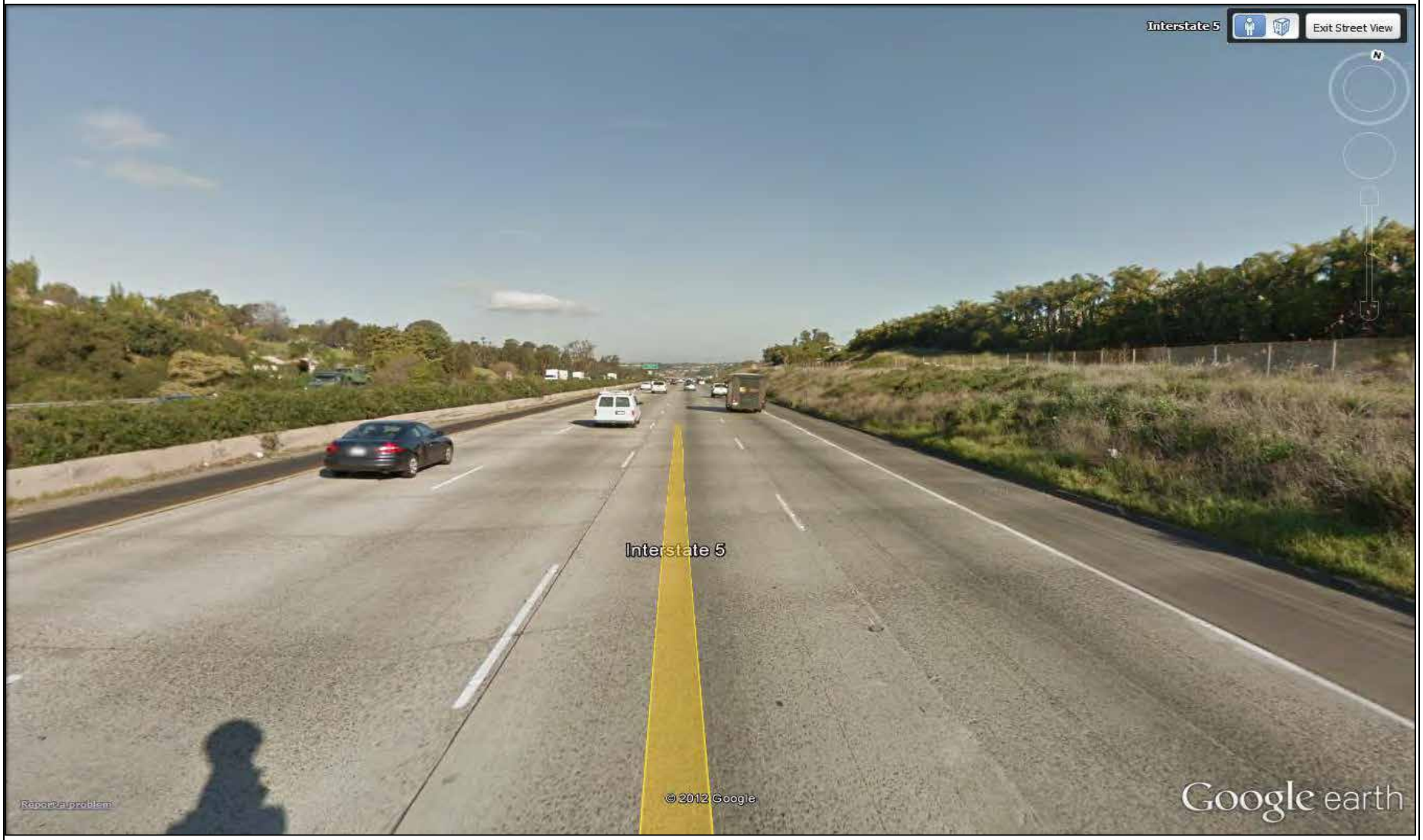
Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08B

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08C

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08D

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08E

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08F

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08G

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08H

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08l

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08J

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08K

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08L

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-08M

Western/Eastern Views from I-5 (Between Manchester/Birmingham and Leucadia/La Costa Exits) of Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09A

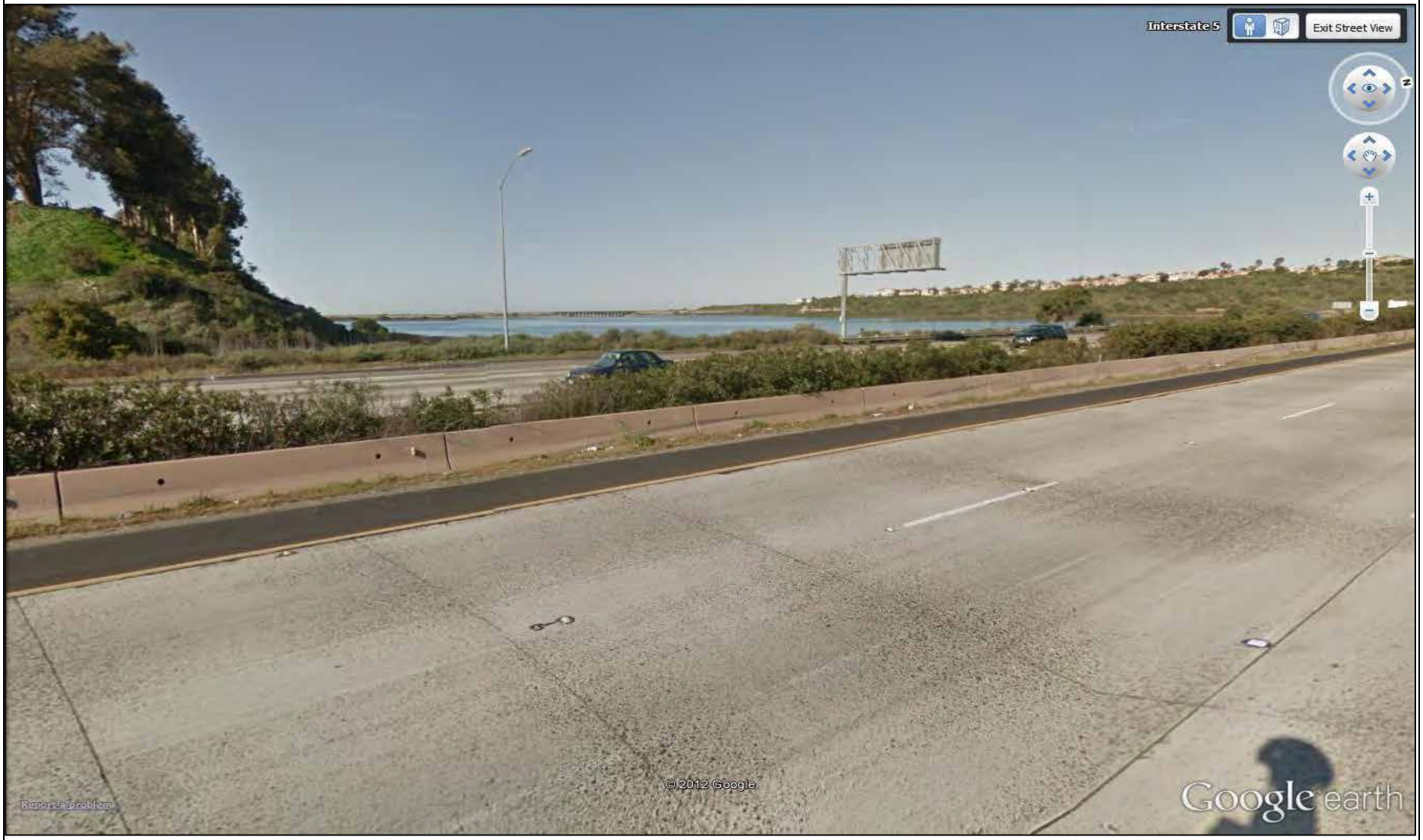
Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09B

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09C

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09D

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09E

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09F

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09G

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09H

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09I

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09J

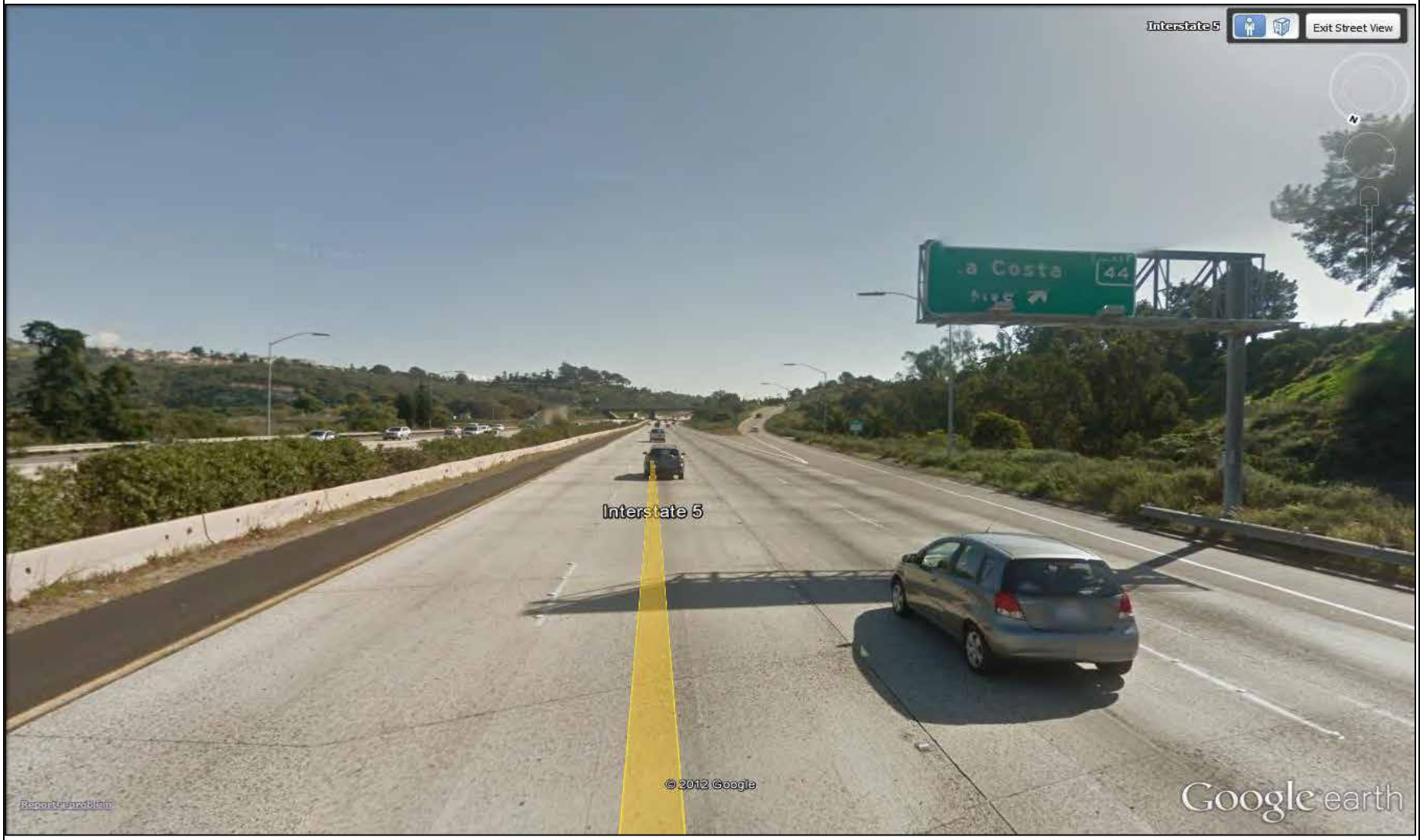
Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09K

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-09L

Western/Eastern Views from I-5 Including the Pacific Ocean, Batiquitos Lagoon and Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure EC-10A

Northwestern Views from La Costa Avenue Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-10B

Northwestern Views from La Costa Avenue Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-10C

Northwestern Views from La Costa Avenue Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-10D

Northwestern Views from La Costa Avenue Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure EC-12A

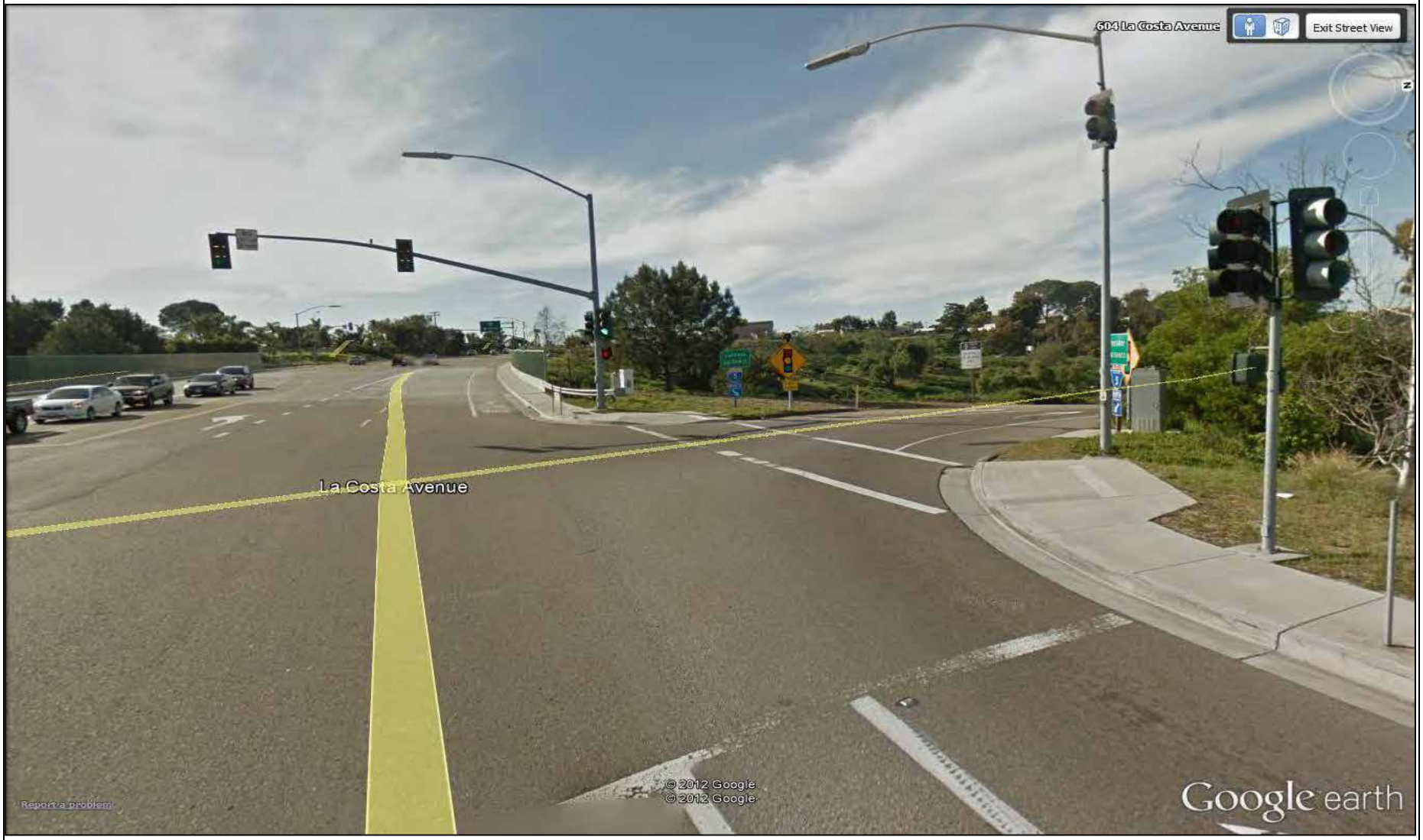
Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12B

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12C

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12D

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12E

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12F

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12G

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-12H

Northeast/Northwest Corner of I-5 and La Costa Avenue



DATA SOURCES: Google, Caltrans

Figure EC-14A

Existing Vista Point on Southbound I-5 (north of Manchester Avenue)



DATA SOURCES: Google, Caltrans

Figure EC-14B

Existing Vista Point on Southbound I-5 (north of Manchester Avenue)



DATA SOURCES: Google, Caltrans

Figure CB-02A

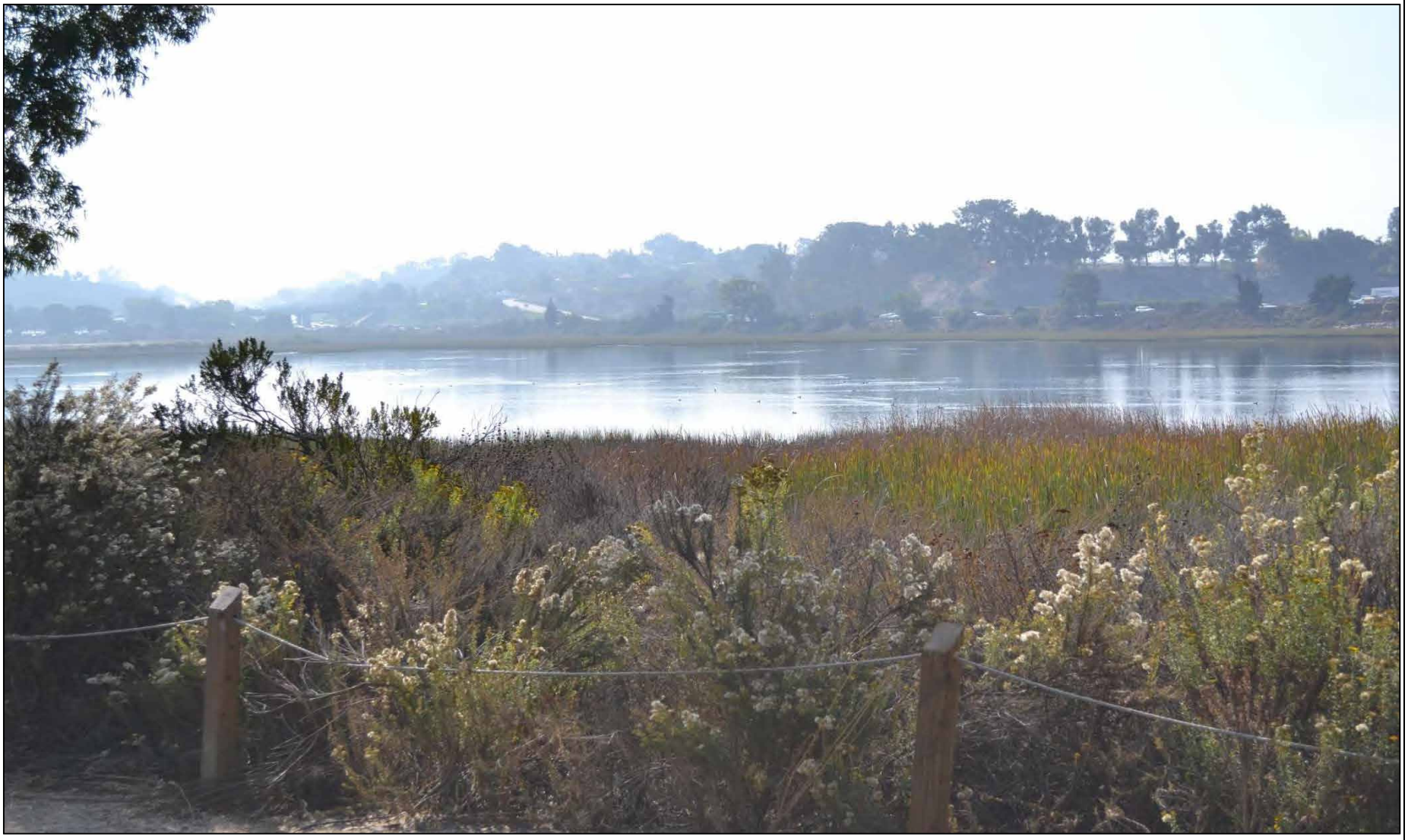
Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02B

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02C

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02D

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02E

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02F

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02G

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02H

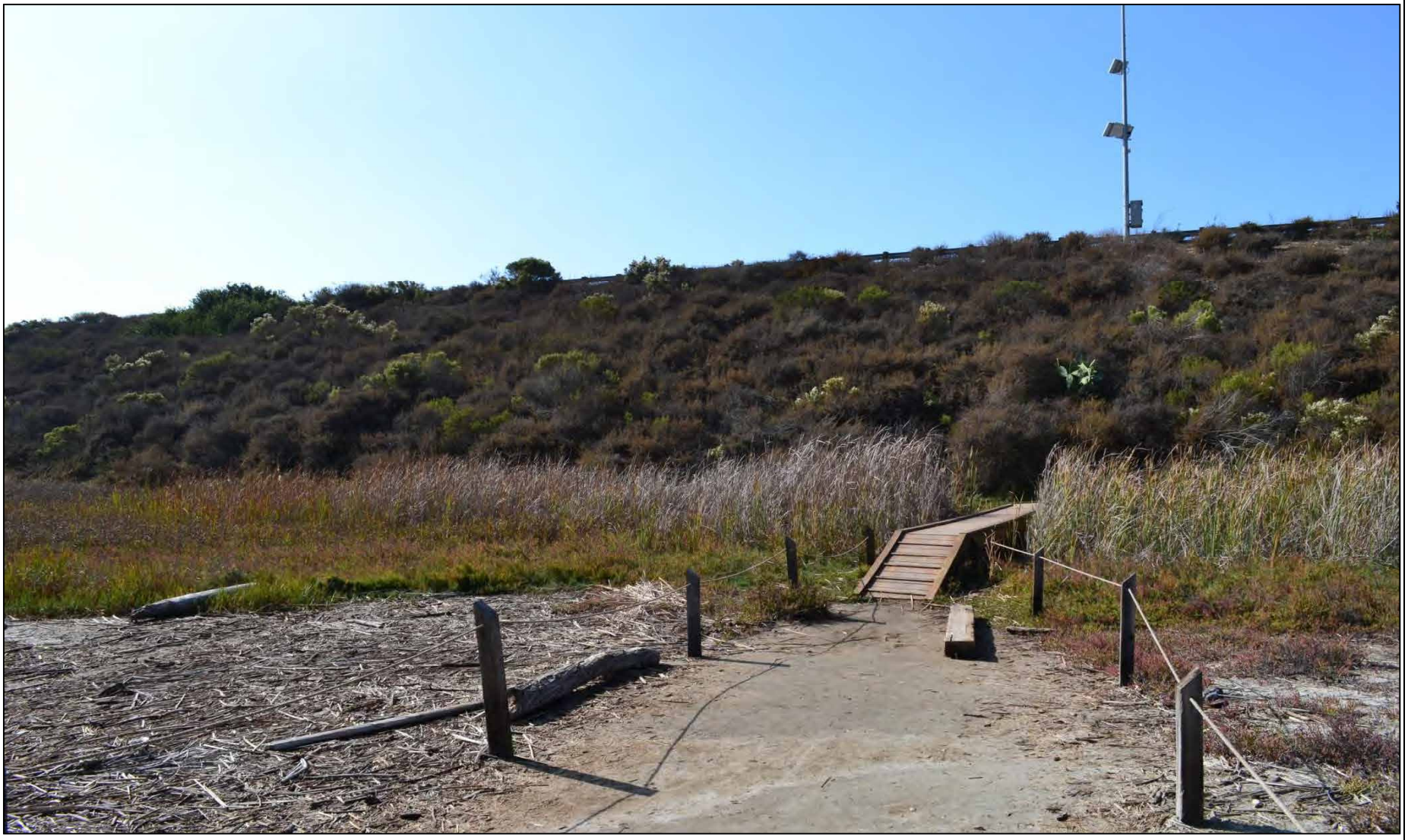
Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02I

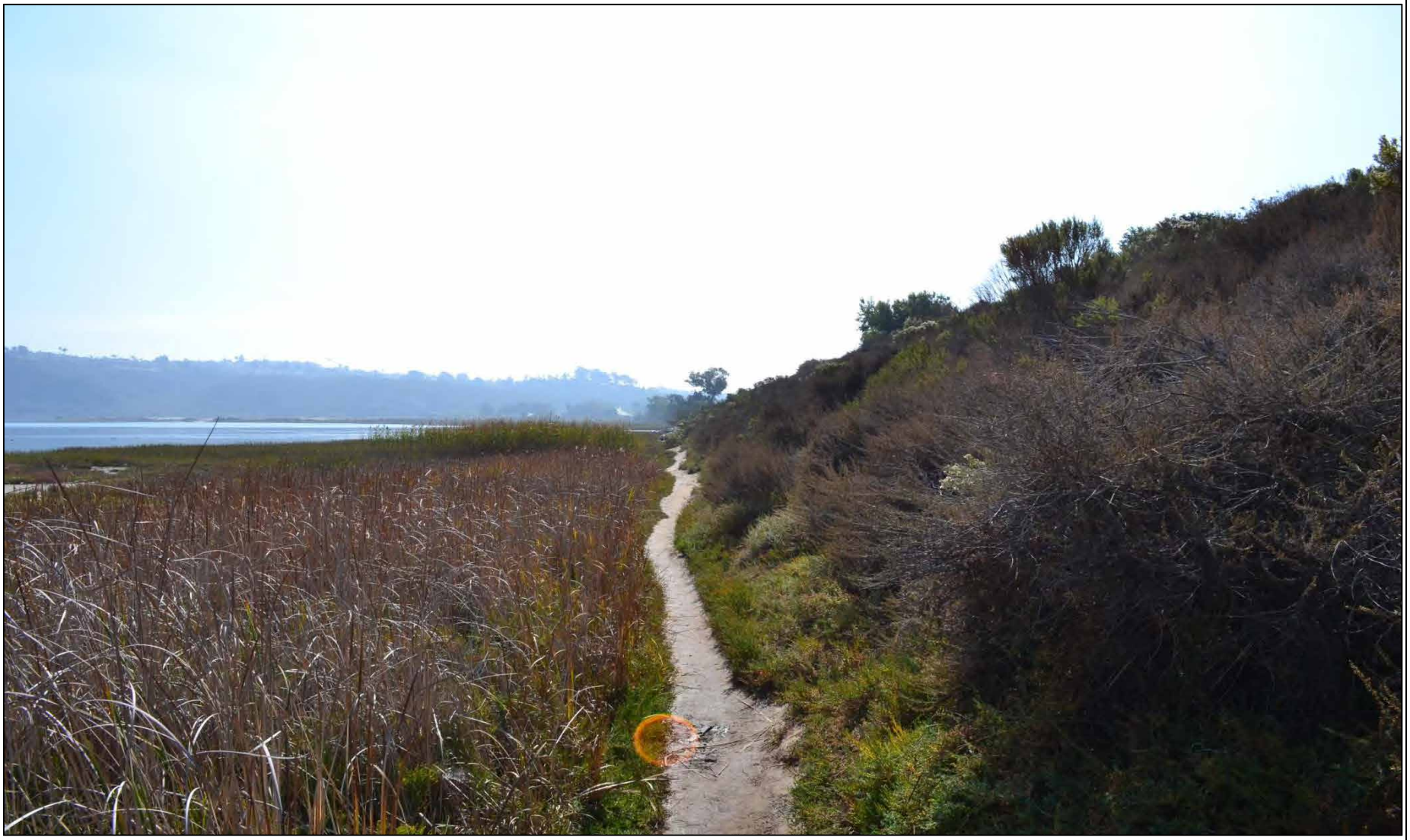
Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02J

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-02K

Views from Public Trails Along Northern Lagoon Perimeter Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-03A

Eastern Views from Public View Point at the End of Navigator Circle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-03B

Eastern Views from Public View Point at the End of Navigator Circle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-03C

Eastern Views from Public View Point at the End of Navigator Circle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-03D

Eastern Views from Public View Point at the End of Navigator Circle Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-04A

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04B

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04C

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04D

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04E

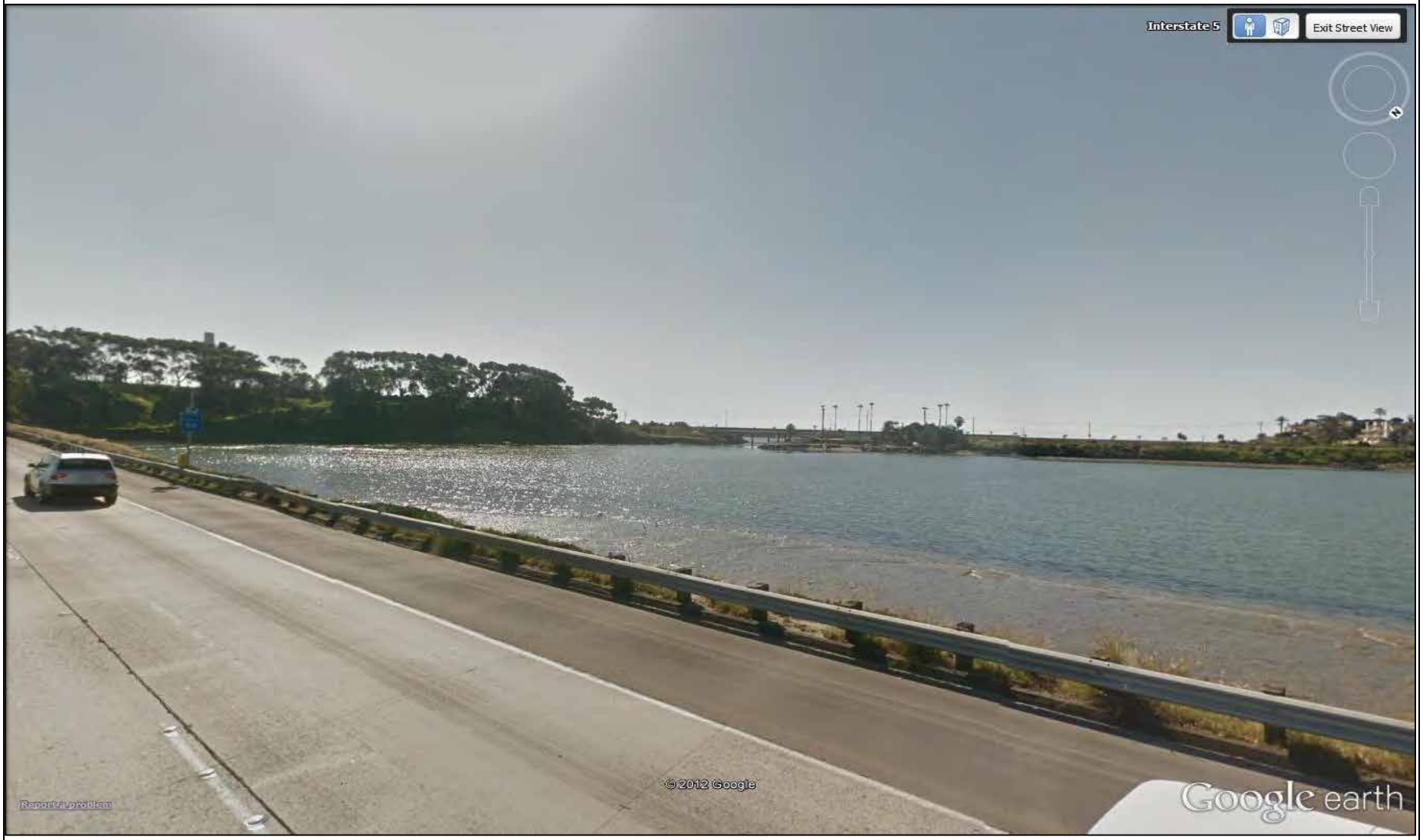
Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04F

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04G

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04H

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04I

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-04J

Western/Eastern Views from I-5 Including Agua Hedionda Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure CB-05A

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05B

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05C

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05D

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05E

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05F

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05G

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-05H

Views from Public Trails Along Lagoon Perimeter that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure CB-07A

Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-07B

Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-07C

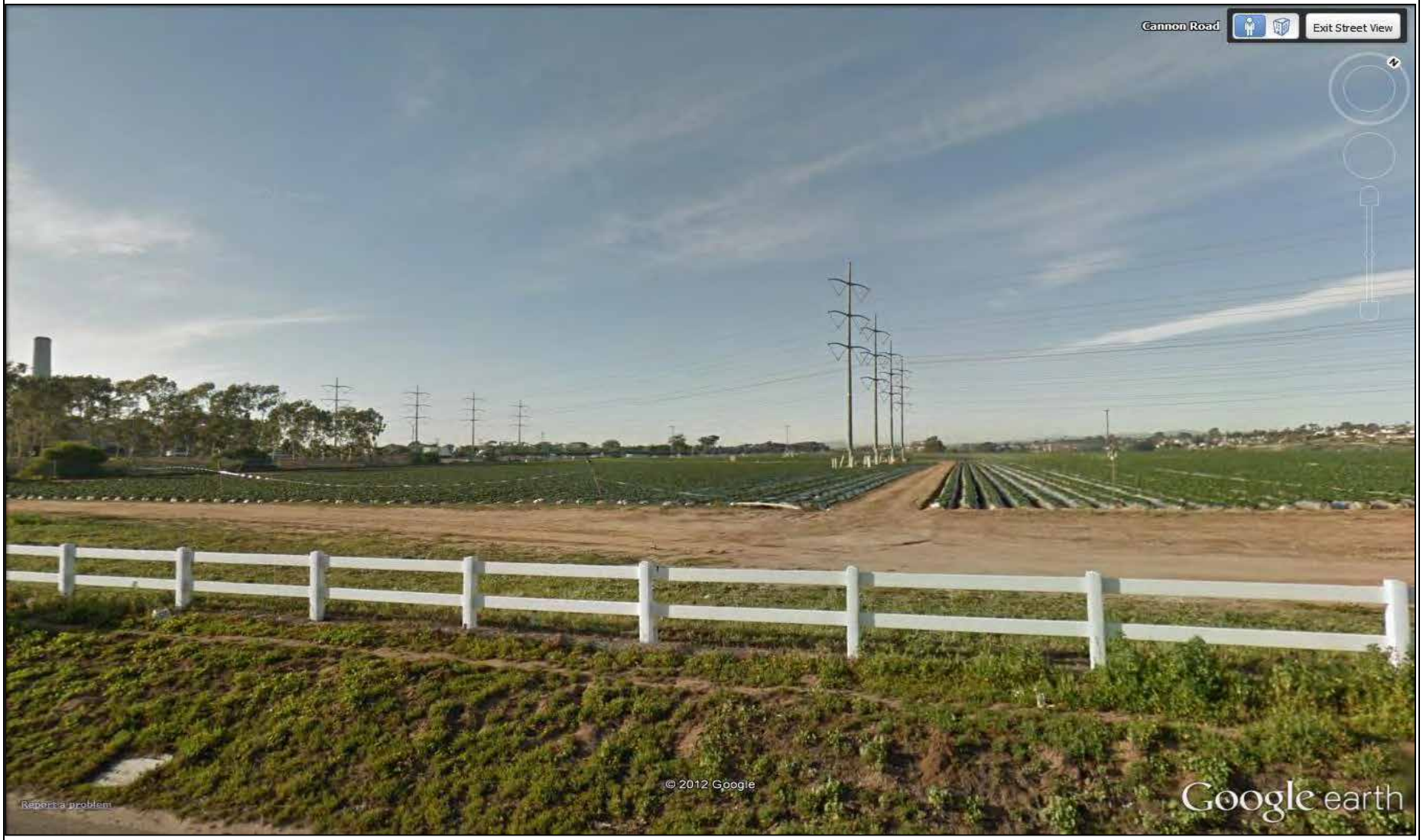
Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-07D

Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-07E

Northwestern Views from Cannon Road Across Lagoon/Open Space Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09A

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09B

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09C

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09D

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09E

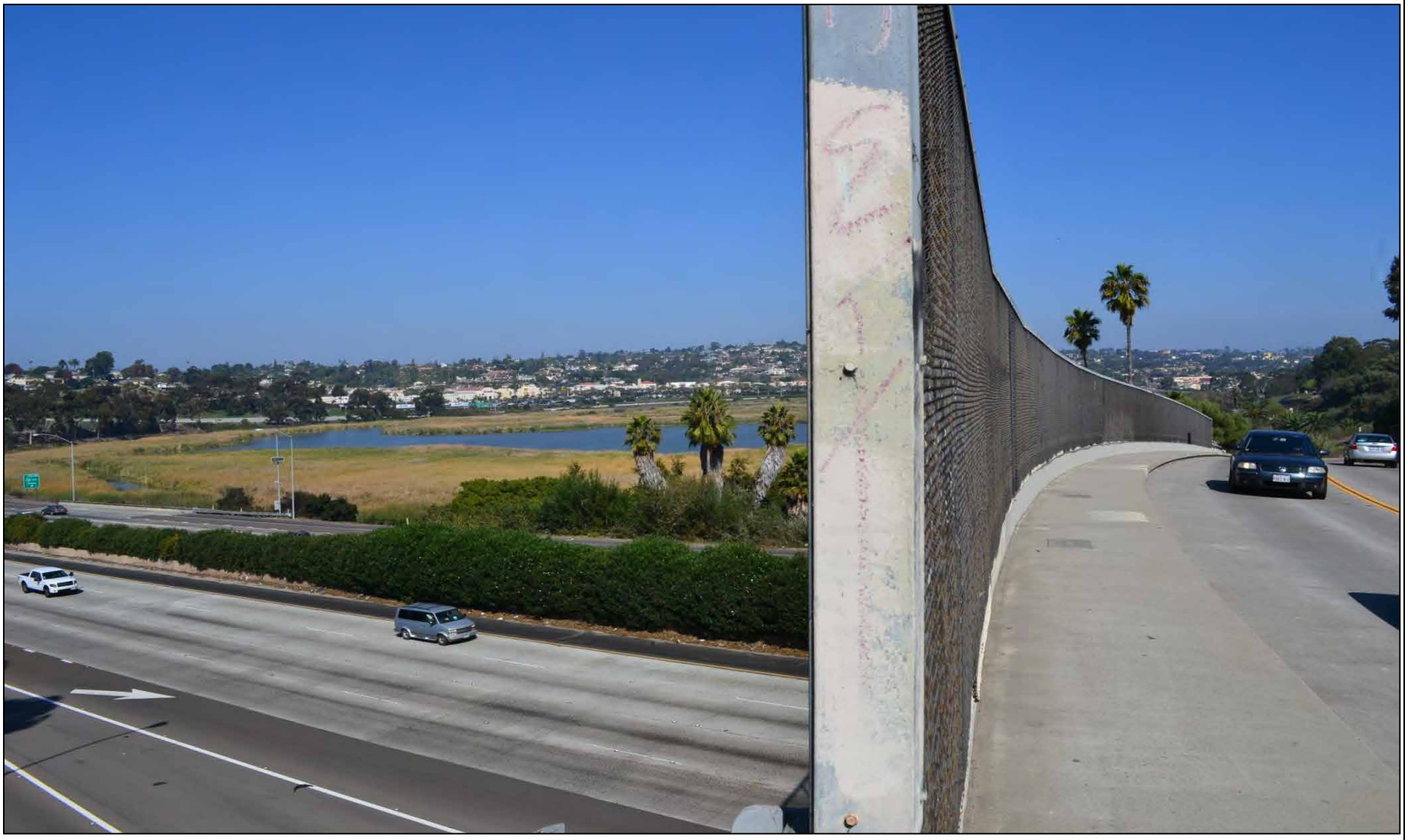
Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09F

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-09G

Northern/Western/Eastern Views from Jefferson Street Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-10A

Eastern Views from State Street/Carlsbad Boulevard Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-10B

Eastern Views from State Street/Carlsbad Boulevard Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-10C

Eastern Views from State Street/Carlsbad Boulevard Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure CB-11A

Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)



DATA SOURCES: Google, Caltrans

Figure CB-11B

Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)



DATA SOURCES: Google, Caltrans

Figure CB-11C

Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)



DATA SOURCES: Google, Caltrans

Figure CB-11D

Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)



DATA SOURCES: Google, Caltrans

Figure CB-11E

Batiquitos Lagoon at La Costa Avenue (Near Park and Ride; see Also Encinitas LCP Vista Points)



DATA SOURCES: Google, Caltrans

Figure OC-01A

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-01B

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-01C

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-01D

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-01E

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-01F

Western/Eastern Views from I-5 Including Buena Vista Lagoon and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-02A

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-02B

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-02C

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-02D

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-02E

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-02F

Southern/Western Views from SR 78 Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-03A

Eastern Views from Carlsbad Boulevard (Public Fishing Area) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-03B

Eastern Views from Carlsbad Boulevard (Public Fishing Area) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-03C

Eastern Views from Carlsbad Boulevard (Public Fishing Area) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-03D

Eastern Views from Carlsbad Boulevard (Public Fishing Area) Across Lagoon Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-04A

Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-04B

Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-04C

Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-04D

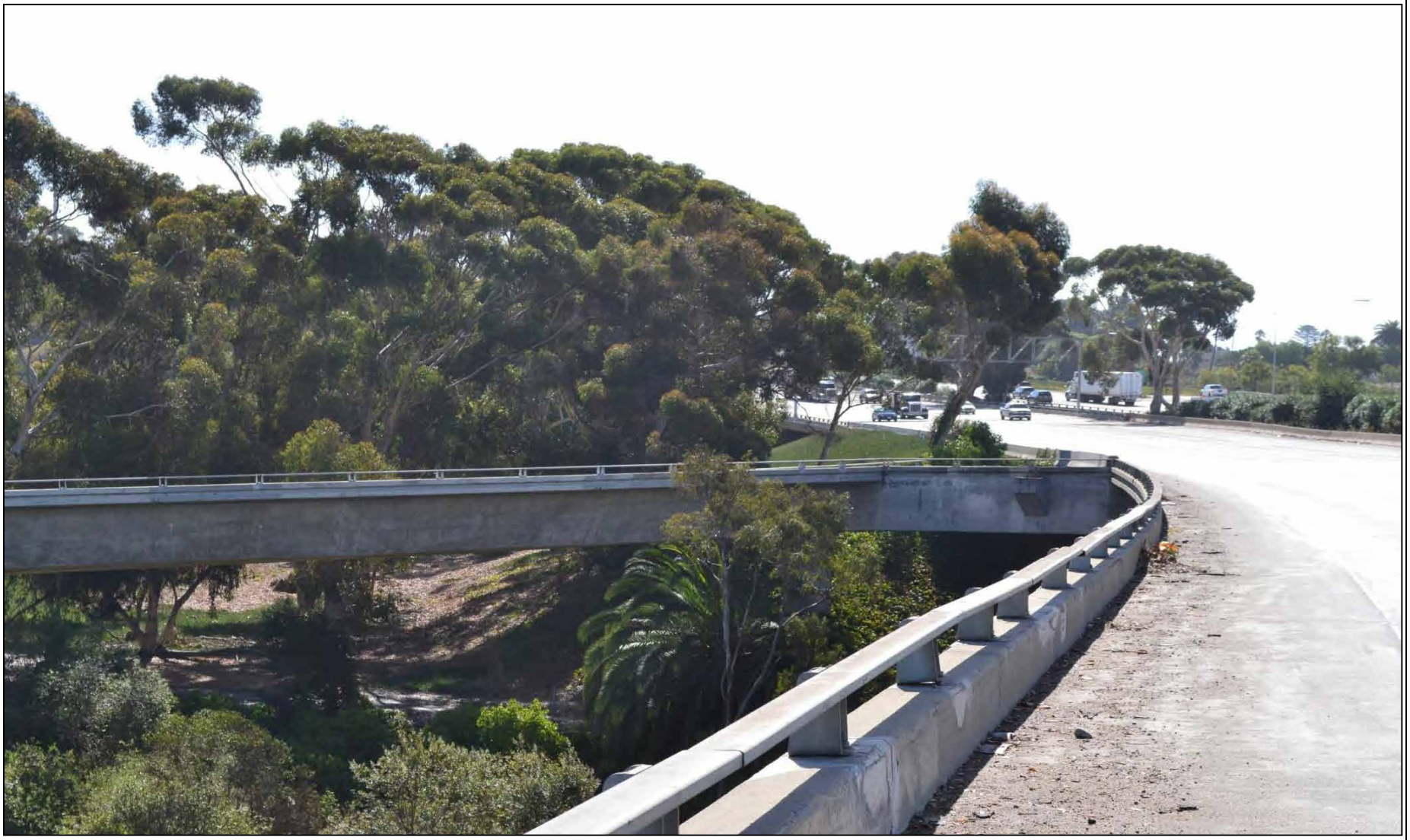
Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-04E

Eastern Views from Public Trail System Extending Along Lagoon Perimeter East of Audubon Center Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-05A

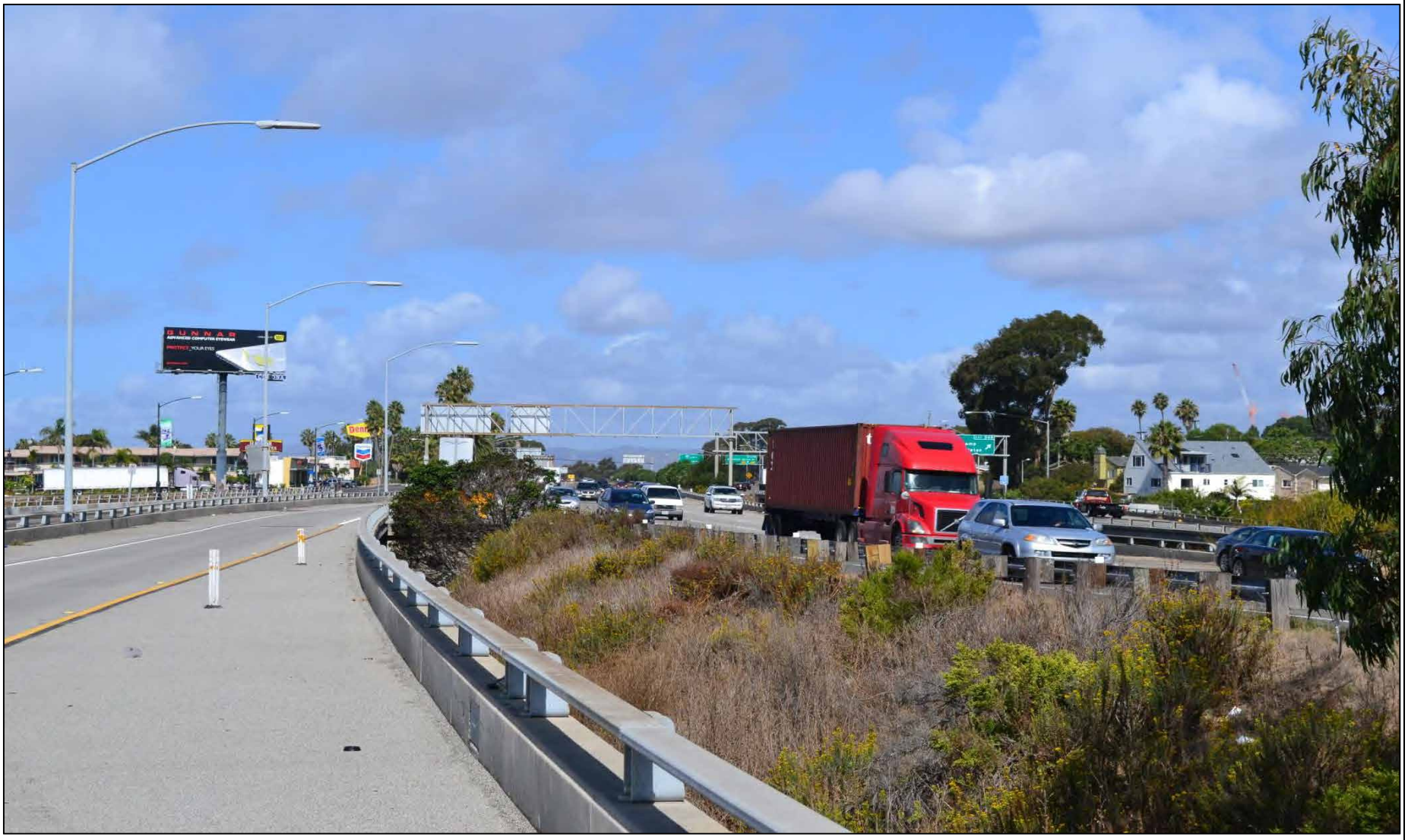
Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-05B

Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-05C

Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-05D

Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-05E

Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-05F

Western/Eastern Views from I-5 Including the Pacific Ocean, San Luis Rey River Valley, and Coastal and Inland Natural Coastal Landforms



DATA SOURCES: Google, Caltrans

Figure OC-06A

Northern/Western Views from SR 76 Across San Luis Rey River Valley Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-07A

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07B

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07C

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07D

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07E

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07F

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07G

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-07H

Views from Public Trails (San Luis Rey River Trail) within San Luis Rey River Valley that Include Proposed I-5 Improvements



DATA SOURCES: Google, Caltrans

Figure OC-08A

Eastern Views from Pacific Street Across River Valley Toward I-5



DATA SOURCES: Google, Caltrans

Figure OC-08B

Eastern Views from Pacific Street Across River Valley Toward I-5

Appendix C:
I-5 North Coast Corridor
Design Guidelines

Please Refer to
Appendix L
of the I-5 North Coast Corridor Project
Final Environmental Impact Report/
Environmental Impact Statement



San Diego Region Coastal Sea Level Rise Analysis

Final Report

September 2013

Prepared for the:

San Diego Association of Governments

and

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EXECUTIVE SUMMARY

Sea level rise (SLR) has occurred on a global and local scale over the last century, and projections suggest that the rate might accelerate into future planning horizons (e.g., 2050 and 2100), as shown in Figure ES-1. Recently, projects being planned within the coastal zone have been required by regulatory, resource, and funding agencies to incorporate SLR considerations into project planning and design. Contingent on the project, incorporation of these SLR projections into project design can have significant impacts on the project relative to cost, the environment, wetlands encroachment, views, existing structures, right of way, and flood control; all of which will be fully evaluated in the identification of the Least Environmentally Damaging Practicable Alternative (LEDPA) during the environmental review and permitting phase of the project.

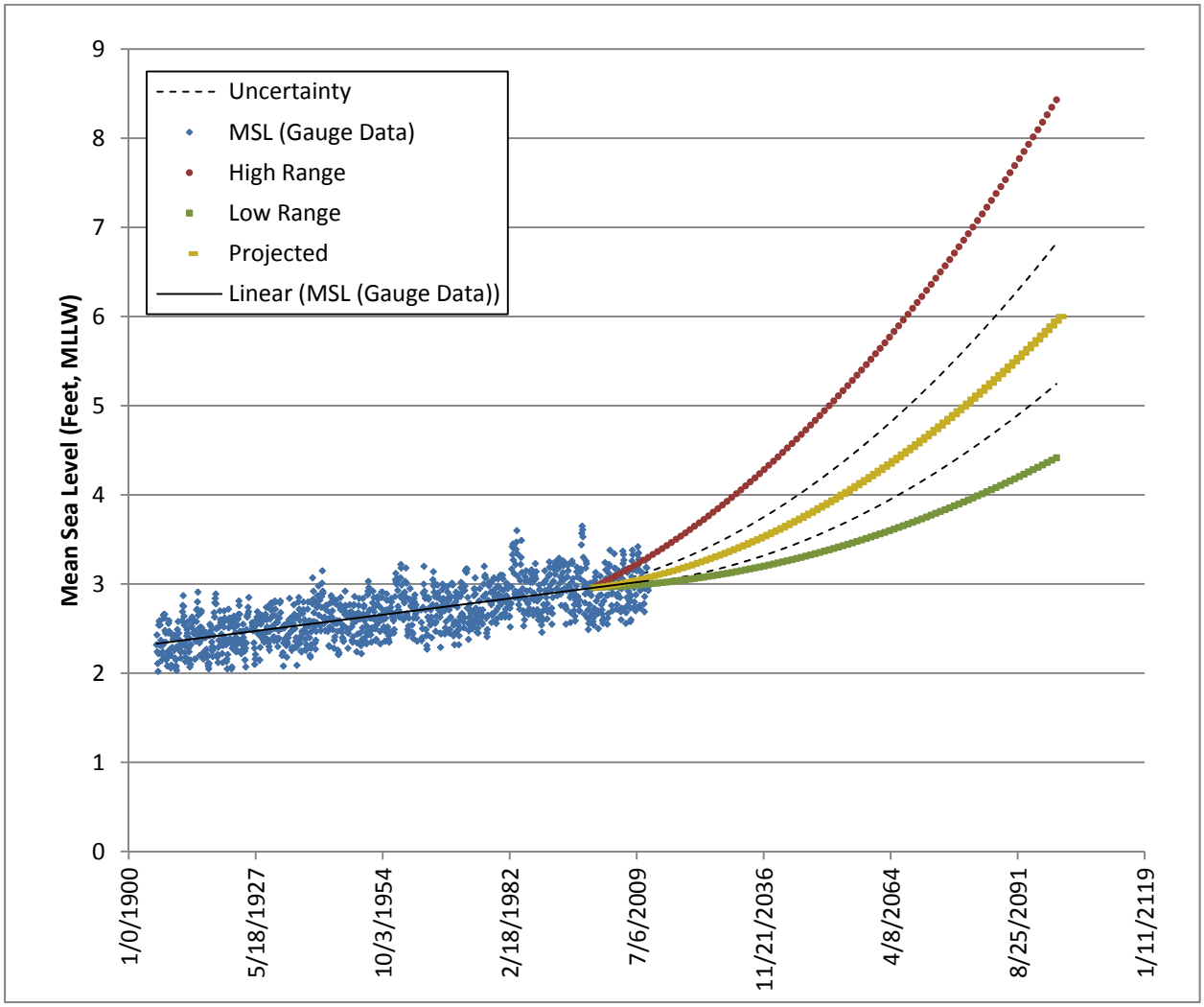


Figure ES-1: La Jolla Mean Sea Level Tide Gauge Data and Future Projections from the National Research Council (2012)

(Mean lower low water is 2.29 feet below NGVD29 vertical datum and 0.18 feet below NAVD88)

This report summarizes and compiles relevant state, federal, and local guidance for sea level rise and provides recommendations of future ocean water levels for consideration by Project Development Teams (PDTs) in the design of the proposed transportation improvements associated with the North Coast Corridor (NCC) Program. This report was also prepared in accordance with SANDAG's Climate Action Strategy and addresses the NCC Program area of coastal San Diego County.

The NCC Program includes improvements to Interstate 5 from Oceanside to the University Town Center area, and on the LOSSAN railroad from Oceanside to Sorrento Valley, but does not include improvements to Highway 101. Highway 101 is the responsibility of the local agencies that it passes through. The proposed approach for Project Development Teams during the design of future improvements will consider the full range of SLR projections in the alternatives analysis phase over the design life of an individual project. Based on current scientific developments, regulations, and the results of these site-specific analyses, the preliminary design will either: 1) accommodate SLR projections specified in local, state, and federal guidance documents in combination with flood flows; 2) include adaptation strategies so that the structures can be raised in the future should the projections be realized; or 3) consist of a risk assessment that may conclude the benefits of developing a design that fully accommodates SLR projects may be outweighed by the environmental and economic impacts of constructing such a project design, leading to a less conservative design and episodic operational constraints.

In March 2013, the State of California, via the California Climate Action Team and Ocean Protection Council, established the latest SLR 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 SLR of 0.13 feet to 0.98 feet between 2000 (Base Year) and 2030, 0.39 feet to 2.00 feet between 2000 and 2050, and 1.38 feet to 5.48 feet between 2000 and 2100. The high end of the range is based on high fossil fuel usage, and the low end of the range is a change in lifestyle resulting in a lower mean sea level rise scenario. The guidance also recommends a site-specific risk analysis to inform design and to determine the appropriate SLR projection for design. This risk tolerance approach is the most likely outcome for any NCC rail/highway bridge that can't accommodate the upper projection of SLR.

The NCC Program is a 40-year program of regional transportation improvement consisting of a series of individual projects planned to be implemented over four decades: 2010-2020, 2021-2030, 2131-2040, and 2041-2050. Bridges currently permitted met the requirements at the time they were permitted so any changes needed to address SLR for those bridges will be made in the future. Phase 1 bridges (implementation in the 2010-2020 decade) are being designed in consideration of current SLR science and guidance, with varying approaches consisting of: 1) complete consideration of SLR; 2) partial consideration of SLR (if constrained) with future

adaptation; or 3) inability to accommodate SLR but with episodic, low-frequency operational constraints such as bridge closures when freeboards are exceeded. .The estimated time for such closures is on the order of several hours rather than days. Bridges to be built in subsequent phases will be reassessed in the future and such assessment will be done in the context of SLR science and guidance available at that time. This document can be updated for each implementation phase to help maintain a consistent approach to addressing SLR for all NCC program components.

Guidance for design water levels for the NCC Program was provided across this range of 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 SLR of 1.5 feet, 3.0 feet, 4.6 feet, and 5.5 feet are compared to existing and proposed bridge elevations (I-5 and railroad) to assist PDTs in bridge design. For Highway 101 bridges, due to their proximity to the coastline, design water levels need to consider both fluvial floods under future mean sea levels and extreme wave crest elevations under future mean sea levels with the higher design water level used for bridge design. The report also discusses the potential impacts of tsunamis to the study area and recommends that the proposed improvements be designed to accommodate various influences of these phenomena. Such measures typically include using pile-supported structures, protecting embankments from scour, and securing pre-cast elements from uplift. Load combinations for tsunamis can consist of water levels due to tsunamis during ocean mean high water conditions, without a fluvial flood event. Figure ES-2 shows an example of the components of high water levels that affect bridge infrastructure design.

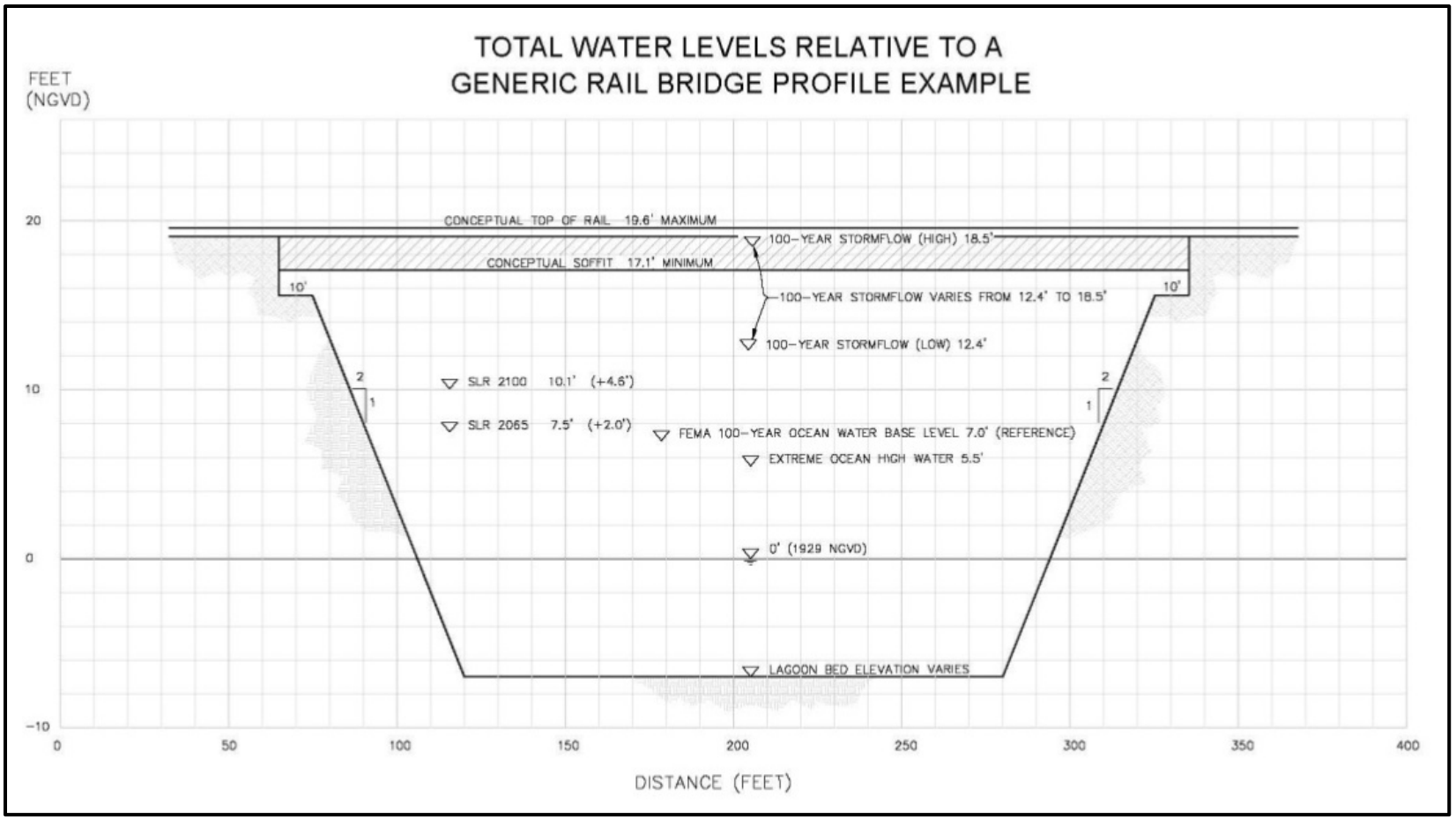


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LIST OF ACRONYMS

4AR	Fourth Assessment Report
Caltrans	California Department of Transportation
CAS	Climate Action Strategy (from SANDAG)
CCCC	California Climate Change Center
CCSM	Community Climate System Model (from NCAR)
CDIP	Coastal Data Information Program (at SIO)
CEQA	California Environmental Quality Act
CNRM	Centre National de Recherches Meteorologiques
CO-CAT	Coastal and Ocean Working Group of the California Climate Action Team
CSCC	California State Coastal Conservancy
EC	Engineering Circular
EIR	Environmental Impact Report
ENSO	El Niño Southern Oscillation
EO	Executive Order
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRA	Federal Rail Authority
FTA	Federal Transit Authority
HEC	Hydraulic Engineering Circular
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
LOSSAN	Los Angeles to San Diego
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
NAS	National Academy of Sciences
NAVD	North American Vertical Datum
NCAR	National Center for Atmospheric Research
NCC	North Coast Corridor
NRC	National Research Council
NEPA	National Environmental Protection Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NIPP	National Infrastructure Protection Plan
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
OPC	Ocean Protection Council
PDO	Pacific Decadal Oscillation
PDT	Project Development Team
PID	Project Initiation Document
PIER	Public Interest Energy Research
POLA/POLB	Ports of Los Angeles and Long Beach
SANDAG	San Diego Association of Governments
SCC	State Coastal Conservancy
SIO	Scripps Institution of Oceanography,
SLC	State Lands Commission
SLR	Sea Level Rise
TAR	Third Assessment Report
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation

1.0 INTRODUCTION

This document presents the processes to determine sea levels for the San Diego coastal region to be utilized for the design of transportation infrastructure associated with the proposed I-5 North Coast Corridor (NCC) Program including rail, roadway, and bridge improvements. The study area encompasses coastal areas from north San Diego County to just south of the I-5/I-805 merge, as shown in Figure 1-1.



Figure 1-1: Project Study Area Map

This study was prepared in accordance with the San Diego Association of Governments (SANDAG) Climate Action Strategy (CAS) (SANDAG 2010a) that recommends consideration of climate change in the design of transportation infrastructure.

Specifically, the study is consistent with Goal 4 (Project Transportation Infrastructure from Climate Change Impacts), Objective 4b of the CAS, as listed below:

- Objective 4b: Protect Transportation Infrastructure from Sea Level Rise (SLR) and Higher Storm Surges. This objective includes the following policy measures:
    - Develop a climate vulnerability plan that will identify areas in the San Diego region at risk of damage from SLR and storm surges;
    - Modify standards for the design, location, and construction of infrastructure to account for areas potentially subject to storm surge, SLR, and more frequent flooding events;
    - Reduce building in floodplains and areas subject to storm surge or SLR, or adequately protect structures in floodplains;
    - Engage a multi-disciplinary team of climate change and coastal experts along with hydraulics and bridge design specialists during the scoping process of coastal bridge projects to consider localized effects;
    - Identify adaptive management and monitoring to incorporate into regional transportation planning (SANDAG); and
    - Address adaptation issues in the design and location of new projects and when improvements are made to existing infrastructure.

The NCC Program's goal is to meet a mobility vision defined in the 2050 Regional Transportation Plan that would serve to improve and maintain public transportation facilities of regional, state, and national significance. The NCC Program highway and rail improvements are described in detail in the public documents prepared for SANDAG and California Department of Transportation (Caltrans) as listed below:

- San Diego – Los Angeles to San Diego (LOSSAN) Corridor Project Prioritization Analysis (SANDAG 2009);
- SANDAG 2050 Regional Transportation Plan (SANDAG 2011); and
- North Coast Corridor Public Works Plan/Transportation Resource Enhancement Program (PWP/TREP) (SANDAG 2013).

The NCC Program improvements are being administered by SANDAG and Caltrans. The capital improvements in the LOSSAN Rail Corridor are being funded by the Federal Rail Authority (FRA), Federal Transit Authority (FTA), State of California, Amtrak, and local TransNet Program. Highway and freeway projects are being funded by the Federal Highway Administration (FHWA), Caltrans, State of California, and local TransNet Program. This study focuses on both roadway and railroad improvements along Interstate 5 and the LOSSAN rail corridor. Highway 101 is not included in the NCC Program, but is included in this report for completeness.

2.0 CLIMATE CHANGE SCIENCE AND SEA LEVEL RISE OVERVIEW

The anticipated changes in climate and sea level are a result of build-up of "greenhouse" gases in the atmosphere over time due to emissions from burning of fossil fuels for energy production and from natural sources. Greenhouse gases trap long-wave thermal radiation within the Earth's atmosphere and warm the atmosphere and globe, which results in climate change and SLR. A schematic illustrating incoming short-wave radiation from the sun and outgoing, long-wave thermal radiation being partially trapped by the presence of greenhouse gases is shown in Figure 2-1.

Atmospheric gas constituents in the atmosphere and their relative percentage of greenhouse gases are shown in Figure 2-2. Although greenhouse gases comprise of less than a tenth of a percent of the atmosphere, the thermal effect of these gases is disproportionate to their relative percentages. Therefore, the warming of the atmosphere relative to the composition of these gases is a non-linear process. Carbon dioxide is the chief constituent of greenhouse gases.



Figure 2-1: The "Greenhouse" Effect
(Source: BBC 2012)

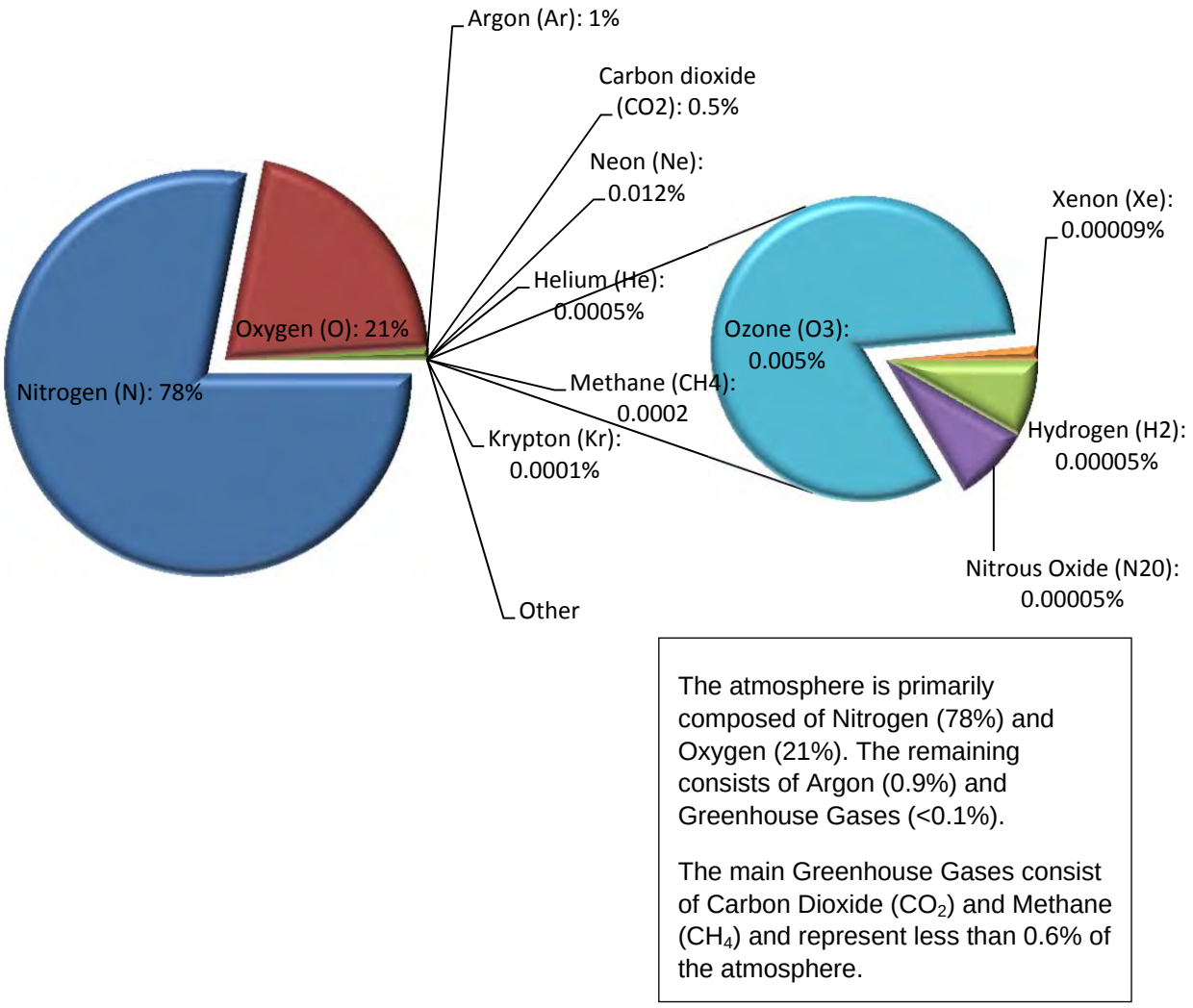


Figure 2-2: Atmospheric Gases Composition
(Source: Encyclopedia Britannica 2012)

2.1 Sea Level Rise Projections

Global (i.e., eustatic) SLR refers to increases in the volume of water in the ocean principally related to thermal expansion and glacial ice sheet melt. There are a wide range of opinions and projections about global SLR rates due to the non-linear relationship between carbon dioxide build-up, thermal effects on the atmosphere, and climate change. An example of the disparity between the various SLR projections for year 2100 is shown in Figure 2-3. Certain outliers (e.g., Hanson 2007) include parameters associated with glacial processes that result in much higher numbers (up to 5 meters). Although there is no probability assigned to SLR predictions at this time, some projections are being more widely adopted by agencies than others. Global SLR projections and agency guidance are discussed in detail in Section 3.0 of this study. A

recently released study by the National Research Council (NRC) is presented that indicates the degree of uncertainty in the predictions, as discussed subsequently in this study.

In the Study area, the rate of global SLR is of less practical importance than the rate of SLR relative to the land. This concept is commonly referred to as relative SLR. The rate of relative SLR can be affected by:

- local ocean conditions (e.g., some parts of the ocean may be warming and, therefore, exhibiting rising water levels more rapidly than others);
- regional decadal oscillation patterns;
- land uplift or subsidence; and
- rates of sedimentation or erosion of an area.

This Study focuses on relative SLR in the local area as dictated by local conditions, referred to as local SLR. Local SLR is discussed in more detail in Section 5.2 of this study.

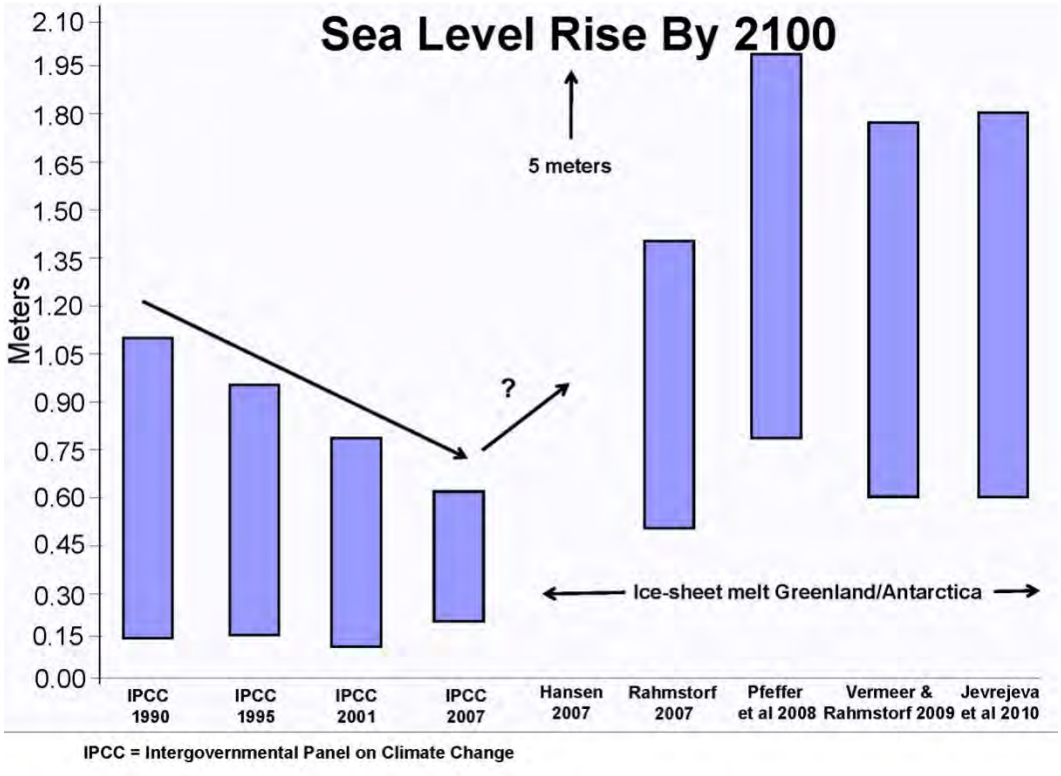


Figure 2-3: Comparison of Global Sea Level Rise Projections in 2100
(Source: Houston & Dean 2011)

2.2 Project-Level Sea Level Rise Considerations

Consideration of SLR may be required through various project phases, including alternatives analysis, preliminary design, permitting, and final design. Recommendations for identifying and addressing SLR issues for the project include: 1) identifying whether the project could potentially be affected by future higher sea levels within its design life, and then 2) identifying all responsible agencies that might participate and their respective role(s).

Planners, engineers, and scientists have had a broad array of global SLR projections since the 1980s; however, specific agency guidance on how to incorporate SLR considerations into projects has only become available recently. The combination of varying SLR projections and multiple sets of agency guidance can complicate the design of coastal projects. Since multiple regulatory agencies need to be consulted to obtain project approvals, a comprehensive SLR guidance approach is necessary.

Regulatory and funding agency guidance were analyzed to determine the approach for the project. Basic project assumptions are as follows:

- Project start year of 2013 or later;
- Project design life is 100 years for the LOSSAN rail bridges and 75 years for the Interstate 5 Freeway (Highway 101 is not included in the NCC Program); and
- Principal funding agencies are SANDAG, Caltrans, FHWA, FRA, and FTA.

The relevant sea level guidance is organized in Table 2-1 by the various sponsoring agencies/organizations.

Table 2-1. Relevant Agency Sea Level Rise Guidance

Agency/Organization	Sea level Rise Guidance	Applicable
SANDAG	Climate Action Strategy (2010a)	Yes
	San Diego Region Coastal Sea Level Rise Analysis	Yes
San Diego Bay bordering Cities, County, and Port	Sea Level Adaptation Strategy for San Diego Bay	Yes
Public Utilities Commission	None	--
Amtrak	None	--
CO-CAT	CO-CAT Guidance, 2013	Yes
U.S. DOT	LaHood, 2011	Yes
FRA	None	--
FHWA	HEC-25	No
FEMA	FEMA 1991, 2004, 2005, 2010, 2011a	No
USACE	USACE 2009a, 2009b, 2011	Yes

These agencies/organizations have different types of involvement, including funding, administration and/or oversight, planning, regulatory review and approval, design, construction, monitoring, emergency preparedness, or multiple levels of involvement. Depending on the agencies/organizations involved in the specific projects that are a a part of the NCC Program, the PDTs may need to consider other relevant guidance in addition to the guidance from this study.

3.0 SUMMARY OF RELEVANT PUBLIC SEA LEVEL RISE GUIDANCE

A technical review of available public guidance on SLR was conducted to provide applicable project planning and design information. Guidance is summarized in this section by the publication's origin (i.e., international/federal/state/local entities, and the scientific community) and date of release (earliest to most recent). Of note is that all guidance discussed in this section is in terms of global SLR rather than local SLR. Local SLR is specifically discussed in Section 5.2.

3.1 Internationally Recognized, Peer-Reviewed Literature

3.1.1 Intergovernmental Panel on Climate Change Projections

This section summarizes the two most recent reports released by the Intergovernmental Panel on Climate Change (IPCC). These reports provide SLR projections that were later incorporated into federal and state guidance documents.

3.1.1.1 Third Assessment Report (IPCC 2001)

The Third Assessment Report (TAR) of the IPCC is a detailed synthesis of the available peer-reviewed science. It is similar to the subsequent Fourth Assessment Report in being consensus-driven and potential contributions to SLR are not included unless there is broad agreement that they are quantitatively understood.

The TAR projects a SLR of 4 to 35 inches (10 to 89 centimeters [cm]) between 1990 and 2100. As with the Fourth Assessment Report, the largest contribution to the uncertainty is associated with modeling uncertainties and, in particular, with the potential for dynamic ice sheet instability. The West Antarctic Ice Sheet is particularly called out in regard to uncertainty.

3.1.1.2 Fourth Assessment Report (IPCC 2007)

The Fourth Assessment Report (4AR) of the IPCC contains a detailed synthesis of the available peer-reviewed science of climate change and sea level modeling, and has received contributions and comments from a vast array of respected researchers in the field. This document is discussed at some length herein because it is the baseline for most other assessments, even those critical of its results.

The 4AR gives a widely quoted projection of 7 to 23 inches (18 to 59 cm) for SLR in the 21st Century. These are considered to be 5 to 95 percent confidence ranges. The 4AR includes a second set of projections – from 7 to 30 inches (18 to 76 cm), which includes a scaled-up ice discharge term. The projections cover the period from 1990 to the midpoint of 2090-2099. The 4AR does not provide SLR values at intermediate periods (e.g., to 2050).

The models described in the 4AR give reasonable hindcasts of observed SLR between 1993 and 2003, although they under-predict observed SLR between 1961 and 2003.

The uncertainty in the quoted projections derives from two main sources:

- Different greenhouse gas emission scenarios. The IPCC defines six future scenarios of world population and economy that predict different levels of greenhouse gas emissions. The 4AR stresses that no scenario can be considered more likely than others.
- The second, and larger, uncertainty is associated with limitations to current scientific knowledge. The range of SLR projections for a given scenario is based on the range of results from 17 independently developed and peer-reviewed general circulation models.

Compared to the TAR, the projections in 4AR are slightly smaller and significantly narrower. The “headline value” from the TAR was 4 to 35 inches (10 to 89 cm) between 1990 and 2100. The reasons for the differences are as follows:

- The projections in the 4AR are to the midpoint of the period 2090 to 2099, while those in the TAR are to 2100;
- The TAR included some small additional contributions (e.g., 0.2 inch [0.5 cm]) based on additional rise in the 21st Century due to permafrost, which are not included in the 4AR; and
- The 4AR modeling uncertainties have been decreased with improved information and modeling capabilities. The TAR uses simple climate models to estimate SLR; these are less detailed than the atmosphere-ocean general circulation models used in the 4AR.

Mechanisms that may lead to SLR are not included in the 4AR projections unless there is a broad scientific consensus that they are well and quantitatively understood. That is, the 4AR projections are conservative in a scientific sense, but not in an engineering or planning sense. The 4AR freely admits that it may under-predict as well as over-predict future SLR. In particular, the projections do not include potentially large and nonlinear effects such as a potential nonlinear instability and accelerated loss of the Antarctic and Greenland Ice Sheets – because there are no broadly accepted models of these processes. It is not even known whether ice sheet discharge will increase or decrease SLR in the short-term. The projections do include the best current understanding of polar ice dynamics.

Critics of the IPCC have generally focused on this scientific conservatism. In particular, many planners have expressed concern that the projections are not sufficiently conservative in an engineering sense, and that the upper limits of the IPCC projections do not represent a worst-case scenario. However, the scientific community generally

has not attempted further synthesis of the huge range of available models and potential contributions to future SLR; as a result, few hard numerical predictions of total SLR have been published in the peer-reviewed literature since dissemination of the 4AR.

3.2 Federal Guidance

Several federal SLR guidance documents have been prepared and are summarized below. The latest U.S. Army Corps of Engineers (USACE) guidance (2011) and NRC (2012) study are the most applicable to the project. However, it should be noted that the USACE guidance only applies to USACE led, civil works projects. State SLR guidance is currently being updated and it is our understanding that the NRC (2012) study projection will be the basis of this revision.

3.2.1 U.S. Army Corps of Engineers, Engineering Circular No. 1165-2-211 (2009a)

Engineering Circular (EC) No. 1165-2-211 issued by the USACE recommends evaluation of three scenarios in planning civil works projects potentially affected by SLR:

- **Low Rate** – future rates of sea level change are based on historical trends in local mean sea level, which are best determined by tide gage records greater than 40 years in duration;
- **Intermediate Rate** – modified NRC Curve I (1.7 feet [0.5 meters] in 2100), considers both the most recent IPCC projections and modified NRC projections; and adds those to the local rate of vertical land movement; and
- **High Rate** – modified NRC Curve III (5.0 feet [1.5 meters] in 2100), considers both the most recent IPCC projections and modified NRC projections and adds those to the local rate of vertical land movement. This high rate exceeds the upper bounds of IPCC 2001 and 2007 estimates and accommodates the potential rapid loss of ice from Antarctica and Greenland.

This is a straightforward method of projecting SLR. The NRC curves were originally estimated in 1987 and estimates can be compared to actual sea levels measured since that time.

3.2.2 U.S. Army Corps of Engineers, National Vertical Datum (2009b)

The USACE established their policy for referencing project elevation grades to nationwide vertical datums established and maintained by the U.S. Department of Commerce (USACE 2009a). The current reference datum is the North American Vertical Datum of 1988 (NAVD88) and the water level reference is the National Tidal Datum Epoch of 1983 – 2001. The Engineer Manual (USACE 2010) provides detailed guidance for referencing datums on civil works projects.

3.2.3 Federal Emergency Management Agency (2010)

The Federal Emergency Management Agency (FEMA), a part of the U.S. Department of Homeland Security, administers the National Flood Insurance Program (NFIP) and the National Infrastructure Protection Plan (NIPP).

The NFIP offers federal flood insurance in participating communities that meet minimum floodplain management requirements in order to mitigate flood losses. In participating communities, FEMA prepares flood risk maps delineating flood risk zones that coincide with insurance premiums. Currently, FEMA does not specifically require addressing SLR as part of the NFIP and flood insurance studies. However, climate-change related SLR is indirectly incorporated into the NFIP through various requirements and incentives (FEMA 1991, 2000, 2004, 2005, 2010, 2011a, 2011b). FEMA is researching climate change and impacts to the NFIP that includes a National Climate Change Study, which is anticipated for completion in 2012 and may revise FEMA's policy on SLR.

The NIPP was designed to ensure the resiliency of critical infrastructure and key resources of the United States from catastrophic loss from terrorist attacks and natural, manmade, or technological hazards. The NIPP provided guidance for many specific risks, but does not address threats from SLR or climate change (NIPP 2009).

FEMA also addresses impacts from SLR based on mapping of high-risk areas, with more emphasis on flood risk. FEMA maps only contain current conditions, not future or projected conditions. Hence, FEMA periodically updates maps of high-risk areas for informational purposes. In 2010, FEMA conducted a proof-of-concept study to generate a SLR advisory layer as a follow-on product to their normal flood risk maps and flood insurance studies. Conceptually, the SLR map would be non-regulatory and would be intended to help states and communities identify and adapt to potential increases in risk to flood hazards.

3.2.4 U.S. Department of Transportation (2011)

The U.S. Department of Transportation (USDOT) climate change policy is to incorporate climate change adaptation strategies into its transportation missions, programs, and operations (LaHood 2011). The Transportation and Climate Change Clearinghouse within the USDOT coordinates the research on climate change and impacts to transportation systems. Enforcement of the USDOT climate change policy is left to each modal administration within the USDOT.

The FHWA is a division within the USDOT. The FHWA provides guidance for the analysis, planning, design, and operation of highways. Currently, the FHWA does not require consideration for SLR in the design of bridges. Guidance for bridge design is published in hydraulic engineering circulars (HEC) and SLR is discussed in HEC-25 (Douglass and Krolak 2008). The target audiences for HEC-25 are engineers,

designers, inspectors, and planners who are expected to fulfill professional obligations to seek out and utilize relevant project guidance.

3.2.5 Federal Rail Authority

The Federal Rail Authority does not possess specific guidance on SLR. Research into this potential guidance did not generate applicable information.

3.2.6 U.S. Army Corps of Engineers, Engineering Circular No. 1165-2-212 (2011)

The EC No. 1165-2-212 provides guidance on the consideration of the direct and indirect physical effects of SLR across the project life cycle for civil works projects. Under this EC guidance, the following should be considered:

1) Degree to which systems are sensitive and adaptable to climate change and other global changes**,** including: a) natural and managed ecosystems; and b) human and engineered systems. The following documents were recommended for consideration in addressing these topics:

   a) The Climate Change Science Program Synthesis and Assessment Product 4.1 *"Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region"* – presents the most recent knowledge on regional implications of rising sea level and possible adaptive responses.

   b) The National Research Council's (NRC 1987) report *"Responding to Changes in Sea Level: Engineering Implications"* – outlines a multiple scenario approach to deal with uncertainties for which no reliable or credible probabilities can be obtained.

2) Three SLR scenarios (low, intermediate, and high) over the project life cycle. These three scenarios are as follows:

   - Low Rate – the historical rate of SLR extrapolated from tide gauge records over the project life;
   - Intermediate Rate – this is the modified NRC Curve I and Equations 1 and 2 (Figure 3-1) added to the local rate of vertical land movement.

$$E(t) = 0.0017t + bt^2 \quad \text{(Equation 1)}$$

$$E(t_2) - E(t_1) = 0.0017(t_2-t_1) + b(t_2^2-t_1^2) \quad \text{(Equation 2)}$$

Where:

$E(t)$ = the global SLR, in meters, as a function of t.
b = constant given for each of the three NRC (1987) curves.
t_1 = time between the project's construction date and 1992.
$t_2 = t_1$ + number of years after construction.

These equations assume a global mean SLR estimate of 0.067 inches/year (1.7 millimeters/year), and that projects will be constructed at some date after 1992.

- High Rate – this is the modified NRC Curve III and Equations 1 and 2 (Figure 3-1) added to the local rate of vertical land movement. Note that the high rate exceeds the upper bounds of IPCC estimates from both 2001 and 2007 to accommodate potential rapid loss of ice from Antarctica and Greenland, but is within the range of peer-reviewed articles released since that time.

3) Evaluate the sensitivity of alternative plans and designs to future mean SLR. There are many ways to address this comparison and selection step. Examples are as follows:

- Use a single SLR scenario and identify a preferred alternative under this scenario. This approach is best when conditions and plan performance are not very sensitive to the rate of SLR.
- Compare all alternatives against all SLR scenarios.
- Select a plan which provides a way forward to address uncertainty. This could be in the form of a sequence of decisions allowing for adaptation based on evidence.

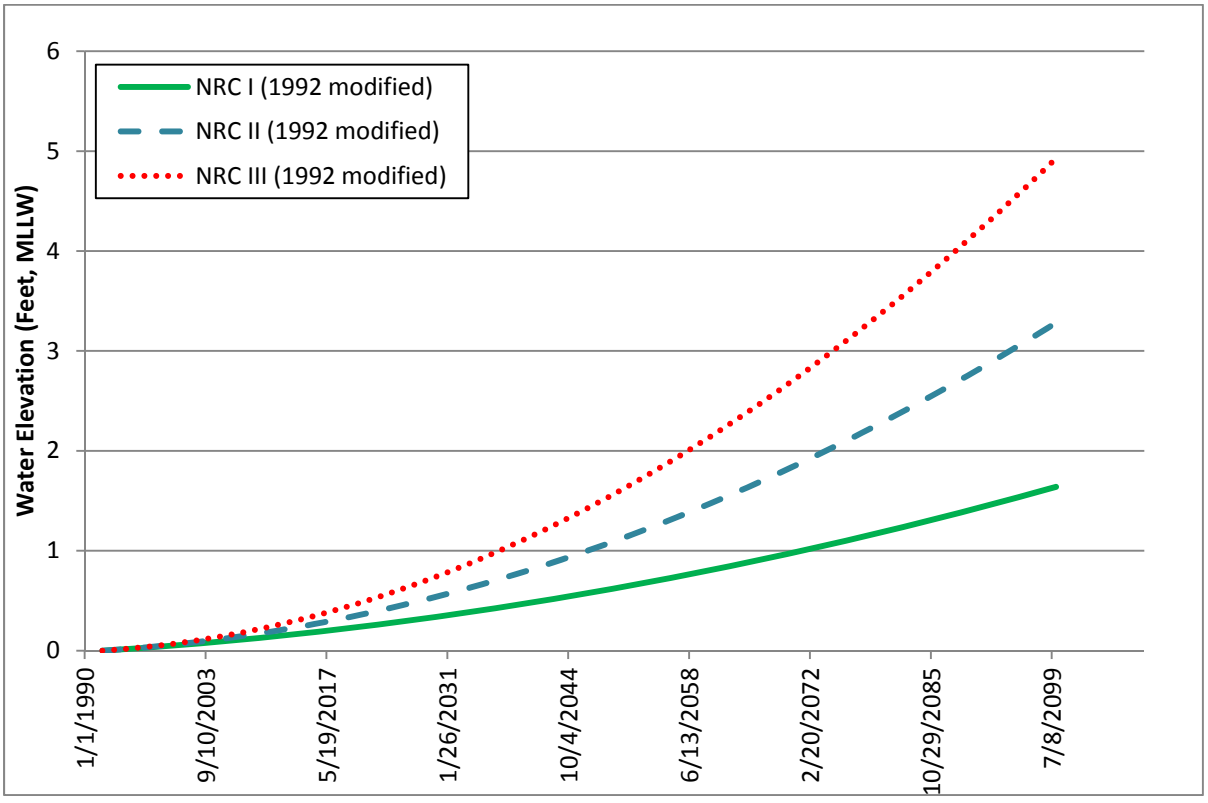


Figure 3-1: Scenarios for Global SLR (Based on Updates to NRC 1987)
(Derived from: USACE 2011)

3.2.7 National Research Council (2012)

The 2012 NRC report updates the 4AR with estimates of global and, specifically, U.S. West Coast (California, Oregon, and Washington) SLR projections. The study divided the U.S. West Coast into two zones (north and south of Cape Mendocino) due to their differing tectonic characteristics and consequent vertical land movement. The area north of Cape Mendocino (Cascadia region) is generally rising, while the area south of Cape Mendocino (San Andreas region) is generally sinking. The study made the following findings for the region south of Cape Mendocino, which includes this study area:

- Tide gages indicate variability in sea level change along the coast, although most of the gages show that relative SLR has been rising over the past 6-10 decades;
- Vertical land motion (based on GPS measurements) suggests that the coast is sinking at an average rate of about 0.04 inches (1 mm) / year;
- Factors that affect local SLR for this region include: thermal (steric) variations; wind-driven differences in ocean heights; gravitational and deformational effects (SLR fingerprints) of melting of ice from Alaska, Greenland, and Antarctica; and vertical land motions along the coast; and
- Regional SLR projections are less certain than global ones because there are more components to consider.

The NRC study predicts a 0.9-foot increase in SLR by 2050 and a 2.7-foot increase by 2100 globally, as shown in Table 3-1 and Figure 3-2. Regionally, the study predicts the Southern California region will track closely with global SLR estimates. Projections were produced for the Los Angeles region, which were estimated at a 0.5-foot increase in SLR by 2050 and a 3.1-foot increase by 2100 (Table 3-2).

Table 3-1. NRC 2012 Global SLR Projections

Year	Projection (ft)	Uncertainty (ft, +/-)	Low Range (ft)	High Range (ft)
2030	0.4	0.1	0.3	0.8
2050	0.9	0.1	0.6	1.6
2100	2.7	0.3	1.7	4.6

Table 3-2. NRC 2012 Regional SLR Projections (Los Angeles)

Year	Projection (ft)	Uncertainty (ft, +/-)	Low Range (ft)	High Range (ft)
2030	0.5	0.2	0.2	1.0
2050	0.9	0.3	0.4	2.0
2100	3.1	0.8	1.5	5.5

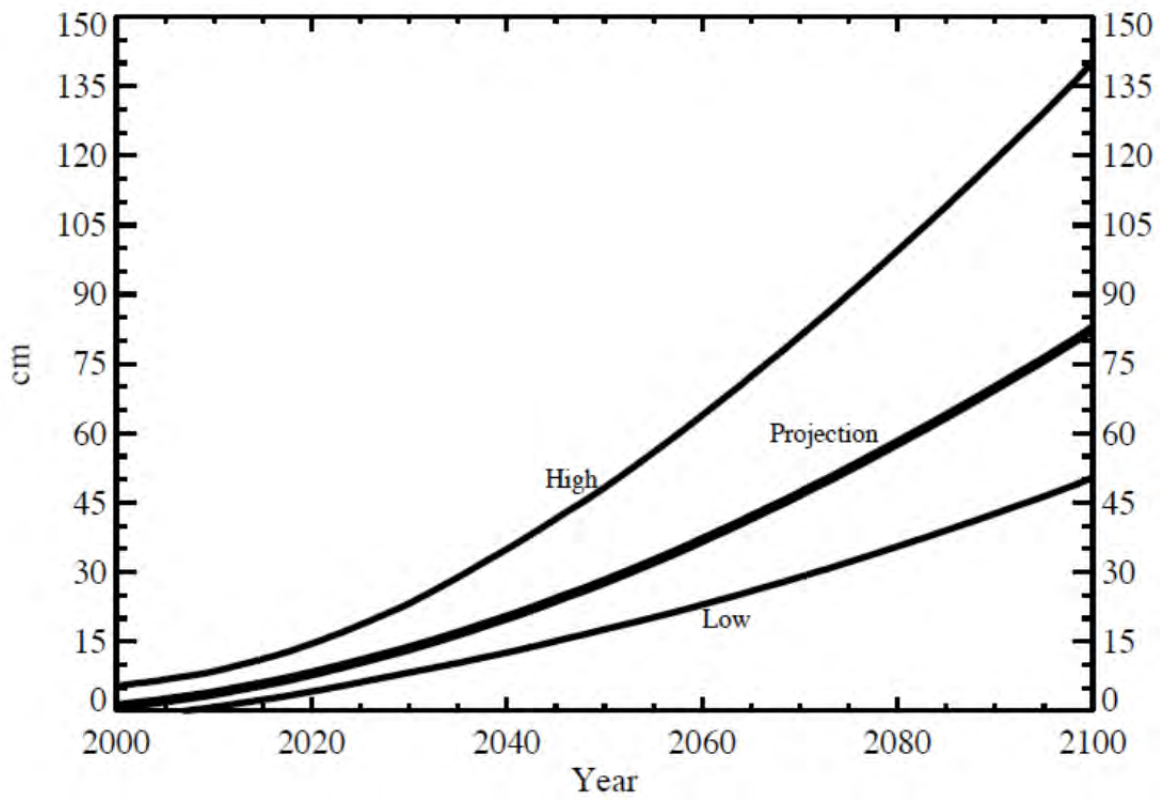


Figure 3-2: NRC (2012) Global Sea Level Rise Projections

The study provides both uncertainty as well as high and low ranges for each of the projections. The uncertainty and ranges are a function of the various global emission scenarios and ocean response mechanisms. The study suggests a much higher confidence in the shorter time horizon years (i.e., 2030 and 2050) and a much lower confidence level in the 2100 projection.

3.3 State Guidance

Several SLR guidance documents have been prepared by the State of California. These documents are summarized in this section by agency and in order of release date (earliest to most current). The most recent document was prepared by the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT) with science

support provided by the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust, and was issued in March 2013 and is currently considered the state SLR guidance. That document is presented below in this section.

3.3.1 California Coastal Commission (2001)

The California Coastal Commission's paper titled "*Overview of Sea Level Rise and Some Implications for Coastal California*" (CCC 2001) recognized that the continued rise in sea level will affect almost all coastal systems by increasing the inundation of low coastal areas and increasing the potential for storm damage, beach erosion, and beach retreat. Regarding implications, the report states that:

> *"In California, it is likely that a combination of hard engineering, soft engineering, accommodation/adaptation, and retreat responses will be considered to address sea level rise. There are situations where each response may be appropriate and well suited. In all coastal projects, it is important to recognize and accept that there will be changes in sea level and in other coastal processes over time."*

3.3.2 Governor's Executive Order S-3-05 (2005)

The Governor's Executive Order (EO) S-3-05, issued on June 1, 2005, primarily addressed the establishment of greenhouse gas reductions; however, it did acknowledge the potential climate change related impacts associated with rising sea levels. The EO specifically states that *"…rising sea levels threaten California's 1,100 miles of valuable coastal real estate and natural habitats."*

3.3.3 Governor's Executive Order S-13-08 (2008)

EO S-13-08 issued by Governor Arnold Schwarzenegger on November 14, 2008, recognizes the impact that SLR may have on coastal development in California. This order provides information from the longest continuous sea level gauge at Fort Point, San Francisco which recorded a 7-inch rise in sea level in the 20th Century. Further, the IPCC (2007) predicted a global SLR between 7 and 23 inches in the 21st Century.

The EO directed the California Resources Agency to request that the National Academy of Sciences convene an independent panel to complete the first California SLR Assessment report. This report is the NRC 2012 report described above. The EO states that prior to the release of the final SLR Assessment Report, all state agencies planning construction projects in areas vulnerable to future SLR shall, for the purposes of planning, consider a range of SLR scenarios for the years 2050 and 2100 in order to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to SLR.

SLR estimates should be used in conjunction with appropriate local information regarding local uplift and subsidence, and coastal erosion rates, predicted higher high water levels, storm surge, and storm wave data.

This EO specifies that a new study to be done by the NRC will set permanent guidance and supersede the interim guidance.

3.3.4 Climate Change Impacts Assessment (2008)

The biannual scientific reports overseen by CO-CAT serve as the primary basis for quantifying SLR projections in California as mandated by EO S-13-08. The first climate change impacts assessment included estimates of SLR as published by the California Climate Change Center (CCCC) in 2006. The 2008 Climate Change Impacts Assessment (2008 Assessment) is the second of these biannual scientific reports. The 2008 Assessment is comprised of 40 studies and reports conducted by the CCCC for the California coast (CCCC 2009 & 2009a). The methodology for these SLR projections was based on the method of Rahmstorf (2007) applied to IPCC scenarios. For the 2008 Assessment, it was assumed that SLR along the California coastline was the same as global SLR and an accounting for the global growth of dams and reservoirs that trap water was added. The 2008 Assessment SLR projections are shown in Figure 3-3 (CCCC 2009a). SLR projections above the 2000 water level for year 2050 ranged from 12 to 18 inches (30 to 45 cm) and for year 2100 ranged from 20 to 55 inches (50 to 140 cm).

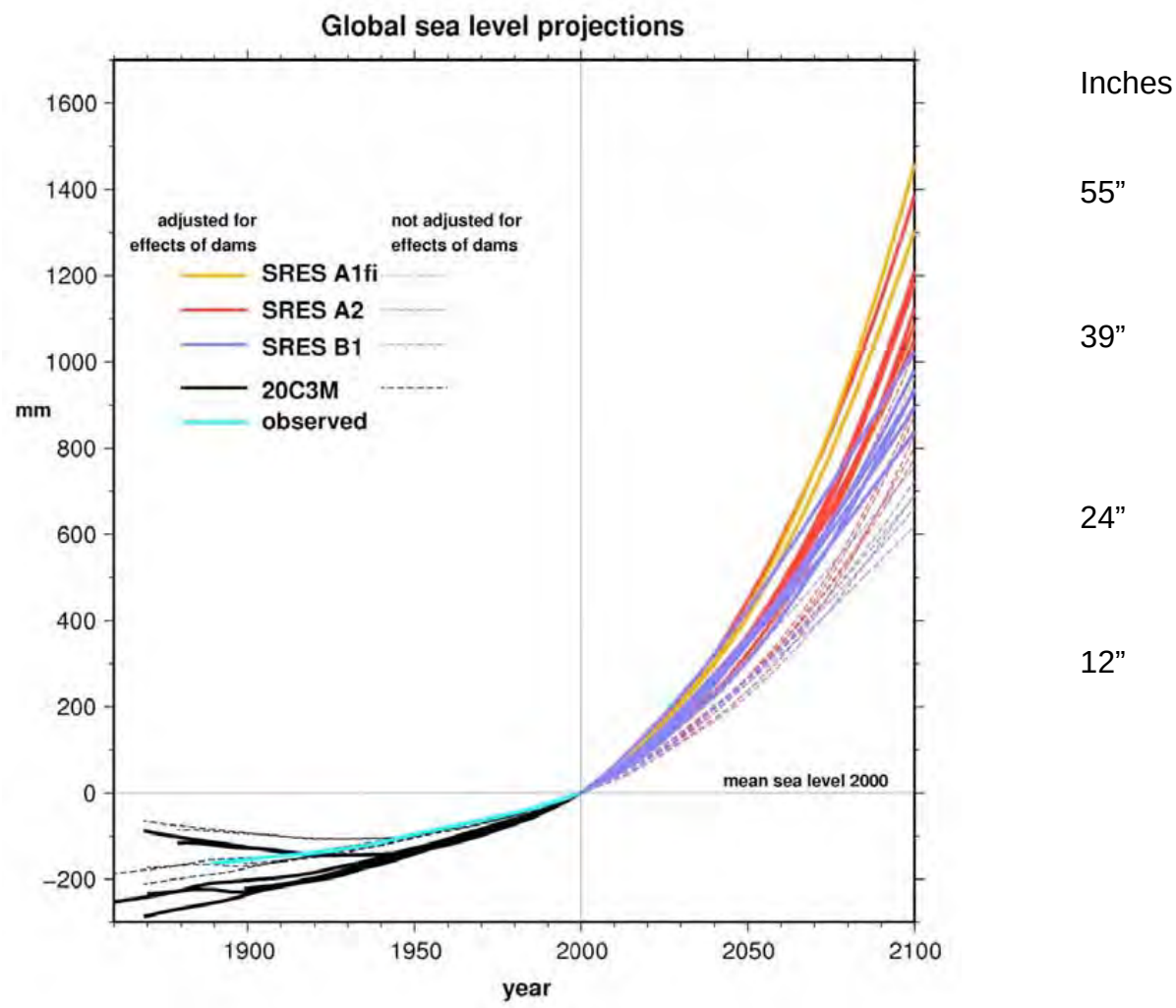


Figure 3-3: 2008 Assessment Sea Level Rise Projections
(Source: CCCC 2009a)

3.3.5 California Climate Adaptation Strategy

The 2008 Assessment SLR projections were the basis for the reports titled *The Impacts of Sea-level Rise on the California Coast* (CCCC 2009b) and *California Climate Adaptation Strategy* by the California Natural Resources Agency (2009, 2010). The latter report was initiated by EO S-13-08 to develop California's first statewide climate change adaptation strategy to assess expected climate change impacts and recommend climate adaptation policies. This adaptation strategy is based on a projected sea-level rise of 55 inches (140 cm) by 2100 under the A2 IPCC climate change scenario. The strategy led to the adoption of a recent amendment to the California Environmental Quality Act (CEQA) Guideline, Section 15126.2, which requires lead agencies “to analyze how future climate change may affect development under the general plan.”

Departments within the California Natural Resources Agency include the California Conservation Corps, Department of Boating and Waterways, Department of Conservation, Department of Fish and Game, Department of Parks and Recreation, Department of Resources, Recycling and Recovery, and Department of Water Resources.

3.3.6 California State Coastal Conservancy Memo (2009)

The California State Coastal Conservancy (CSCC) adopted a Climate Change Policy on June 4, 2009, which includes the following direction applicable to projects funded by the CSCC:

> *"Prior to the completion of the National Academy of Sciences report on SLR, consistent with Executive Order S-13-08, the Conservancy will consider the following SLR scenarios in assessing project vulnerability and, to the extent feasible, reducing expected risks and increasing resiliency to SLR:*
>
> - *16 inches (40 cm) by 2050; and*
> - *55 inches (140 cm) by 2100.*

3.3.7 Coastal and Ocean Working Group of the California Climate Action Team Interim Guidance (2010)

The *State of California Sea-level Rise Interim Guidance Document* (Interim Guidance) was released in October 2010 to provide guidance to state agencies for incorporation of SLR projections into planning decisions prior to the release of the National Academy of Sciences (NAS) California SLR Assessment Report and is intended to enhance consistency among state agencies (CO-CAT 2010). The Interim Guidance was developed by the Sea Level Rise Task Force of the CO-CAT, with science support provided by the California Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust. CO-CAT is comprised of senior staff from various California state agencies with ocean and coastal resource management responsibilities. The Sea Level Rise Task Force is comprised of staff from the following California agencies:

- The Business, Transportation and Housing Agency;
- California Coastal Commission;
- Department of Fish and Game;
- Department of Parks and Recreation;
- Department of Public Health;

- Department of Toxic Substances Control;
- Department of Transportation (Caltrans);
- Department of Water Resources;
- Environmental Protection Agency (CalEPA);
- Governor's Office of Planning and Research;
- Natural Resources Agency;
- Ocean Protection Council (OPC);
- San Francisco Bay Conservation and Development Commission;
- State Coastal Conservancy (SCC);
- State Lands Commission (SLC); and
- The State Water Resources Control Board.

The Interim Guidance includes policy recommendations agreed upon by the Sea Level Rise Task Force members. The recommended SLR projections are based on the Vermeer and Rahmstorf 2009 values, adjusted to a year 2000 baseline. The Vermeer and Rahmstorf 2009 SLR projections were based on a second order, semi-empirical method correlating modeled global temperatures to SLR from 1990. The Vermeer and Rahmstorf 2009 SLR projections were reduced by 0.112 feet (0.034 meters) to adjust the 1990 baseline to a 2000 baseline (i.e., remove 10 years of SLR that has occurred from 1990 to 2000).

The Interim Guidance recommends that SLR projections, as summarized in Table 3-3, should be used as a starting place, and SLR value selection should be based on agency and context-specific considerations of risk tolerance and adaptive capacity. SLR projections are provided for the years 2030, 2050, 2070, and 2100. Projections for the years 2070 and 2100 include three ranges of values for low, medium, and high greenhouse gas emissions scenarios corresponding to the IPCC (2007) scenarios designated as B1, A2, and A1FI, respectively, and defined in subsequent section 3.5.2 of this report.

Table 3-3. Interim Guidance SLR Projections

Year	Description	Average of Models in (cm)	Range of Models in (cm)
2030		7 (18)	5-8 (13-21)
2050		14 (36)	10-17 (26-43)
2070	Low	23 (59)	17-27 (43-70)
	Medium	24 (62)	18-29 (46-74)
	High	27 (69)	20-32 (51-81)
2100	Low	40 (101)	31-50 (78-128)
	Medium	47 (121)	37-60 (95-152)
	High	55 (140)	43-69 (110-176)
SLR projections from 2000 baseline. Source: CO-CAT 2010			

Additional recommendations regarding SLR projections include:

- Consider timeframes, adaptive capacity, and risk tolerance when selecting estimates of SLR;
- Coordinate with other state agencies when selecting values of SLR and, where appropriate and feasible, use the same projections of SLR;
- Future SLR projections should not be based on linear extrapolation of historical sea level observations;
- Consider trends in relative local mean sea level;
- Consider storms and other extreme events (e.g., storm surge, El Niño, and wave setup); and
- Consider changing shorelines.

3.3.8 California Department of Transportation (2011)

In May 2011, Caltrans published their *Guidance on Incorporating Sea-level Rise* for use in the planning and development of project initiation documents (Caltrans 2011). Caltrans participated in the Sea Level Rise Task Force of the CO-CAT, which developed the Interim Guidance and 2013 Guidance documents. Hence, Caltrans guidance utilizes a portion of the SLR projections from the 2013 Guidance; specifically, the column labeled “Average of Models” in Table 3-3.

3.3.8.1 Sea Level Rise Impact Assessment

The guidance recommends analysis of potential SLR impacts and determination of whether SLR adaptation measures should be incorporated into the project. This determination is based on level of risk and should be documented in a project initiation document. Each project should be initially screened to determine if there is a potential to be impacted by SLR, generally based on the following three questions:

- Is the project located on the coast or in an area vulnerable to SLR?
- Will the project be impacted by the projected SLR scenarios?
- What is the design life of the project?

If the project is located in the coastal zone and could potentially be impacted by SLR then the Project Initiation Document (PID) must contain a discussion on SLR.

3.3.8.2 Selecting Sea Level Rise Values for Caltrans Project Design

If it is determined that SLR could impact the project, then an analysis should be performed weighing the level of risk and potential for SLR-related consequences. If it is determined that SLR should be incorporated into a project, SLR projections are to be based on the 2013 Guidance (Table 3-3). SLR considerations should incorporate the following:

- Adjustments may be required for local subsidence or uplift;
- Adjustments may be required from the 2000 baseline;
- For a design life up to 2050, use value from “Average of Models”;
- For projects with a design life beyond 2070, use the range of the three, “Average of Models”;
- For design life years not provided in the Interim Guidance, linearly interpolate values in the table;
- SLR impacts are not needed for a project design life earlier than 2030; and
- SLR values for projects which include new bridge or other major structures should choose a future date commensurate with the life of the structure (e.g., 75 years or more).

Currently, the Caltrans guidance only addresses changes to sea level. Due to the level of uncertainty, guidance has not yet been established for other climate change impacts such as changes to temperatures, storm intensity, storm surge, wave heights, precipitation patterns, and precipitation intensities. As more information becomes available on climate change, additional guidance is expected.

Once a determination has been made that SLR should be incorporated into the project, the PDT will need to conduct studies to estimate the degree of potential impact and assess alternatives for preventing, mitigation, and/or absorbing the impact and document those in the alternatives analyses stage and/or a PID.

3.3.9 California Ocean Protection Council (2011)

In March 2011, the Ocean Protection Council (OPC) adopted guidance titled *Resolution of the California Ocean Protection Council on Sea Level Rise*. The guidance resolves that projects and programs should:

- Incorporate consideration of the risks posed by SLR into all decisions regarding areas or programs potentially affected by SLR;
- Follow the science-based recommendations in the Interim Guidance (including the projections in Table 3-3) and which will be revised in future guidance documents developed by the CO-CAT;
- Not solely use SLR values within the lower third of the range in the Interim Guidance, and instead should generally assess potential impacts and vulnerabilities over a range of SLR projections, including analysis of the highest SLR values presented in the Interim Guidance document;
- Avoid making decisions based on SLR values that would result in high risk; and
- Coordinate with one another when selecting values of SLR and use the same baseline projections of SLR for the same project or program, with agency discretion to use higher projections and apply a safety factor as necessary.

SLR projections were also given in this study, which were identical to those given in the Interim Guidance.

3.3.10 Ballona Wetlands Land Trust v. City of Los Angeles (Case No. B231965)

California's Second District Court of Appeal has addressed provisions of the California Environmental Quality Act (CEQA) checklist questionnaire that appear to require analysis of the effects of environmental hazards on the proposed project. The court held that such impacts are not encompassed by CEQA. It rejected a claim that an Environmental Impact Report (EIR) was required to evaluate the impacts of potential SLR on a project. Essentially, CEQA requires analysis of the effects of human-induced changes on the environment rather than the environment's changes on humans. Therefore, infrastructure projects need to consider and design for SLR, but are not required to analyze SLR impacts on projects in their environmental review documents.

3.3.11 CO-CAT (2013)

CO-CAT prepared the State of California Sea Level Rise Document in March 2013 to update state interim guidance in light of the NRC study results. The updated guidance recommends a similar approach to that specified in the 2010 interim guidance, and also that planning for SLR be done using the ranges of SLR presented in the June 2012 National Research Council report on *Sea-Level Rise for the Coasts of California,*

Oregon, and Washington as a starting place. Specific SLR values should be based on agency and context-specific considerations of risk tolerance and adaptive capacity. Table 3-4 (below) presents SLR projections based on the June 2012 NRC report on SLR. Refer to recommendations in the CO-CAT document for a discussion of time horizon, risk tolerance, and adaptive capacity, which should be considered when choosing values of SLR to use for specific assessments.

Table 3-4. NRC Sea-Level Rise Projections Using 2000 as the Baseline

Time Period	South of Cape Mendocino
2000-2030	4 to 30 cm (0.13 to 0.98 ft)
2000-2050	12 to 61 cm (0.39 to 2.0 ft)
2000-2100	42 to 167 cm (1.38 to 5.48 ft)

CO-CAT also indicates that future SLR projections should not be based on linear extrapolation of historical sea level observations. For estimates beyond one or two decades, linear extrapolation of SLR based on historical observations is inadequate and would likely underestimate the actual SLR. According to the OPC Science Advisory Team, because of non-linear increases in global temperature and the unpredictability of complex natural systems, linear projections of historical SLR are likely to be inaccurate.

3.4 Local Guidance

Local guidance was defined as any studies specific to the San Diego region. These studies generally utilized SLR scenarios based on the above guidance documents and applied them locally to produce impact analysis and identify areas of vulnerability. Therefore, these studies do not provide any specific guidance, rather they only demonstrate application of the SLR projections locally. These studies are summarized in this section.

3.4.1 San Diego Foundation Regional Focus 2050 Study (Messner et al. 2008)

The *San Diego Foundation Regional Focus 2050 Study* (Focus 2050 Study) explores potential qualitative and quantitative impacts of a changing climate on the San Diego region in the year 2050. The forecasted impacts in this study are based on projections of climate change generated by scientists at Scripps Institution of Oceanography (SIO), using three climate change models and two emission scenarios developed by the IPCC.

Results of three simulation scenarios indicate sea level increases of 12 to 18 inches (30 to 45 cm) by 2050. Projected SLR based on application of the Rahmstorf 2007 method with and without adjustment for the effects of dams are compared with observed values between 1900 and 2000. These projections are shown in Figure 3-4.

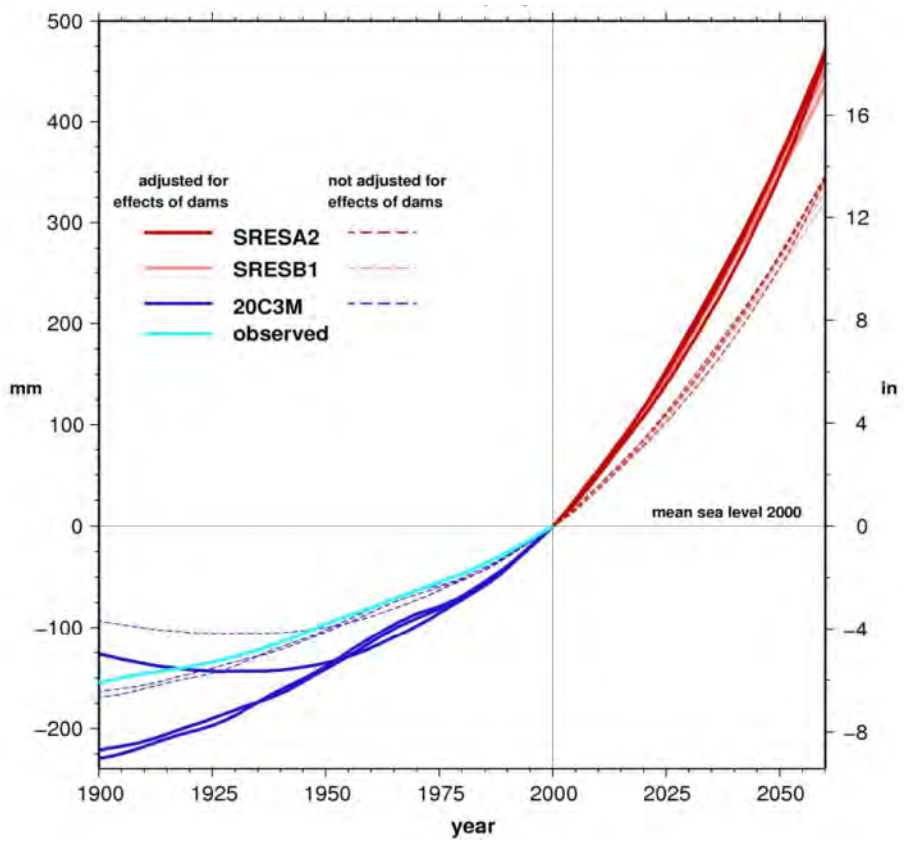


Figure 3-4. San Diego Foundation Sea Level Rise Projections
(Source: Messner et al. 2008)

The study combined the effects of SLR, tidal fluctuations and run-up from moderately common wave events (from SIO's Coastal Data Information Program, or CDIP) to produce inundation maps for six flood-prone areas in the region (i.e., Oceanside, Del Mar, La Jolla Shores, Mission Beach, Coronado, and South Imperial Beach). The graphics show inundation areas in year 2050 under the following frequency categories and can be seen at (http://www.cleantechsandiego.org/):

- **Very Likely:** predicted high tide range in 2050
- **Moderately Common**: estimated sea level + tide + wave run-up elevation recurrence, on average, every five years in the 50-year simulation. Expected to occur every few years when El Niño conditions are not present.
- **Moderately Rare**: estimated sea level + tide + wave run-up elevation recurrence, on average, every 10 years in the 50-year simulation; but expected in most years when El Niño conditions are present.
- **Somewhat Rare:** estimated sea level + tide + wave run-up elevation recurrence on average every 25 years, based on the 50-year simulation.

- **Very rare**: highest combination of sea level + tides + wave run-up elevation in the 50-year simulation.

An example inundation simulation is shown in Figure 3-5 for the Cities of Del Mar and Oceanside shoreline. As the decades proceed, the simulations show an increasing tendency for heightened sea level events to persist for more hours, which would likely cause greater coastal erosion and related damage.

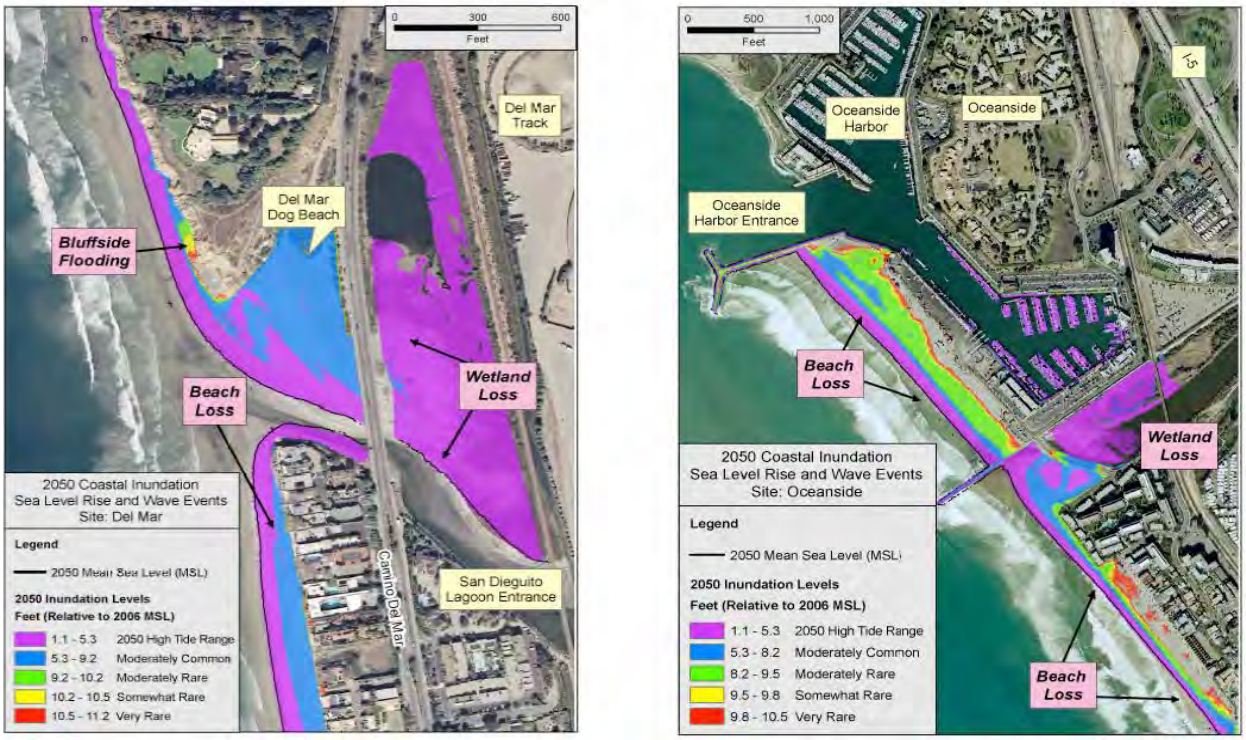


Figure 3-5: Year 2050 Inundation Simulations for Del Mar Beach (left) and Oceanside Beach (right)
(Source: Messner et al. 2008)

3.4.2 The Impacts of Sea Level Rise on the California Coast (Heberger et al. 2009)

California Energy Commission's Public Interest Energy Research (PIER) Program established the CCCC to document climate change research relevant to the State. This center is a virtual organization with core research activities at SIO and the University of California, Berkeley, complemented by efforts at other research institutions. This study is a part of a report series that details ongoing center-sponsored research.

The report cites recent research by leading climate scientists who claimed that more accurate sea level measurements by satellites indicate that SLR from 1993 to 2006 has outpaced the IPCC projections at some locations (Rahmstorf 2007). The authors suggest that the climate system, particularly sea levels, may be responding to climate changes more quickly than the models predict. Additionally, most climate models fail to

include ice melt contributions from the Greenland and Antarctic ice sheets and may underestimate the change in volume of the world's oceans.

To address these new factors, the PIER projects used SLR forecasts developed by a team at the SIO led by Dr. Dan Cayan. Using a methodology developed by Rahmstorf (2007), Cayan et al. (2009) produced global sea level estimates based on projected surface air temperatures from global climate simulations for both the IPCC A2 and B1 scenarios using the output from six global climate models: 1) the National Center for Atmospheric Research (NCAR) Parallel Climate Model; 2) the National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluids Dynamics Laboratory version 2.1; 3) the NCAR Community Climate System Model (CCSM); 4) the Max Planck Institute ECHAM3; 5) the MIROC 3.2 medium-resolution model from the Center for Climate System Research of the University of Tokyo and collaborators; and 6) the French Centre National de Recherches Meteorologiques models.

Additionally, Cayan et al. (2009) modified the SLR estimates to account for water trapped in dams and reservoirs that artificially reduced runoff into the oceans (Chao et al. 2008). Absolute SLR along the California coast was assumed to be the same as the global estimate. Based on these methods, Cayan et al. (2009) estimate an overall projected rise in MSL along the California coast for the B1 and A2 scenarios of 39 inches (1.0 meter) and 55 inches (1.4 meters), respectively, by 2100. The more severe A1FI scenario, which assumes a continued high-level use of fossil fuels, was not used in this analysis, but is shown in Figure 3-6 for comparison.

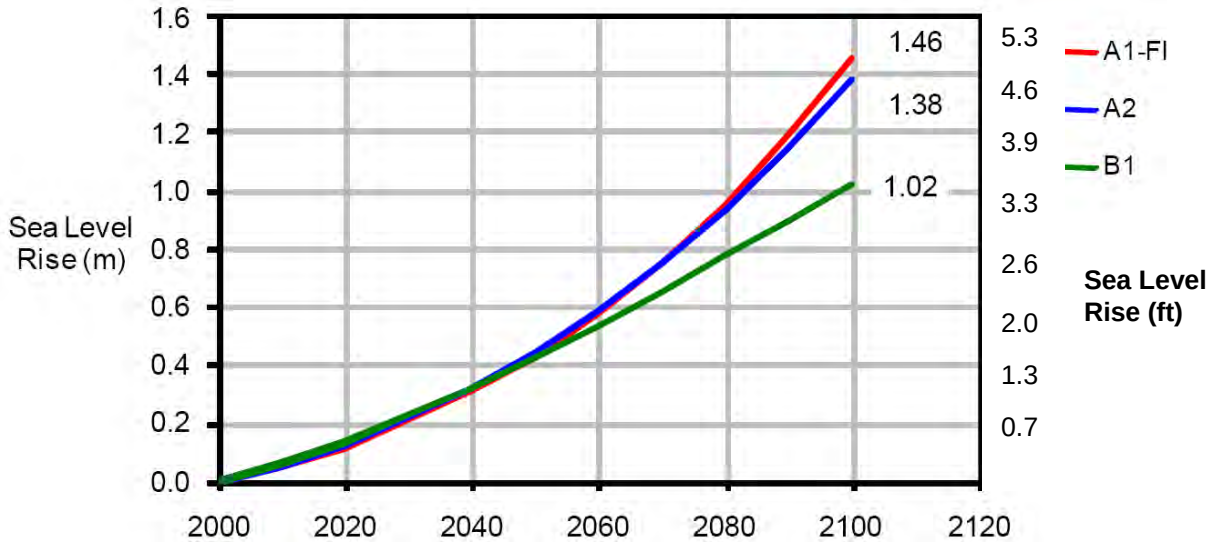


Figure 3-6: Cayan el al. (2009) Scenarios of Sea-level Rise to 2100
(Source: Dan Cayan (2009), Scripps Institution of Oceanography, NCAR CCSM3 simulations, Rahmstorf method.)

3.4.3 Climate Change-Related Impacts in the San Diego Region by 2050 (Messner et al. 2009)

This study states that it relies heavily on research conducted in the Focus 2050 Study to analyze climate and SLR impacts to the San Diego region in year 2050. The report's analysis and conclusions, in regard to SLR, appear identical to those of the prior study (Messner et al. 2009).

3.4.4 Climate Action Strategy (SANDAG 2010)

SANDAG's CAS is a planning-level document that serves to help policymakers address climate change as they make decisions to meet needs of a growing population, maintain and enhance quality of life, and promote economic stability. The document outlines goals and objectives to work toward that end and specifically addresses SLR under Goal 4 and Objective 4b as listed in the Introduction to this study.

3.4.5 Sea Level Rise Adaptation Strategy for San Diego Bay (ICLEI 2012)

The Adaptation Strategy document is intended to provide participating steering committee jurisdictions with policy recommendations that will aid in making bay-front communities more resilient to SLR and its associated impacts such as coastal flooding, erosion, and ecosystem shifts. The steering committee consists of staff from the:

- City of Chula Vista;
- City of Coronado;
- City of Imperial Beach;
- City of National City;
- City of San Diego;
- Port of San Diego;
- San Diego County Airport Authority; and
- International Council for Local Environmental Initiatives.

The bay was separated into a number of different potentially impacted sectors (i.e., ecosystems, facilities, stormwater / wastewater systems, etc.) for which vulnerabilities and adaptation strategies were developed. Impacts were evaluated from four SLR planning scenarios, as follows:

1. **2050 Daily Conditions** — Mean high tide in 2050 with 0.8 feet (0.5 meters) of SLR.

2. **2050 Extreme Event** – 100-year extreme high water event in 2050, with 0.8 feet (0.5 meters) meters of SLR, including such factors as El Niño, storm surge, and unusually high tides.

3. **2100 Daily Conditions** – Mean high tide in 2100 with 4.9 feet (1.5 meters) of SLR.

4. **2100 Extreme Event** – 100-year extreme high water event in 2100, with 4.9 feet (1.5 meters) of SLR, including such factors as El Niño, storm surge, and unusually high tides.

3.5 Scientific Publications

A number of scientific publications were the basis of the SLR scenarios. These scenarios were the foundation of the previously discussed guidance documents. Relevant scientific publications are summarized in this section.

3.5.1 Rahmstorf (2007)

A semi-empirical approach has been developed by Stefan Rahmstorf of the Potsdam Institute for Climate Impact Research, Germany, in an attempt to address the IPCC model limitations. The approach uses existing temperature projections, while using a linear model based on observations from 1880 to 2001 to predict SLR directly from temperature changes. It may capture the effect of mechanisms such as the loss of mass from ice caps, which may already be occurring but which are not yet understood in detail. The semi-empirical approach describes SLR from 1990 to 2006 better than the TAR, although it has not been compared to the 4AR. The approach is controversial in its application of statistical methods but has been widely quoted and is regularly used in planning literature. It increases the estimate of 21st Century SLR to between 1.6 to 4.6 feet (50 and 140 cm) between 1990 and 2100.

3.5.2 Vermeer & Rahmstorf (2009)

In 2009, the semi-empirical relationship for projecting SLR was revised to account for second order warming effects, which result in quicker temperature changes (Vermeer and Rahmstorf 2009). A second term was added to the relationship to account for shorter time-scale sea level responses such as heat content in the ocean surface. The updated relationship was found to capture short-term variability when utilized with global climate change models that could account for solar variability, volcanic activity, changes in greenhouse gas concentration, and tropospheric sulfate aerosols. The revised relationship resulted in higher SLR projections for the same IPCC scenarios used in the Rahmstorf 2007 study. The revised SLR projections ranged from 2.66 to 5.87 feet (0.81 to 1.79 meters) above 1990 levels by the year 2100, as summarized in Table 3-4.

Table 3-4. Vermeer and Rahmstorf (2009) Sea Level Rise Projections to Year 2100

Scenario	Emissions Categories	Sea-level Rise feet (meters)
B1	Low to Medium-Low	2.66 – 4.30 (0.81 – 1.31)
A1T	Low to Medium-Low	3.18 – 5.18 (0.97 – 1.58)
B2	Medium-Low to Medium-High	2.92 – 4.76 (0.89 – 1.45)
A1B	Medium-Low to High	3.18 – 5.12 (0.97 – 1.56)
A2	Medium-Low to High	3.22 – 5.09 (0.98 – 1.55)
A1FI	High	3.71 – 5.87 (1.13 – 1.79)
Sea-level rise projections from 1990 baseline		

3.5.3 Houston and Dean (2011)

The study titled, *Sea-Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global Gauge Estimates* (Houston & Dean 2011), analyzes U.S. and global tide gauge data with durations of 60 to 156 years, starting in Year 1930 to 2010. Based on this data set, the study found that empirical-based SLR predictions postulated by IPCC, Rahmstorf, and others were not observed in the long-term tide gauges, and, in fact, many of them showed small average SLR decelerations. The study uses these findings to question the acceleration of SLR that has been cited in most model projections (e.g., Vermeer & Rahmstorf 2009). The study states that without the empirical-based predictions for SLR acceleration, the 20th Century SLR trend of 0.7 inches / year (1.7 mm / year) would produce a rise of only approximately 0.5 feet (0.15 m) from 2010 to 2100. The study also poses the question of why the increase in global temperatures of 1.33°F (0.74°C) during this time period did not result in acceleration of rising sea levels, and, in fact, a deceleration occurred over certain time periods.

3.5.4 Rahmstorf and Vermeer (2011)

As a rebuttal to Houston & Dean (2011), Rahmstorf and Vermeer published Discussion of: Houston, J.R. and Dean, R.G., 2011. Sea Level Acceleration Based on U.S. Tide Gauges and Extensions of Previous Global-Gauge Analyses. The paper demonstrates that the results of the Houston & Dean (2011) study are the result of their specific focus on acceleration since the year 1930, which represents a unique minimum in the acceleration curve (Figure 3-7). Further, the study suggests that global SLR is accelerating in a way that is strongly correlated with global temperature and that this correlation explains the acceleration minimum for time periods starting around 1930 as being due to the mid-twentieth-century plateau in global temperature.

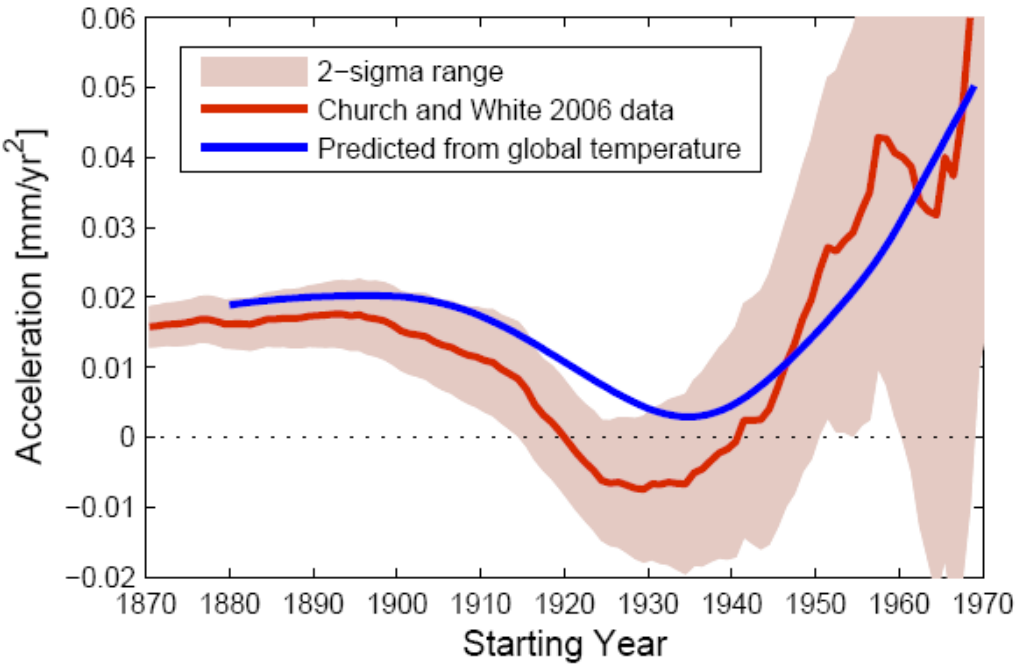


Figure 3-7: Acceleration of Sea Level Rise

(Source: Realclimate.org)

4.0 GUIDANCE FROM FUNDING AGENCIES

Many agencies provide funding for transportation projects being administered by SANDAG, Caltrans, and coastal cities. The railway improvements in the LOSSAN Corridor are being funded by FRA, FTA, the State of California, Caltrans Division of Rail, Amtrak, and the local TransNet Program. The freeway projects along the North County Coastal Corridor are funded by FHWA, Caltrans, the State of California, and the local TransNet Program. The funding agencies were contacted to obtain their current guidance on SLR. This section summarizes guidance from these agencies.

4.1 Federal Funding Agencies

4.1.1 Federal Rail Authority

The FRA and the FTA are divisions within the USDOT. The FRA promulgates and enforces rail safety regulations, administers railroad assistance programs, conducts research and development in support of improved railroad safety and national rail transportation policy, provides for the rehabilitation of Northeast Corridor rail passenger service, and consolidates government support of rail transportation activities.

The FRA does not have specific SLR guidance; therefore, USDOT guidance would apply (EIC 2011). This guidance is summarized in Section 1.0 of this document. Adherence of the project to this guidance would require the incorporation of climate change adaptation strategies.

4.1.2 FHWA

As discussed in section 3.2.4, the FHWA does not currently require consideration of SLR in bridge project designs. As previously stated, guidance for bridge design is published in HECs and SLR is discussed in HEC-25 (Douglass and Krolak 2008).

4.2 State Transportation Agencies

4.2.1 Caltrans Division of Rail

The Caltrans Division of Rail follows the 2013 State Guidance on SLR. This agency is a member of CO-CAT and operates according to the guidelines developed by the State.

4.2.2 Caltrans Highways

Caltrans has a process, described in Section 3.3.8 of this document whereby projects are analyzed in light of future SLR. Caltrans takes prediction values shown in Table 3-4 of this document and considers the project's potential effect from SLR, and analyzes and designs accordingly. SLR values considered are those of the State's guidance document from 2013.

4.2.3 Amtrak

Amtrak is the business name for the National Railroad Passenger Corporation, a government owned passenger Rail Corporation. Amtrak does not have any specific guidance on SLR. However, rail projects bordering the coast are evaluated on a case-by-case basis taking into account all pertinent design parameters. Coastal protection is provided to rail infrastructure based on geography/topography, site-specific conditions, historical information, and a risk assessment of future impacts (Richter 2012).

4.3 Local Agencies

SANDAG is developing this study to provide local guidance for transportation projects. Some local coastal agencies are preparing / have prepared plans that address climate change and SLR, as detailed in Table 4-1.

Table 4-1. San Diego Coastal Cities Preparing SLR Guidance Plans

City	Document Title	Author	Status
Oceanside	None	NA	NA
Carlsbad	None	NA	NA
Encinitas	Climate Action Plan	City of Encinitas	Complete
Solana Beach	Local Coastal Plan Policy, Chapter 4 (Natural Hazards)	City of Solana Beach	Complete
Del Mar	None	NA	NA
City of Chula Vista City of Coronado City of Imperial Beach City of National City City of San Diego Port of San Diego San Diego County Airport Authority	SLR Adaptation Strategy San Diego Bay	ICLEI et.al. 2012	Complete

5.0 SEA LEVEL ELEVATIONS

Review and analyses of federal, state, and local SLR studies and other literature summarized herein provide potential future SLR scenarios for the purposes of planning and engineering design of the Project. Results of this technical review are presented in this section.

5.1 Historical Global Sea Level Rise

The latest assessment of global historic SLR estimates provided by NRC 2012 gives the following measured rates:

- Long-term (past 50 to 100 years) rates of about 0.07 inches / year (1.8 mm / year), as estimated from tide gages; and
- Recent (post-1990) rates of about 0.13 inches / year (3.2 mm / year), as estimated from satellite altimetry and tide gages.

These rates are in close agreement with the 4AR and provide a context for projected rates into the future.

5.2 Local Sea Level Rise

As previously mentioned, the rate of global SLR is of less practical importance than the local rate of SLR relative to the land. The first analysis method of the local conditions is to look to long-term tide gage records in the Project area. There are two long-term water level records within the study area (La Jolla and San Diego Bay) operated by NOAA. An analysis of the components of relative SLR are presented in this section, which includes analysis of local tide gage data as well as the vertical movement of the land over this same time period.

5.2.1 Tide Gage Data

NOAA estimates the rate of local SLR at the La Jolla gage as 0.08±0.01 inches / year (2.07±0.29 mm / year, 0.68±0.1 feet (0.21 meter / century), based on monthly MSL from 1924 to 2006 (NOAA 2012). This is generally consistent with the global rate (i.e., 0.07 inch / year; 1.7 mm / year), suggesting that uplift or subsidence are not contributing significantly to the rate of local SLR at the Project site. Similarly, NOAA has analyzed the tidal record for San Diego Bay and estimates the rate of local SLR as 0.08±0.01 inches / year (2.06±0.20 mm / year, 0.68 feet 0.21 meter / century), based on monthly MSL from 1906 to 2006. Figure 5-1 and Figure 5-2 show these water level records.

Local SLR was compared to the NRC 1987 projections to determine how the region was performing over the last 30 years (Figure 5-3). Based on this tidal record, the region appears to be following the low SLR projection (NRC I). As shown in this graphic, from 1987 through 2010, MSL recorded at the La Jolla tide gage followed the NRC I

projection closely and fell below the high projection (NRC III) by approximately 0.2 feet. This analysis should be considered a first-order estimate and a more detailed analysis would be necessary to reach any firm conclusions.

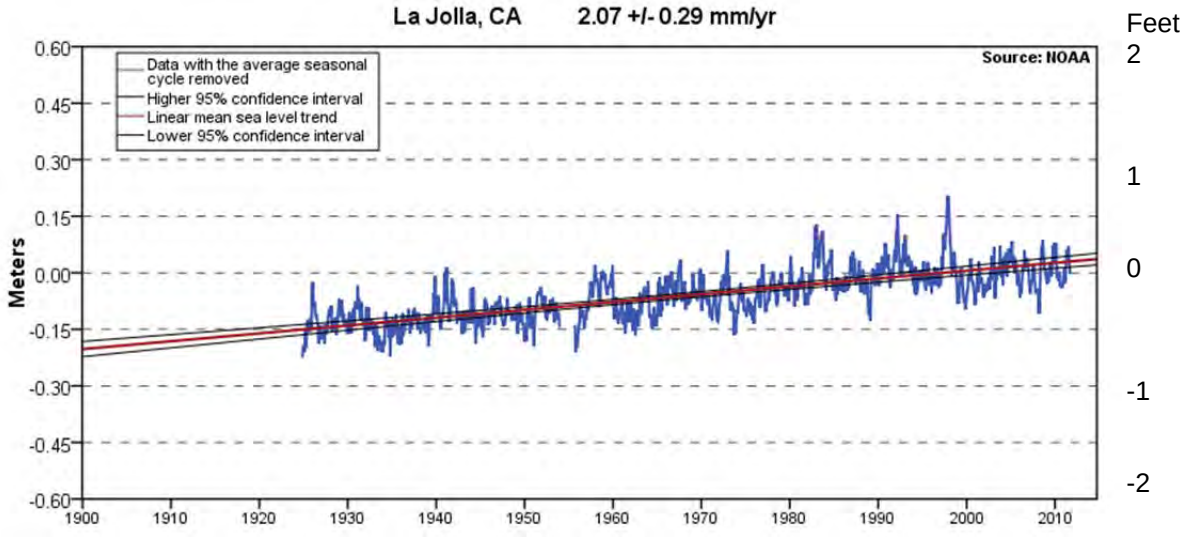


Figure 5-1: La Jolla Water Level Record

(Source: NOAA 2012)

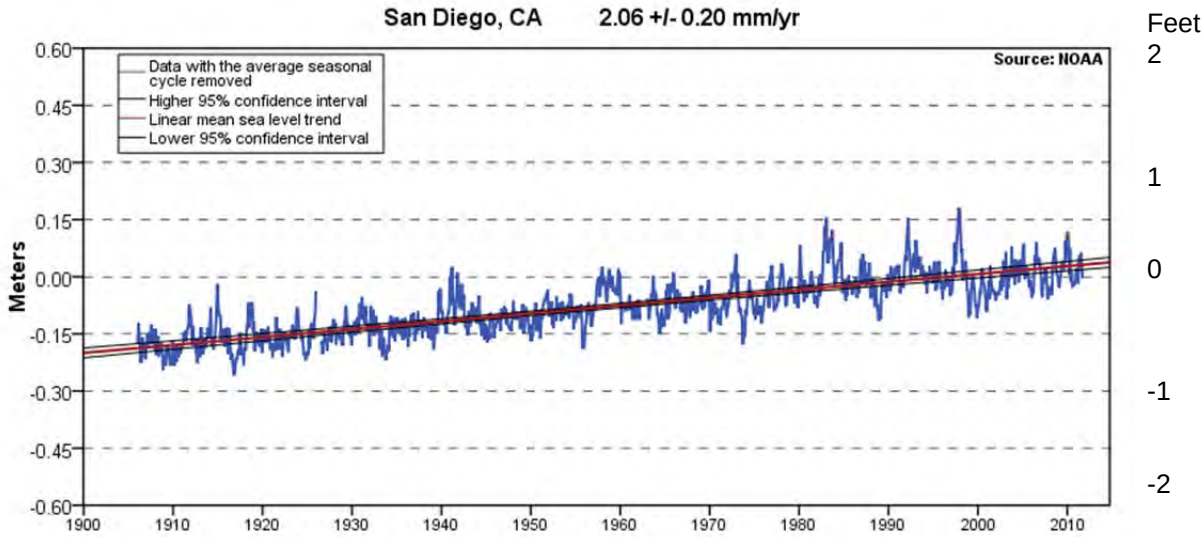


Figure 5-2: San Diego Water Level Record

(Source: NOAA 2012a)

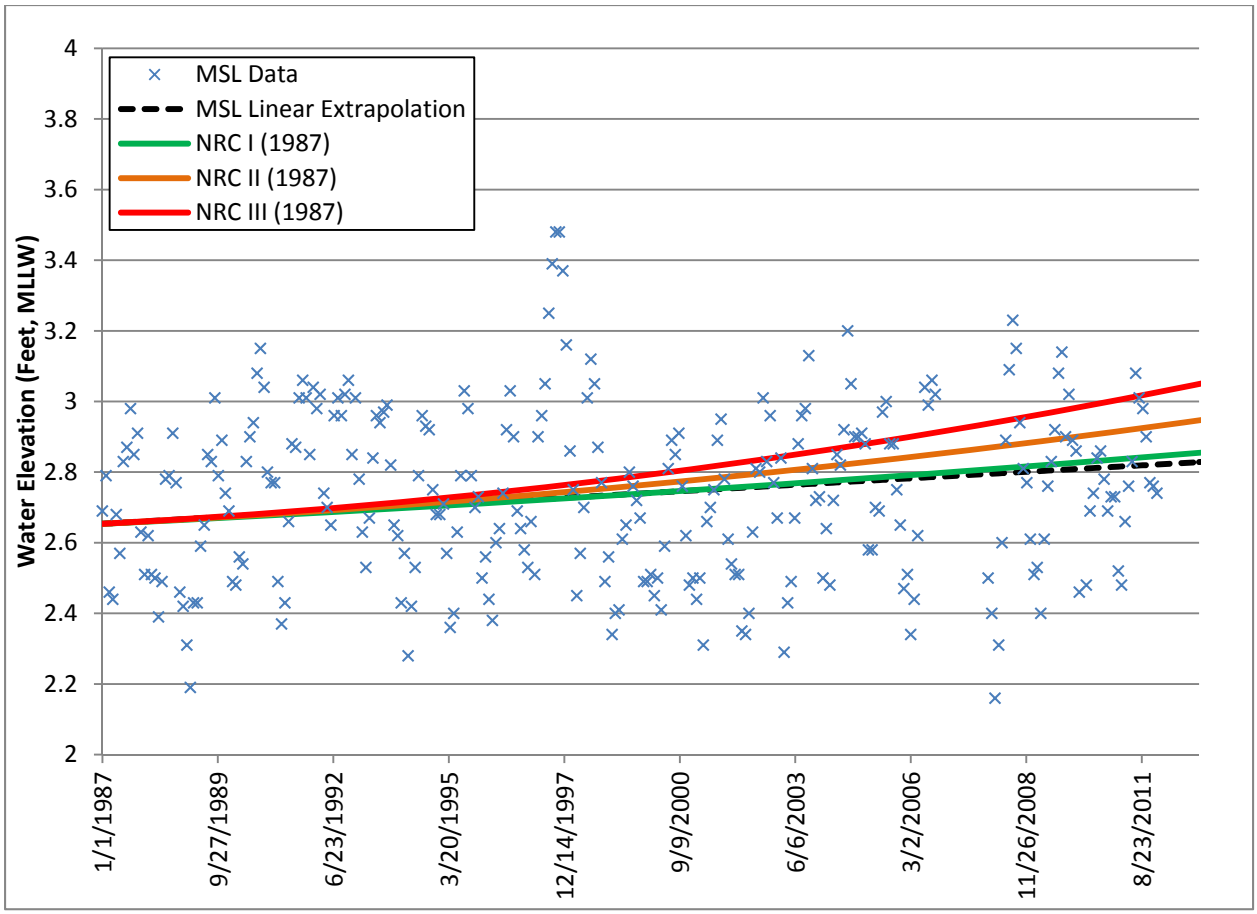


Figure 5-3: La Jolla Mean Sea Level Data Compared to NRC 1987 Projections

5.2.2 Vertical Land Movement

Vertical land movement in the San Diego region depends on varying contributions of glacial isostatic adjustment, sediment compaction, fluid withdrawal or recharge, and local compressional tectonics that may or may not be related to earthquake faults. Two very different assessments of vertical land movement have been made for the San Diego region and both are presented below. Although they vary, the magnitude of the vertical land changes does not significantly affect SLR because this is typified primarily by strike-slip (lateral) movement rather than vertical movement.

The NRC report (2012) found that the San Diego region is projected to subside at a rate of 0.06 inch / year (1.5 mm/ year) from 2010 to 2100 based on projections from existing satellite records. This subsidence rate was accounted for in the NRC 2012 SLR projections.

In contrast, Abbott (1999) indicates that land in the San Diego region is slowly being uplifted as presented in the book titled *The Rise and Fall of San Diego, 150 Million Years of History Recorded in Sedimentary Rocks.* This book states that the land is rising at an average rate of about 5.5 inches (14 cm) per thousand years, or 0.55 inches

per century. In the last 80,000 years the rate of uplift seems to have increased to nearly 12 inches (30.5 cm) per thousand years (1.2 inches per century); southwest of the Rose Canyon fault, the uplift rate is closer to 18 inches (45.7 cm) per thousand years (1.8 inches per century). This equates to an uplift rate 0.01 to 0.02 inches (0.03 to 0.05 cm) per year. Since this uplift value is approximately equal to the SLR measurement errors and are well within the SLR variability based on different projections, this uplift rate can be ignored and not applied to the global SLR rate to determine the local SLR in the San Diego region. Consequently, at this time, local uplift does not appear to be a significant factor in assessing local relative SLR rate in the region.

5.2.3 Recent Observations

Recently the rate of SLR along the California coast (and the west coast of North and Central America as a whole) has slowed, or even reversed (Bromirski et al. 2011). The following studies support this observation.

- Based on multi-satellite altimetry (Cazenave et al. 2008; CNES et al. 2010) and tide gage records (Bromirski et al. 2011; Coastal Environments 2010), the sea level along the Southern California coast has actually dropped, as shown in Figure 5-4.

- Based on monthly mean water levels measured at La Jolla (Willis et al. 2008), the rate of sea level increase between 1993 and the end of 2009 was only 0.02 inches (0.6 mm) per year (0.2 feet (6.1 cm) per century) – much less than the 20th Century average.

A localized decrease in ocean temperatures and hemispheric wind stress patterns appear to be responsible for this slowing or reversal in sea level along the Pacific Coast of North America (Cazenave et al. 2008; Bromirski et al. 2011). Figure 5-5 shows global sea surface temperatures, and those for the eastern Pacific Ocean are lower than those for the central and western Pacific. Recent changes in the wind stress patterns may indicate a regime shift toward conditions allowing SLR to resume at rates equal to or greater than global rates.

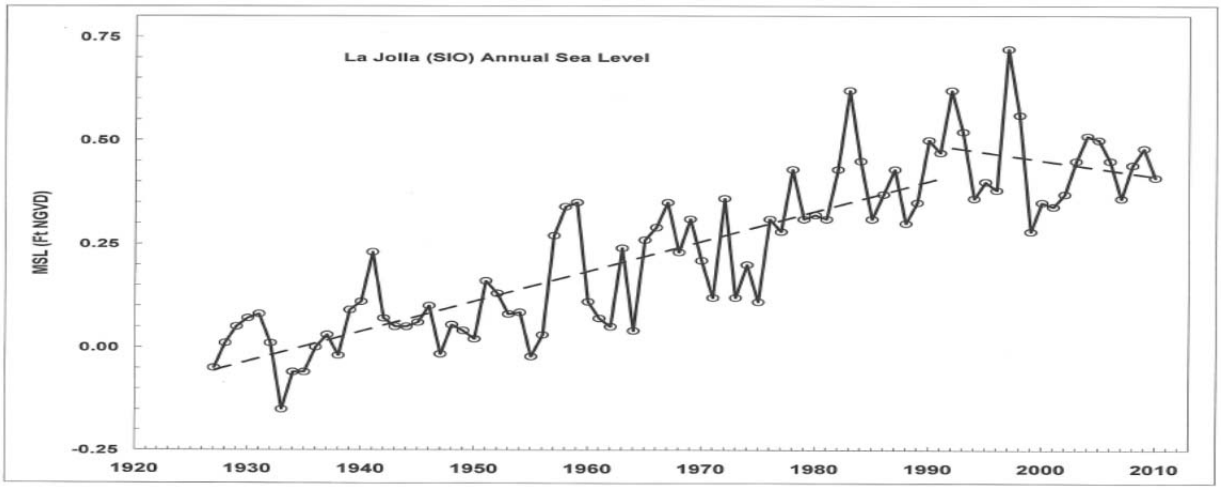


Figure 5-4: Local Sea Level Trends from Satellite Tide Gages, 1927-2010
(Source: Coastal Environments 2010)

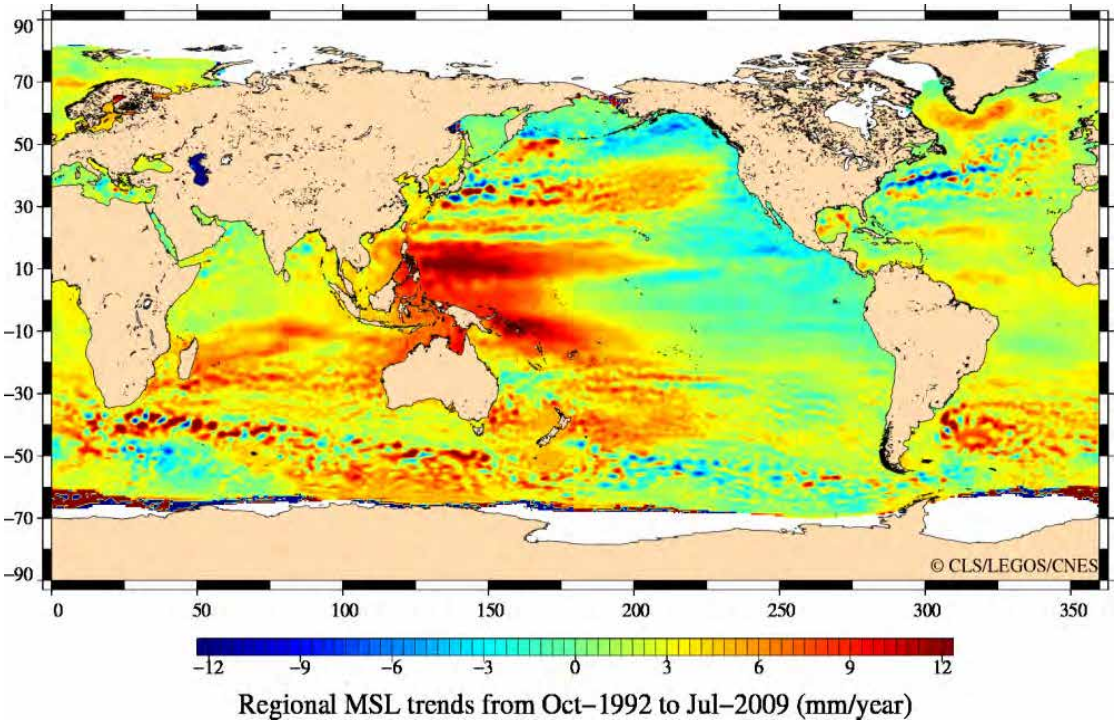


Figure 5-5: Global Sea Level Trends from Satellite Altimetry, October 1992 to July 2009

5.3 Tidal Range Increase

The tidal range measured at La Jolla has increased measurably during the 20th Century. This means, for example, that the elevation of Mean Higher High Water (MHHW) is rising more rapidly than the MSL (Flick et al. 2003). Based on

measurements at La Jolla from 1924 to 2006, the rate of SLR at the MHHW datum is approximately 0.74 feet (22 cm) per century, compared to 0.66±0.10 feet (20 cm ± 3 cm) per century at MSL and 0.66 feet (20 cm) per century at Mean Lower Low Water (MLLW).

The mechanisms causing this increase in tidal range are not known, and it is also not known whether the rate of increase will increase, decrease, or remain constant. The difference between the two rates of increase – 0.66 feet (20.7 cm) per century at MSL versus 0.74 feet (22.5 cm) per century at MHHW – is small compared to the general level of uncertainty regarding future SLR. Consequently, it does not seem necessary to account for the increase in tidal range in most planning activities.

6.0 RECOMMENDED SEA LEVEL RISE SCENARIOS

Since funding is possible from both state and federal entities, it is recommended that the Interim Guidance (2010) and USACE (2011) guidance be followed for SLR in the planning and design for this Project. However, the most recent guidance from CO-CAT (2013) with scientific input from the OPC should also be considered as it represents the most recent science. Since the Program will be constructed in phases, SLR rates are given for a number of planning horizon years below for consideration of the various capital improvement projects. Projects conducted under the NCC Program that are planned for design and construction in later years (e.g., beyond the year 2020) should consider the relevant SLR projections and agency guidance available at that time. This could also be addressed through continued updating of this document and subsequent use of the information for future planning and design of NCC Program projects.

6.1 Concurrence with State of California Guidance

SLR scenarios were extracted from CO-CAT State Guidance (2013) for the various planning horizon years, as shown in Table 6-1.

Table 6-1. State of California Sea Level Rise Scenarios (CO-CAT Guidance 2013)

Year	Low Inches (cm)	High Inches (cm)
2030	1.56 (3.92)**	11.76 (29.87)***
2050	4.68 (11.89)**	24.00 (60.96)***
2100	16.56 (42.06)	65.76 (167.03)

***Low end of the "Range of Models"*
****High end of the "Range of Models"*

6.2 Concurrence with USACE (2011) Guidance

Assuming the Project requires a USACE permit and/or involves federal funding, SLR scenarios were generated for the Project consistent with USACE (2011) guidance. These scenarios are shown in Table 6-2 and presented graphically in Figure 6-1 for horizon years 2030, 2050, and 2100.

Table 6-2. Sea Level Rise Scenarios Per USACE (2011) Guidance

Year	Low Rate (Linear Extrapolation)		Intermediate Rate (NRC I)		High Rate (NRC III)	
	Inches	**Centimeters**	**Inches**	**Centimeters**	**Inches**	**Centimeters**
2030	1.20	3.05	3.60	9.14	8.40	21.34
2050	3.60	9.14	7.20	18.29	19.20	48.77
2100	7.20	18.29	19.20	48.77	58.80	149.35

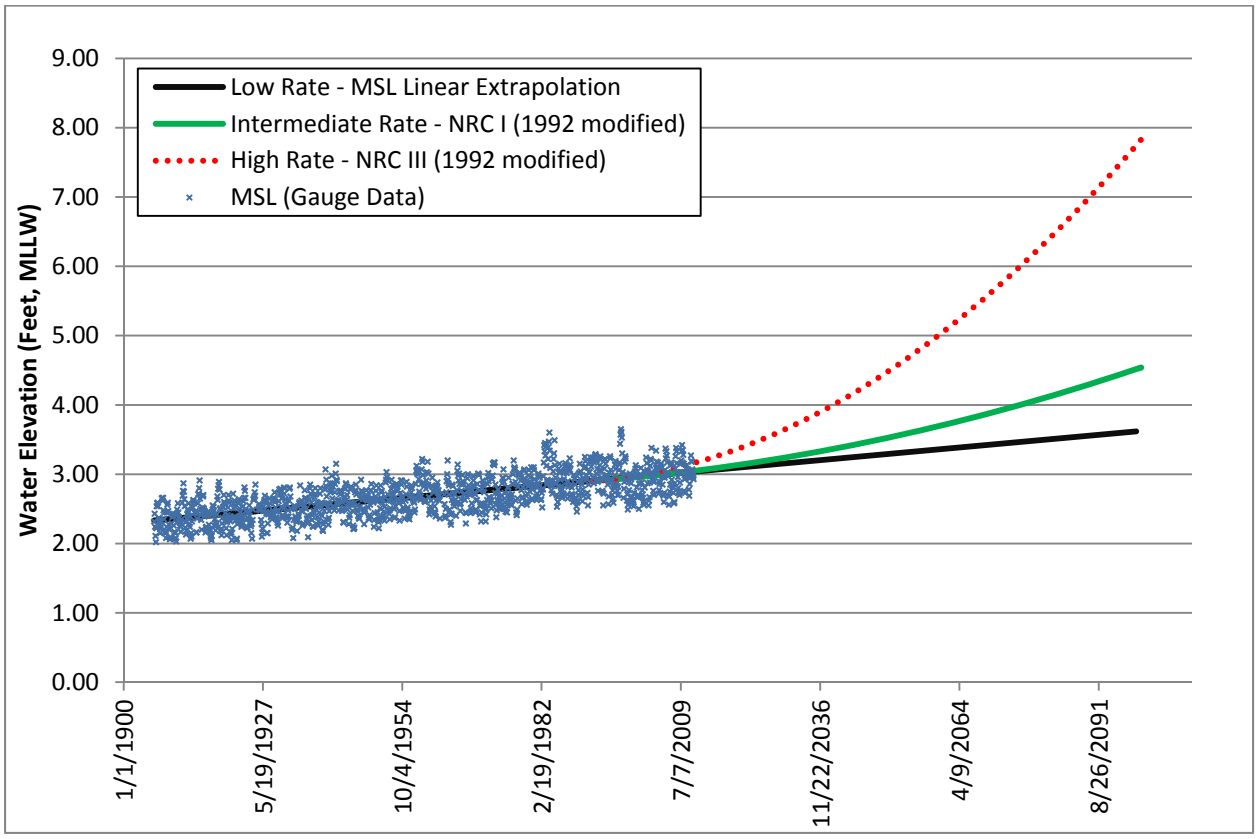


Figure 6-1: Project Sea Level Rise Scenarios per USACE (2011) Guidance

6.3 Sea Level Rise Guidance Discussion

The State and Federal guidance presented above differs most notably as years progress toward 2100. The recommended approach for each PDT is to consider the full range of projected SLR scenarios over the design life of the Project and, if possible, design to accommodate the highest prediction. The full range of SLR should be 16.56 inches (1.4 feet) to 65.76 inches (5.5 feet) from 2000 to 2100 per State guidance (March 2013 CO-CAT). Should conflicting design requirements limit the PDT from designing to the highest projection of 5.5 feet, then a lower value for SLR, based on risk tolerance assessment or planned adaptation strategies for the structures, should be considered. That lower level of SLR to be considered is to be determined based on project-specific requirements and constraints. Adaptation strategies are discussed in more detail in Section 8.0. In addition, even in cases where design requirements do not limit the ability to design for the highest prediction, the PDT might consider conducting an economic analysis to determine if it is more cost-effective to develop designs based on lower projections with adaptation measures. Alternatively, risk tolerance considerations of the impacts to public health and safety, public investments, and the environment may support the use of lower SLR projection for the project design process.

7.0 DESIGN WATER LEVEL GUIDANCE

Most bridge structures are built across rivers, streams, and creeks that are dominated by fluvial (riverine) processes while some are built across large estuaries that are dominated by ocean (tidal) processes. The NCC Program bridges will cross rivers and lagoons that are dominated by ocean processes throughout dry periods and fluvial processes during wet periods. Consequently, the water levels that should be considered in the design of the NCC Program corridor bridges should include consideration of these two primary water level components: Ocean Water Level and Fluvial Water Level. These two water level components are described in this section.

Before discussing these components, it is important to define the vertical datum that is used as the reference for such discussions. Section 7.1, defines the vertical datum used in this section along with the corresponding rationale for its use. This section further defines components of ocean water level (Section 7.2), extreme water levels (Section 7.3), fluvial water levels (Section 7.4), and combined water levels (Section 7.5).

7.1 Vertical Datums

Several vertical datums are used for surveys and structure designs within the coastal zone. Elevations presented herein are relative to the National Geodetic Vertical Datum of 1929 (NGVD 29) to be consistent with the historical datum used thus far for the San Diego Region LOSSAN bridges (Smith 2012). However, all four of the common vertical datums (NGVD 29, NAVD 88, MLLW, and MSL) are used in this study for ease of reference to source documents. The relationship of the first three of these vertical datums to NGVD 29, as well as to one another at the Scripps Pier in La Jolla is shown in Figure 7-1. The water level information presented in Figure 7-1 is based on the National Tidal Datum Epoch of 1983 - 2001.

7.2 Ocean Water Level

Ocean water levels are influenced by several components that occur over different time and spatial scales. The major components of ocean water levels, which are listed below, are discussed in more detail herein.

- Astronomical tide;
- Storm surge;
- Wave set-up;
- Cyclic climatic patterns (e.g., El Niño Southern Oscillation/ENSO);
- Tsunamis; and
- Local SLR.

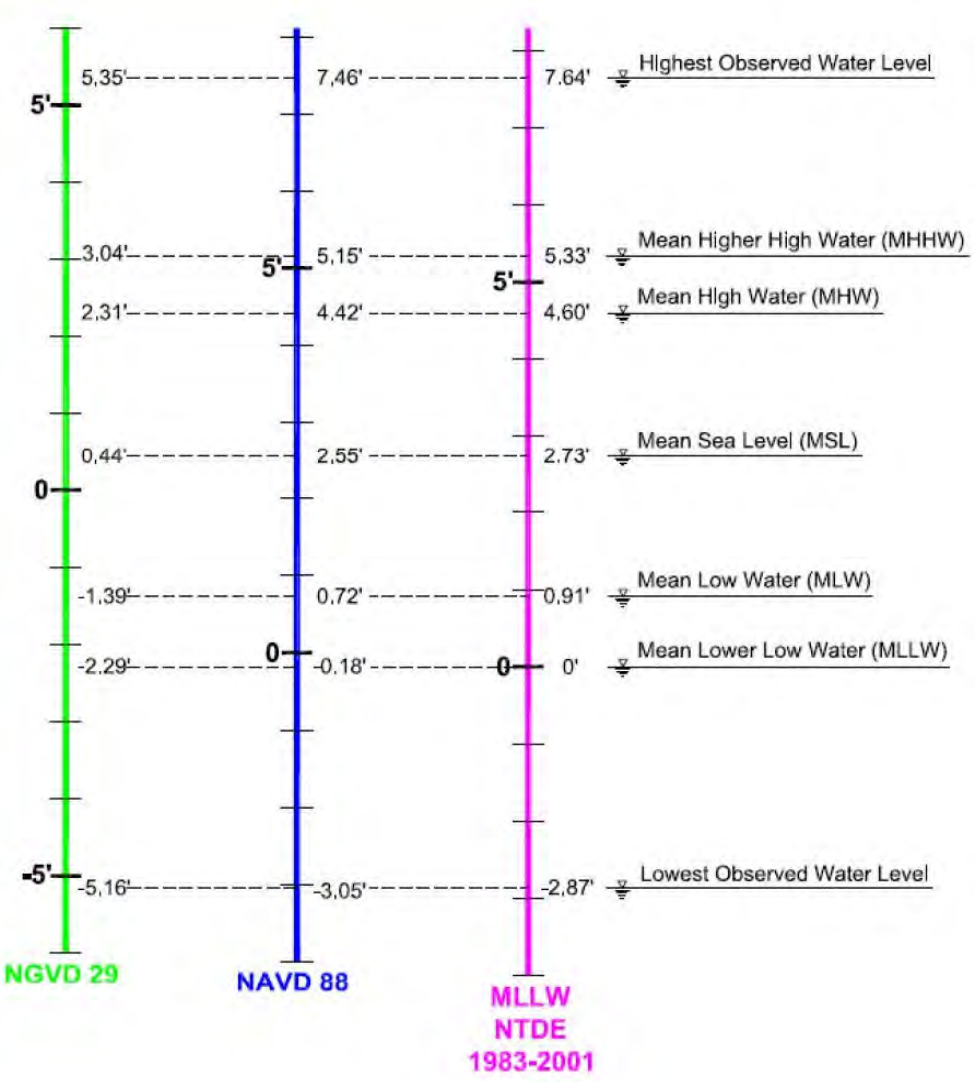


Figure 7-1: Vertical Tidal Datums at Scripps Pier in La Jolla

To obtain quantitative information on the ocean water level components listed above, NOAA conducts ocean water level measurements at numerous tide gage locations (stations) throughout the U.S., including Southern California. The NOAA station closest to the LOSSAN corridor is located at Scripps Pier in La Jolla. Given that this gage station is located on the open coast, the water levels measured at this station include all of the ocean water level components discussed above, although it may not obtain the maximum value of wave set-up since wave set-up varies with location offshore. The tidal datums, developed by NOAA through analysis of the ocean water level measurements collected at this gage station, are presented in Table 7-1. As seen in the table, the highest water level observed at the Scripps Pier reached 5.36 feet, NGVD29 on November 13, 1997.

Table 7-1. Tidal Datums for La Jolla (Based on 1983-2001 Tidal Epoch)

Description	Elevation (ft, MLLW)	Elevation (ft, NGVD 29)	Elevation (ft, MSL)	Elevation (ft, NAVD 88)
Extreme High Water (11/13/1997)	7.65	5.36	4.92	7.47
Mean Higher High Water (MHHW)	5.33	3.04	2.60	5.15
Mean High Water (MHW)	4.60	2.31	1.87	4.42
Mean Tidal Level (MTL)	2.75	0.46	0.02	2.57
Mean Sea Level (MSL)	2.73	0.44	0.00	2.55
National Geodetic Vertical Datum 1929 (NGVD 29)	2.29	0.00	-0.44	2.11
Mean Low Water (MLW)	0.90	-1.39	-1.83	0.72
North America Vertical Datum 1988 (NAVD 88)	0.18	-2.11	-2.55	0.00
Mean Lower Low Water (MLLW)	0.00	-2.29	-2.73	-0.18
Extreme Low Water (12/17/33)	-2.87	-5.16	-5.60	-3.05

7.2.1 Astronomical Tide

The astronomical tides, which are driven by the gravitational influence of the celestial bodies on the Earth's oceans, represent the most persistent component of ocean water levels. The tides in Southern California are semi diurnal (two high tides and two low tides each day) with a diurnal inequality (one higher high water and one lower high water as well as one lower low water and one higher low water). Due to the relative position of the three celestial bodies with the greatest influence on the tides (Earth, Sun, and Moon), the tides include two neap tides and two spring tides each month. The neap tides, which occur when the Earth, Sun, and Moon are out of alignment, are relatively small in magnitude. Tides that are relatively large in magnitude, known as spring tides, occur when the Earth, Sun, and Moon are in alignment.

7.2.2 Storm Surge

Storm surge is the increase in ocean water level caused by the decrease in air pressure (i.e., barometric pressure) associated with a storm, plus the increase in ocean water level caused by wind (i.e., wind set-up) blowing across the ocean water surface. Storm surge can be quite large (e.g., 10 to 20 feet) in areas with large storm events and extensive, relatively shallow continental shelves (e.g., Gulf of Mexico coast). In Southern California, the continental shelf is relatively narrow and such large storm events (e.g., tropical cyclones) rarely occur in the nearshore waters. As described below, the two reasons why tropical cyclones rarely occur in Southern California are due to relatively low sea surface temperatures and the usual upper-level winds in the eastern Pacific.

- Sea Surface Temperature: The tropical cyclones draw fuel from heat stored in the upper ocean. Typically, ocean surface waters of 80 degrees Fahrenheit are required to form and fuel tropical cyclones. But water temperatures never get that

high in the coastal waters of California. On rare occasions, they may reach about 75 degrees Fahrenheit near the shore in Southern California, typically during an El Niño episode. But generally speaking, low 60s is about as warm as they get farther from shore and elsewhere in coastal California according to an article published on the Jet Propulsion Laboratory (JPL 2012) web site. Global warming has raised the average ocean temperature by 0.18 degrees Fahrenheit over the century (National Geographic 2012).

- Upper-Level Winds: The upper-level winds in the Tropics tend to carry and steer storms to the west and northwest, away from the coast, and also tend to shear the tops off of tropical cyclones and break them apart. Lower-level winds off Southern California are prevailing northwest sea breezes. These prevailing northwesterly winds push warmer surface waters offshore, drawing cooler subsurface waters up to the surface, and this further adds to the cool nature of the nearby ocean waters that tends to weaken any cyclones that approach California.

Historically, there has never been a documented case of a hurricane-making landfall in California, although California has been affected by a few tropical cyclones which occurred in El Niño years around September. In Southern California, the primary threat from tropical cyclones is not wind or storm surge, but, rather, rainfall which has led to flooding damage and occasionally, causalities. Below are a few notable tropical cyclones that affected Southern California in recorded history.

- The San Diego hurricane of 1858. This is the only tropical cyclone ever known to have affected California as a hurricane. The storm formed in the eastern Pacific Ocean in late September and intensified into an estimated Category 1 hurricane with estimated highest winds of about 85 miles per hour (74 knots). By October 2, its untypical north-northeasterly course had steered it just off the coast of San Diego, where cooler waters and strong wind shear weakened it slightly. Luckily, just before it was about to make landfall, the storm made a turn to the west-northwest, and then dissipated near Santa Catalina Island. Despite the near miss, instrument records in San Diego indicate the area experienced hurricane or near-hurricane force winds of approximately 75 mph (65 knots), heavy rain, and considerable property damage. Researchers reported that based upon historical records and modeling results, such a storm can be expected in the San Diego area about every 200 years, most likely during an El Niño event.

- The Tropical Cyclones of the El Niño of 1938-39. In September 1939, Southern Californians experienced the first of four tropical cyclones affecting the region during the El Niño of 1938-39. The first two storms - remnants of hurricanes - tracked northeastward across northern Baja California into southwest Arizona, bringing heavy rainfall to parts of Southern California: up to 7 inches for the first storm and up to 4 inches for the second. A third storm dissipated in southern

Baja California but brought up to 3 inches of rain to parts of the Southland. Then, on Sept. 25, an unnamed storm made landfall near San Pedro with winds near 50 mph (43 knots), becoming the only tropical cyclone to ever make landfall in Southern California as a tropical storm in recorded history. In addition to the winds, the storm brought up to 5 inches (13 centimeters) of rain to the Los Angeles basin and as much as 12 inches (30 centimeters) of rain to the surrounding mountains. The storm caused heavy flooding and killed at least 45 people, mostly at sea. Low-lying coastal regions from Malibu to Huntington Beach were flooded, and thousands of people were stranded in their homes. There was heavy street flooding - up to 3 feet (1 meter) in places. The fact that the storm came on suddenly, leaving many people unprepared, led to the establishment of a Southern California forecast office for the United States Weather Bureau in 1940.

- Hurricane Kathleen occurred in mid-September of 1976 during an El Niño year. It made landfall in northern Baja California and moved into California and Arizona, still at tropical storm strength. Sustained winds of 57 mph were reported in Yuma, Ariz. The storm brought 6 to 12 inches of rain to Southern California's central and southern mountains. Ocotillo, California suffered catastrophic damage, with 70 to 80 percent of the town destroyed. Twelve deaths were blamed on the storm in the United States. The Associated Press reported hundreds of homes were destroyed or damaged in the United States by Kathleen, which was described as a one-in-160-year event.

- Hurricane Linda occurred in September 1997 during an El Niño year. It is the strongest eastern Pacific hurricane on record. This Category 5 hurricane at one point had maximum sustained winds of 185 mph (161 knots). For a couple of days, National Hurricane Center forecasters warned the storm could barrel into Southern California, most likely as a tropical storm. Fortunately, the storm turned westward away from land. Still, Linda brought significant rainfall across parts of Southern California and waves up to 18 feet, and caused several million dollars in property damage.

- Hurricane Nora happened in September 1997 during an El Niño year. In the wake of Hurricane Linda, Hurricane Nora crossed into California and Arizona from Baja California as a tropical storm, bringing heavy rains to parts of southeast California and Arizona. The storm caused hundreds of millions of dollars in damage, especially to agriculture.

7.2.3 Wave Set-up

Wave set up is the increase in ocean water level associated with the excess momentum caused by breaking waves. Wave set-up can exceed one foot in Southern California during events with large waves. Although wave set-up can contribute to the overall

ocean water level, the effect is limited to the breaker zone and beach area. Therefore, locations farther inland are generally not impacted by wave set-up.

7.2.4 Cyclic Climatic Patterns

Cyclic climatic oscillations can have a large impact on ocean water levels with this impact extending over large temporal and spatial scales. The two largest cyclic climatic oscillations are the El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). ENSO occurs every four to seven years and causes an increase in ocean water level of the west coast of North and South America. It is common for ENSO events to raise the ocean water level by 0.5 to 1.0 foot. For example, during the 1997-1998 ENSO event, monthly MSLs in southern California were increased by up to 1.0 foot (USACE 2002). Local tide gauges recorded up to 8.6 inches of water level increase for the same event. On a longer time scale, the PDO was recently shown to be a likely cause of suppressed ocean water levels on the west Coast of North America and may lead to a rapid increase in local ocean water levels in the near future (Bromirski 2011).

7.2.5 Tsunamis

Tsunamis are typically caused by submarine earthquakes and landslides. They are long period, fast moving waves generated by large displacements of the seafloor (e.g., underwater earthquakes or landslides) or impacts from celestial bodies (e.g., meteors). Earthquake faults along colliding tectonic plates tend to be thrust faults that result in vertical land movement and ocean water displacement. These faults occur along the western Pacific Ocean near Asia and the Eastern Pacific along Alaska and South America. California is located along a boundary of sliding tectonic plates called strike-slip faults. The San Andreas Fault separates two plates with the one west of the fault moving north, and the plate east of the fault moving south. Strike-slip faults do not generally result in tsunamis unless they cause submarine landslides. Figure 7-2 shows the San Andreas earthquake fault in California.

The tsunami generated by the Miyagi earthquake in Japan on April 7, 2011 reached Southern California with a very small tsunami wave (less than a foot) observed along the coast. A more pronounced tsunami wave was recorded after the Chile earthquake on February 27, 2010, where waves of approximately two feet were measured at San Diego. There have been several historical tsunamis of significant magnitude along the Southern California coast generated by seismic events in Alaska and Chile. A number of references were reviewed relative to the potential tsunami wave heights within the Project area and this information is summarized below.



Figure 7-2: San Andreas Fault in California

7.2.5.1 State of California Tsunami Inundation Maps (2009)

The “Tsunami Inundation Maps for Emergency Planning” were published on June 1, 2009 through a joint effort by the State of California Office of Emergency Services, the California Geologic Survey, the University of Southern California Tsunami Research Center, and NOAA. The maps present the impacts of both local and distant sources of tsunamis to the California coastline. Tsunami inundation areas were depicted on these maps based on the assumption that the tsunami occurred during mean high water. The maps represent the maximum tsunami run-up from a number of credible, extreme, tsunami sources. The maps do not represent inundation from a single event; rather they display the maximum tsunami inundation generated from either a local or distant source event affecting a given region. This combination of the mean high water level and worst-case scenario tsunami event was used to create what was called a “credible upper bound” for each region of the coastline for the main purpose of emergency preparedness, as opposed to providing design guidance or criteria. Since the maps represent the worst-case model results for each portion of the coastline, specific water level elevations associated with the tsunami inundation areas were not given. The recurrence interval of the events characterized by the California Geology Survey maps is not provided. Researchers associated with the map study indicate that they are likely on the order of 1 in every 2,500 years (Dykstra 2012).

7.2.5.2 SONGS Tsunami Study (2011)

The study updated the San Onofre Nuclear Generating Station (SONGS) tsunami hazard analysis and found that the new maximum tsunami height is approximately 19.9 to 22.9 feet MLLW (17.6 to 20.6 NGVD29) (SCE 2011). The study utilized the State of California Tsunami Inundation Maps (2009) with a slight modification to account for the maps' exclusion of a seawall that fronts a portion of the SONGS facility. As mentioned above, the State's modeling effort is considered conservative in that its objective was to provide a "credible upper bound" of tsunami inundation at any location along the coastline for the main purpose of emergency preparedness and not necessarily for design criteria.

7.2.5.3 Ports of Long Beach and Los Angeles Tsunami Study (2007)

The Ports of Long Beach and Los Angeles (POLA/POLB) completed a study in 2007 of potential exposure to tsunamis to identify concerns. The study utilized a Boussinesq wave model to simulate tsunami wave propagation into the POLA/POLB. Seven potential tsunami sources were modeled, including four local tectonic scenarios, two local submarine landslide scenarios, and one distant tsunami source scenario. Model results suggest the worst-case scenario tsunami for the region would be from a landslide in the vicinity of Palos Verdes. This tsunami could result in water levels in excess of 23 feet and current speeds up to 8.2 feet /second in some locations. Regarding frequency of occurrence, the study found that based on the seismicity, geodetics, and geology of the region, a large locally-generated tsunami from either local seismic activity or a local submarine landslide would likely not occur more than once every 10,000 years.

The study provides information on Southern California's exposure to more distant tsunami sources. Exposure of Southern California to tsunamis is based on ocean bathymetry and coastal reflections. The 2007 study was presented at the Prevention First Conference in 2010 (organized by the State Lands Commission). The study shows specific information about historical tsunamis in Southern California. Historical tsunamis in Southern California are from earthquakes in Chile and Alaska. These events were some of the largest earthquakes on record and, therefore, represent probable worst-case events.

San Diego experienced a water level rise of approximately 1 foot above the tidal elevation upon arrival of a tsunami in 2010 from Chile. Water displacement occurred initially upward by 1 foot (in the positive direction) followed by a drop of approximately the same magnitude, for a total water surface deviation of approximately 2 feet. The POLA/POLB experienced water surface displacement of nearly 2.7 feet total. Neither Port reported damage from the event. Due to the relatively low magnitude of effect from far field tsunamis and the low probability of more local tsunamis, the Ports have chosen not to take design-related actions to provide protection from this type of event.

Analysis of wave height distribution of historical tsunamis is also presented. The region may have experienced the maximum far-field tsunamis, from Chile with a magnitude of 9.5 in 1960 and from Alaska with a magnitude of 9.2 in 1964. Thus, the water surface elevation changes experienced from these events may be the maximum to be expected. The data indicate that the POLA/POLB area may experience waves up to 2 to 3 feet on a decadal basis from these events.

7.2.5.4 Observed Tsunami Water Levels in San Diego

Major earthquakes have occurred at all of the far-field San Diego tsunami source locations over the last century. Observed versus predicted water levels from the La Jolla station were evaluated to determine the actual tsunami wave height in San Diego from these events. However, only hourly data were available from the NOAA website before the year 2000. The resolution of the hourly data is not sufficient to resolve tsunami wave heights. Therefore, tsunami wave heights available from the Ports of Long Angeles and Long Beach are provided in Table 7-2 for reference. The results of this analysis are summarized in Table 7-2. As shown, these events resulted in only nominal wave heights in La Jolla (less than 3 feet in height). Detailed plots of each of these events are provided in Attachment A.

Table 7-2. Observed Tsunami's in San Diego and the Region

Source	Date	Earthquake Magnitude	Tsunami Wave Height at La Jolla* (ft)	Tsunami Wave Height at Long Beach/Los Angeles Harbor (ft)
Japan	March 11, 2011	9.0	1.5	2.5
Chile	February 27, 2010	8.8	1.25	2.7
Alaska	March 28, 1964	9.2	Hourly Data Not Adequate to Resolve the Tsunami	3.3
Chile	May 23, 1960	9.5	Hourly Data Not Adequate to Resolve the Tsunami	5.5
Aleutian Trench	April 1, 1946	7.4	Hourly Data Not Adequate to Resolve the Tsunami	3.2

** As observed at the La Jolla tide gage. Wave height is defined from wave crest to trough.*

7.2.5.5 Recommended Tsunami Water Levels and Actions

The San Diego region may conservatively experience tsunami waves at the coast from 3 feet to 4 feet in height on a decadal basis in the judgment of the tsunami study engineer (Dykstra 2012) for the work described above. However, observed data from La

Jolla show wave heights of approximately 3 feet or less, as shown in Attachment A to this report.

Incident tsunamis at coastal streams and lagoons will likely experience wave diffraction and wave height reduction when propagating upstream, and could be significantly lower by the time they reach rail and highway bridge locations that are set back from the ocean. Consequently, design guidance for bridge elevation should not need to account for ocean water level increases associated with tsunamis. Tsunamis will, however, likely set up a temporarily high current under the bridges due to a hydraulic head created during their approach to shore, their arrival, and their passing. Therefore, design guidelines should assume periods of higher than average currents under bridges during a tsunami for a period lasting potentially for several hours. Other design considerations should include:

- Lateral support for the bridge for impact loading;
- Pile foundations for bridges; and
- Armoring of embankments to protect them from erosion during a tsunami.

Caltrans prepared design guidelines for tsunami hazards in 2010 (Caltrans 2010) for bridges that will apply to the I-5 corridor. The guidelines specifically apply to new bridges below an elevation of 40 feet mean sea level (analogous to NGVD 29) and those within one-half mile from the ocean. The guidelines outline a process for designing bridges affected by the guidance, and provide example measures to be considered in designs including:

- Continuity of the superstructure;
- Deep foundations less vulnerable to the effects of scour;
- Monolithic connections; and
- Tie downs or open vents to alleviate buoyancy effects.

7.2.6 Local Sea Level Rise

The increase in global MSL discussed in prior chapters of this study is another component of ocean water level. Unlike the other components of ocean water level that operate over relatively small time scales (hours, days, weeks, months, and years), global mean SLR operates over relatively large time scales (decades to centuries). For consistency with the relevant agency guidance, temporal reference points of years 2030, 2050, and 2100 were selected for the inclusion of global mean SLR as a component of ocean water level. Consequently, the projected increase in global mean sea level at the year 2100, as adjusted for local land movement, should be added to the ocean water levels to provide an estimate for the corresponding ocean water level in the

year 2100. This approach has the inherent assumption that the other components of ocean water level discussed herein will not change considerably between the present and 2100. If those components change in the future (e.g., increases in ocean water levels due to more frequent and/or more intense storms or ENSO events), the estimates for those changes should be added to ocean water level values to develop updated estimates.

7.3 Extreme Ocean Water Level

An extreme ocean water level of 5.36 feet, NGVD 29 is the highest ocean water level recorded along the San Diego coast as represented at the La Jolla (Scripps Pier) tide gage station since 1924. Extreme ocean water level can also be based on a statistical analysis of the measured water level data for a range of return periods. NOAA conducted such an analysis for the data collected at Scripps Pier and the results are presented in Table 7-3. As shown in the table, the 100-year extreme ocean water level estimated for Scripps Pier is 5.32 feet, NGVD 29. It is recommended that the values shown in Table 7-3 be used as the extreme ocean water level along the San Diego County coast. These data apply to structures adjacent to the coast subject to coastal storm waves.

Table 7-3. Extreme Statistical Ocean Water Levels (Life of the Gage, NOAA 2012b)

Event	Elevation (ft MLLW)	Elevation (ft, NGVD 29)	Elevation (ft, MSL)	Elevation (ft, NAVD 88)
100-Year	7.61	5.32	4.88	7.43
75-Year	7.58	5.29	4.85	7.40
50-Year	7.56	5.27	4.83	7.38
10-Year	7.39	5.10	4.66	7.21
2-Year	7.12	4.83	4.39	6.94
1-Year	6.70	4.41	3.97	6.52

Note: Tidal datums refer to the 1983-2001 tidal epoch.

Freeboards of all bridges under high water conditions are shown in Tables 7-4 through 7-11. The far right hand columns show freeboard relative to the highest SLR projection during the common dry season condition (with no storm flooding) that occurs approximately 99% of the time in any given year. All I-5 bridges have sufficient freeboard to clear that condition. All but one existing rail bridge are high enough to clear this condition and all proposed rail bridges are at an elevation to clear this condition. Dry season conditions in the future during SLR should not pose a major problem for this infrastructure as railroad and I-5 bridges will not suffer tidal inundation with a forecast 2100 SLR. Only combined storm flow conditions and future sea level rise causes high water and eliminates freeboard on certain bridges a portion of the time during storm runoff events.

7.4 Fluvial Water Level

Fluvial analyses were done or will be done to satisfy FEMA requirements and the bridge owner's design criteria to protect property and infrastructure from the effects of flooding. The results were used (for completed work) or will be used for design and protection of the bridge structures. Flood flows pass through each lagoon and under each bridge along the coast within the North Coast Corridor. The water levels associated with these flood flows are an important consideration in the design of the NCC Program bridge structures. The water levels corresponding to extreme storm events are typically used for the design of bridge structures with the 50-year, 75-year, and 100-year storm events selected as the design events. Typically, the water levels within the river are determined through the use of fluvial hydraulic models that route river flows from upstream to downstream. The model is set up to represent the river channel topography, bathymetry, planform, and roughness. A design flow rate or hydrograph of a design storm event (e.g., 100-year) is entered as input at the upstream boundary of the model and a base elevation (e.g., MHHW at the ocean) is established at the downstream boundary. The model is then used to estimate the fluvial water levels and velocities within the river attributed to routing of the design storm event through the river system to the downstream boundary (e.g., ocean).

Numerical fluvial hydraulic studies have been completed at North County coastal lagoons for various entities. However, the results are often not directly comparable due to the following reasons:

- Different hydraulic models were used including both 1D and 2D models;
- Different downstream control elevations were used;
- Some studies were performed with steady-state models, while others were performed with unsteady-state models even though, in some cases, the same model was used (i.e., the same model can be run in a steady state or unsteady state mode);
- Some models (e.g., FLUVIAL-12) simulated sedimentation and scour within and along the river bed (an erodible bed model) while others did not;
- Certain efforts addressed existing bridge conditions while others addressed proposed bridge conditions; and
- Certain efforts assumed existing lagoon conditions while others assumed proposed lagoon conditions (e.g., existing lagoon vs. restored lagoon).

All models applied to these efforts are credible, but many were applied for different objectives, and are useful for different, specific applications.

7.4.1 Numerical Model Selection

Estimates of the fluvial water levels during the 50-year, 75-year, and 100-year storm flow events need to be developed for the purpose of informing bridge design with appropriate numerical model and boundary conditions. An unsteady-state model (e.g. TU-FLOW, RMA, ADH, HEC-RAS) is more realistic and allows for a time varying storm flow (e.g., storm flow hydrograph) at the upstream boundary and a time varying ocean water level (e.g., tidal series) at the downstream boundary. A steady state model requires static conditions at both of these boundaries (e.g., constant, peak flow at the upstream boundary and fixed ocean water level at the downstream boundary, such as MHHW). As such, an unsteady-state model provides a more realistic, but less conservative result, while a steady state model provides a less realistic but more conservative result. A 2-dimensional model is preferred for lagoons, with complicated planform area (multiple channels, storage ponds, etc.), which cannot be represented with simple cross-sections, and a 1-dimensional model is preferred for rivers with more linear planform. Rivers can be modeled using both 1-D and 2-D models depending on their planform.

Erodible bed models can be used to predict scour and generally will yield lower water levels than fixed bed models. Fixed-bed models are more conservative in water level predictions and can be appropriate for flood mapping hazard analysis. They are also less costly and time-consuming to perform than erodible bed models.

7.4.2 Downstream Boundary Condition

Selection of the ocean water level condition to be used for the fluvial hydraulic modeling is an important consideration in the development of design guidance. A highly conservative approach would be to utilize the value presented in the FEMA coastal floodplain maps while a lower, yet still conservative, approach would be to utilize the highest ocean water level ever recorded at the nearest tide gage station. A somewhat liberal approach would be to use mean sea level on the basis that a given storm is equally likely to occur at any time. However, many storms occur over timeframes on the order of hours to days so it is likely that the storm would occur throughout a “tidal day;” hence, it is reasonable to use a value that is more conservative. Consequently, it is recommended that fluvial modeling be conducted with a design sea level value of MHHW if the model is steady state. The simultaneous occurrence of the peak of a 100-year fluvial flood and MHHW provides a condition that is somewhat yet not overly conservative. To analyze scour, the model needs to consider the timing of the occurrence of the peak flood and the lower low tide to identify peak flood flow velocities.

Modeling should consider use of either steady or unsteady state models for fluvial analyses. Unsteady state models are more realistic and accurate in their predictions, but less conservative then steady state models. Steady state models are appropriate for floodplain hazard mapping (similar to fixed bed models), but unsteady state models are

more appropriate for design of structures to balance needs of the design (structure elevation versus cost). Unsteady state models should use the average tidal series varying from MLLW to MHHW (or spring tidal series of Spring MLLW to Spring MHHW) by superimposing the peak of the design storm over the high tidal elevation for flooding and over the low tidal elevation for scour analyses.

7.4.3 Water Levels at Bridge Crossings

Numerical fluvial hydraulic studies have been completed at North County coastal lagoons for various purposes and entities. A summary of the results of these studies for existing and proposed NCC railroad bridges are presented in Table 7-4 through Table 7-7. The studies indicate that both 50-year and 100-year flood elevations at these rivers vary widely for the 100-year event. The downstream control levels (ocean water levels) used to conduct these analyses were not consistent so this needs to be taken into account when considering these values. New modeling studies for the purpose of bridge design with the appropriate numerical model and boundary conditions need to be performed if standardized results are to be compared.

The freeboards between the water levels and the rail bridges are also shown in the tables. LOSSAN design guidelines can be considered based on three sets of criteria. One is the design guidance from the American Railway Engineering and Maintenance-of-Way Association (AREMA) (2009), another is from Metrolink (Steffensmeier 2013), and a third is from the Union Pacific Railroad/Burlington Northern Santa Fe (UPRR/BNSF). Criteria from Metrolink and the UPRR/BNSF are essentially the same. AREMA guidelines indicate the following:

- The water level associated with the 100-year flood (Q_{100}) needs to be below the top of the rail subgrade, which is generally 2 feet below the top of rail per AREMA Section 4.8; and
- The water level associated with the 50-year flood (Q_{50}) needs to be 2 feet below the soffit of the bridge (low chord, or bottom of steel).

The Metrolink and UPRR/BNSF criteria for freeboard are:

- The energy grade line associated with the Q_{100} flood needs to be below the top of the rail subgrade; and
- The water surface elevation associated with the Q_{50} flood needs to be below the soffit of the bridge (low chord, or bottom of steel).

Table 7-4. Water Levels at Existing Rail Bridges for 50 - Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information				Water Surface Elevation With 50-Year Fluvial Flood												Water Surface Elevation During Dry Weather Extreme Tide	
				Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR
Bridge MP #	Floodplain/Bridge	Year Built Year Improved	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
225.4	San Luis Rey River	1916 1925	17.3	10.2	7.1	HEC-RAS Unsteady	-2.3 to 3.0	HNTB 2012	11.7	5.6	13.2	4.1	14.8	2.5	15.7	1.6	10.9	6.47
227.6	Loma Alta Creek	2008	18.6	10.6	8.0	HEC-RAS	3.04	Rick Eng. 2010	12.1	6.5	13.6	5.0	15.2	3.4	16.1	2.5	10.9	7.72
228.6	Buena Vista Lagoon	1984	11.1	9.1	2.0	KAI Unsteady	+5.6 (weir crest)	EIC 2004	10.6	0.5	12.1	(1.0)	13.7	(2.6)	14.6	(3.5)	10.9	0.24
230.6	Agua Hedionda Lagoon West	2007	17.3	No Data Available - 50-Year Event Either Not Modeled or Results Not Provided													10.9	6.47
230.6	Aqua Hedionda Lagoon East	2011	19.3														10.9	8.41
234.8	Batiquitos Lagoon	Unknown 1980 (Deck)	17.3	7.3	10.0	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	8.8	8.5	10.3	7.0	11.9	5.4	12.8	4.5	10.9	6.44
240.4	San Elijo Lagoon	1942	16.9	15.7	1.2	HEC-RAS Steady	MHHW	HDR 2009a	17.2	(0.3)	18.7	(1.8)	20.2	(3.3)	21.2	(4.3)	10.9	6.03
243.0	San Dieguito River North Abutment	1916	19.9	No Data Available - 50-Year Event Either Not Modeled or Results Not Provided													10.9	9.03
243.2	San Dieguito River South Abutment	1916	9.5														10.9	(1.37)
246.1	Los Penasquitos Lagoon	1911	13.4	11.7	1.8	HEC-RAS Steady	3.0	HDR 2009b	13.2	0.3	14.7	(1.3)	16.2	(2.8)	17.2	(3.8)	10.9	2.54
246.9	Los Penasquitos Lagoon	1936	13.9	12.4	1.6	HEC-RAS Steady	3.0	HDR 2009c	13.9	0.1	15.4	(1.5)	16.9	(3.0)	17.9	(4.0)	10.9	3.04
247.1	Los Penasquitos Lagoon	1932	13.7	12.5	1.2	HEC-RAS Steady	3.0	HDR 2009d	14.0	(0.3)	15.5	(1.8)	17.0	(3.3)	18.0	(4.3)	10.9	2.84
247.7	Los Penasquitos Creek Sorrento Valley	1940	15.2	15.1	0.1	HEC-RAS Steady	Normal Depth	HDR 2011	16.6	(1.4)	18.1	(2.9)	19.6	(4.4)	20.6	(5.4)	10.9	4.34
248.7	Los Penasquitos Creek Merge	1942	25.9	Bridge Outside Zone of Tidal Influence													10.9	15.04
249.9	Carroll Creek	Under Construction in 2013	64.02	Bridge Outside Zone of Tidal Influence													10.9	53.16

WSE – Refers to Water Surface Elevation
Note: For Bridges 246.1 through 247.7, depending on the alternative selected to bypass the Del Mar Bluffs, the new bridges may be abandoned when the Del Mar Tunnel is constructed. These bridges are already permitted and are included in this table only for completeness.
Blank cells indicate that no data are available.

Table 7-5: Water Levels at Proposed Rail Bridges for 50 - Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information				Water Surface Elevation With 50-Year Fluvial Flood													Water Surface Elevation During Dry Weather Extreme Tide	
				Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing		With 66-Inch SLR	
Bridge MP #	Floodplain/Bridge	Year Built Year Improved	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
225.4	San Luis Rey River		16.9	Scenarios Not Modeled													10.9	6.0
227.6	Loma Alta Creek	No New Bridge Proposed																
228.6	Buena Vista Lagoon	In Planning (Soffit Elev. Assumed)	11.1	Scenarios Not Modeled													10.9	0.2
230.6	Agua Hedionda Lagoon West	Bridge Completed in 2007 and No New Bridge Proposed																
230.6	Aqua Hedionda Lagoon East	Bridge Completed in 2011 and No New Bridge Proposed																
234.8	Batiquitos Lagoon	In Planning (Soffit Elev. Assumed)	17.3	7.6	9.7	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	9.1	8.2	10.6	6.7	12.2	5.1	13.1	4.2	10.9	6.4
240.4	San Elijo Lagoon Existing Inlet		14.4	15.0	(0.6)	HEC-RAS Steady	MHHW	HDR 2009a	16.5	(2.1)	18.0	(3.6)	19.6	(5.2)	20.5	(6.1)	10.9	3.6
	San Elijo Lagoon New Inlet		15.0	No 50-Year Flood Modeling Done for this Scenario													10.9	4.1
243.0	San Dieguito River North Abutment		20.5	No Data Available - 50-Year Event Either Not Modeled or Data Not Provided													10.9	9.6
243.2	San Dieguito River South Abutment		17.0														10.9	6.1
246.1	Los Penasquitos Lagoon		11.8	11.5	0.3	HEC-RAS Steady	3.0	HDR 2009b	13.0	(1.2)	14.5	(2.7)	16.0	(4.3)	17.0	(5.2)	10.9	0.9
246.9	Los Penasquitos Lagoon		12.3	12.8	(0.4)	HEC-RAS Steady	3.0	HDR 2009c	14.3	(2.0)	15.8	(3.5)	17.3	(5.0)	18.3	(6.0)	10.9	1.5
247.1	Los Penasquitos Lagoon		12.1	12.5	(0.4)	HEC-RAS Steady	3.0	HDR 2009d	14.0	(1.9)	15.5	(3.4)	17.1	(5.0)	18.0	(5.9)	10.9	1.3
247.7	Los Penasquitos Creek Sorrento Valley		15.3	14.9	0.4	HEC-RAS Steady	Normal Depth	HDR 2011	16.4	(1.1)	17.9	(2.6)	19.5	(4.2)	20.4	(5.1)	10.9	4.4
248.7	Los Penasquitos Creek Merge		30.7	Bridge Outside Zone of Tidal Influence													10.9	19.9
249.9	Carroll Creek	Under Construction in 2013	64.02	Bridge Outside Zone of Tidal Influence													10.9	53.2

Legend

WSE= Water Surface Elevation

SLR = Sea Level Rise

PWP Phase 1 bridges

Bridges already permitted

Note: For Bridges 246.1 through 247.7, depending on the alternative selected to bypass the Del Mar Bluffs, the new bridges may be abandoned when the Del Mar Tunnel is constructed. These bridges are already permitted and are included in this table only for completeness.
Blank cells indicate that no data are available.

Table 7-6: Water Levels at Existing Rail Bridges for 100 - Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information				Water Surface Elevation With 100-Year Fluvial Flood												Water Surface Elevation During Dry Weather Extreme	
				Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR
Bridge MP #	Floodplain/Bridge	Year Built Year Improved	Top of Subgrade	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
225.4	San Luis Rey River	1916 1925	24.0	14.3	9.7	HEC-RAS Unsteady	-2.3 to 3.0	HNTB 2012	15.8	8.2	17.3	6.7	18.9	5.1	19.8	4.2	10.9	13.1
227.6	Loma Alta Creek	2008	22.0	11.6	10.4	HEC-RAS	3.0	Rick Eng. 2010	13.1	8.9	14.6	7.4	16.2	5.8	17.1	4.9	10.9	11.1
228.6	Buena Vista Lagoon	1984	11.1	11.0	0.1	KAI Unsteady	+5.6 (weir crest)	EIC 2004 and 2012	12.5	(1.4)	14.0	(2.9)	15.6	(4.5)	16.5	(5.4)	10.9	0.2
230.6	Agua Hedionda Lagoon West	2007	26.0	6.1	20.0	HEC-RAS	Normal Depth	Hanson-Wilson, 2004	7.6	18.5	9.1	17.0	10.6	15.4	11.6	14.5	10.9	15.1
230.6	Aqua Hedionda Lagoon East	2011	26.4	6.0	20.4	HEC-RAS	Normal Depth	Hanson-Wilson, 2004	7.5	18.9	9.0	17.4	10.6	15.8	11.5	14.9	10.9	15.5
234.8	Batiquitos Lagoon	??? 1980 (Deck)	19.6	7.9	11.7	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	9.4	10.2	10.9	8.7	12.5	7.1	13.4	6.2	10.9	8.7
240.4	San Elijo Lagoon	1942	17.0	16.4	0.6	HEC-RAS Steady	MHHW	HDR 2009a	17.9	(0.9)	19.4	(2.4)	21.0	(4.0)	21.9	(4.9)	10.9	6.1
				Not Modeled		HEC-RAS Unsteady	MHHW	HDR 2011a[1]	Modeling Not Done for These Scenarios				16.7	0.3	Not Modeled		10.9	6.1
243.0	San Dieguito River North Abutment	1916	20.0	13.9	6.1	HEC-RAS Unsteady	MHHW	EIC 2009	15.4	4.6	16.9	3.1	18.5	1.5	19.4	0.6	10.9	9.1
243.2	San Dieguito River South Abutment	1916	10.0	13.9	(3.9)	HEC-RAS Unsteady	MHHW	EIC 2009	15.4	(5.4)	16.9	(6.9)	18.5	(8.5)	19.4	(9.4)	10.9	(0.9)
246.1	Los Penasquitos Lagoon	1911	13.7	13.9	(0.2)	HEC-RAS Unsteady	-2.3 to 3.0	HDR 2009b	15.4	(1.7)	16.9	(3.2)	18.5	(4.8)	19.4	(5.7)	10.9	2.8
246.9	Los Penasquitos Lagoon	1936	14.1	14.1	0.0	HEC-RAS Unsteady	-2.3 to 3.0	HDR 2009c	15.6	(1.5)	17.1	(3.0)	18.7	(4.6)	19.6	(5.5)	10.9	3.2
247.1	Los Penasquitos Lagoon	1932	14.1	14.1	0.0	HEC-RAS Steady	3.0	HDR 2009d	15.6	(1.5)	17.1	(3.0)	18.7	(4.6)	19.6	(5.5)	10.9	3.2
247.7	Los Penasquitos Creek Sorrento Valley	1940	15.9	15.3	0.6	HEC-RAS Steady	3.0	HDR 2011	16.8	(0.9)	18.3	(2.4)	19.9	(4.0)	20.8	(4.9)	10.9	5.0
248.7	Los Penasquitos Creek Merge	1942	29.3	Bridge Outside Zone of Tidal Influence													10.9	18.4
249.9	Carroll Creek	Under Construction in 2013	64.02	Bridge Outside Zone of Tidal Influence													10.9	53.2

Legend

WSE= Water Surface Elevation

SLR = Sea Level Rise

Note

[1]HDR conducted modeling with HEC-RAS for the 55-inch SLR scenario and the WSE result was 16.7 ft, NGVD29, which is 4.3 ft less than the conservative approach result presented here.

Note: For Bridges 246.1 through 247.7, depending on the alternative selected to bypass the Del Mar Bluffs, the new bridges may be abandoned when the Del Mar Tunnel is constructed. These bridges are already permitted and are included in this table only for completeness.
Blank cells indicate that no data are available.

Table 7-7: Water Levels at Proposed Rail Bridges for 100-Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information				Water Surface Elevation With 100-Year Fluvial Flood													Water Surface Elevation During Dry Weather Extreme Tide	
				Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR	
Bridge MP #	Floodplain/Bridge	Year Built Year Improved	Top of Subgrade	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
225.4	San Luis Rey River		25.7	14.1	11.6	HEC-RAS Unsteady	-2.3 to 3.0	HNTB 2012	15.6	10.1	17.1	8.6	18.7	7.0	19.6	6.1	10.9	14.8
227.6	Loma Alta Creek	No New Bridge Proposed																
228.6	Buena Vista Lagoon	In Planning (Soffit Elev. Assumed)	11.1	12.7	(1.6)	HEC-RAS Unsteady	MHHW	EIC 2012	Scenario Not Modeled; Does Not Meet Design Criteria				14.1	(3.0)	Scenario Not Modeled; Does Not Meet Design Criteria		10.9	0.2
230.6	Agua Hedionda Lagoon West	Bridge Completed in 2007 and No New Bridge Proposed																
230.6	Aqua Hedionda Lagoon East	Bridge Completed in 2011 and No New Bridge Proposed																
234.8	Batiquitos Lagoon	In Planning (Soffit Elev. Assumed)	19.6	7.9	11.7	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	9.4	10.2	10.9	8.7	12.5	7.1	13.4	6.2	10.9	8.7
240.4	San Elijo Lagoon Existing Inlet		18.1	15.7	2.4	HEC-RAS Steady	MHHW	HDR 2009a, 2011a	17.2	0.9	18.7	(0.6)	20.3	(2.2)	21.2	(3.1)	10.9	7.2
	San Elijo Lagoon New Inlet		15.5	7.6 Modeled	7.9	RMA Unsteady	FEMA Base Flood Coastal WSE	M&N 2012	9.1 Additive (not modeled, just added)	6.4	10.6 Additive (not modeled, just added)	4.9	10.0 Modeled	5.5	13.1 Additive (not modeled, just added)	2.4	10.9	4.7
243.0	San Dieguito River North Abutment		24.7	13.4	11.3	HEC-RAS Unsteady	-2.3 to 3.0	EIC 2009	14.9	9.8	16.4	8.3	18.0	6.7	18.9	5.8	10.9	13.8
243.2	San Dieguito River South Abutment		21.2	15.4	5.8	HEC-RAS Unsteady	-2.3 to 3.0	EIC 2009	16.9	4.3	18.4	2.8	20.0	1.2	20.9	0.3	10.9	10.3
246.1	Los Penasquitos Lagoon		13.8	13.7	0.0	HEC-RAS Steady	3.0	HDR 2009b	15.2	(1.5)	16.7	(3.0)	18.3	(4.5)	19.2	(5.5)	10.9	2.9
246.9	Los Penasquitos Lagoon		14.3	14.9	(0.5)	HEC-RAS Steady	3.0	HDR 2009c	16.4	(2.0)	17.9	(3.5)	19.5	(5.1)	20.4	(6.0)	10.9	3.5
247.1	Los Penasquitos Lagoon		14.2	14.6	(0.5)	HEC-RAS Steady	3.0	HDR 2009d	16.1	(2.0)	17.6	(3.5)	19.2	(5.1)	20.1	(6.0)	10.9	3.3
247.7	Los Penasquitos Creek Sorrento Valley		16.0	15.0	1.0	HEC-RAS Steady	Normal Depth	HDR 2011	16.5	(0.5)	18.0	(2.0)	19.6	(3.6)	20.5	(4.5)	10.9	5.1
248.7	Los Penasquitos Creek Merge		33.3	Bridge Outside Zone of Tidal Influence													10.9	22.4
249.9	Carroll Creek		64.02	Bridge Outside Zone of Tidal Influence													10.9	53.2

Legend

WSE= Water Surface Elevation

SLR = Sea Level Rise

Two different model types applied to the same site yielding different results.

PWP Phase 1 bridges

Bridges already permitted

Note: For Bridges 246.1 through 247.7, depending on the alternative selected to bypass the Del Mar Bluffs, the new bridges may be abandoned when the Del Mar Tunnel is constructed. These bridges are already permitted and are included in this table only for completeness.

Blank cells indicate that no data are available

Several bridges appear to potentially have issues with freeboard not meeting design guidelines as shown in Table 7-8 below during infrequent storm runoff fluvial events in conjunction with a high SLR scenario. SANDAG may wish to consider updating modeling of areas done with steady state models to provide consistent results with more recent unsteady state modeling efforts. If problems with freeboards still exist with unsteady state modeling, then adaptation strategies could be needed, bridge design elevations might have to be raised, or risk tolerance considerations may lead to a conclusion that a lower water surface elevation is the most reasonable to use for a design parameter due to environmental and economic impacts if a higher design elevation were pursued. Finally, even if adequate freeboard per design guidelines may not exist under the 100-year flood, it may be possible to keep the bridge open to travel if tracks are not flooded. Due to the infrequent occurrence of this event, actions of this type (i.e., operational actions) may form part of the SLR adaptive management strategy. Bridges in the vicinity of Los Penasquitos Lagoon (at mileposts 246.1, 246.9, 247.1, and 247.7) and Carroll Creek (milepost 249.9) are outside of the PWP Program area because they are already permitted; however, the information is presented in this report for completeness. In addition, the Los Penasquitos Lagoon bridges may eventually be replaced as part of a large-scale Del Mar project that might include a tunnel.

Table 7-8. Rail Bridges With High Water Exceeding Design Guideline During Fluvial Event

Scenario	Existing Rail Bridges	Proposed Rail Bridges
50-Year Flood, 1.5' SLR Bridges With the 50-Year Flood Above the Bridge Soffit	San Elijo Lagoon (240.4) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)
50-Year Flood, 3' SLR Bridges With the 50-Year Flood Above the Bridge Soffit	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)
50-Year Flood, 5.5' SLR Bridges With the 50-Year Flood Above the Bridge Soffit	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)

Scenario	Existing Rail Bridges	Proposed Rail Bridges
100-Year Flood, 1.5' SLR Bridges With the 100-Year Flood Above the Ballast Subgrade	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) San Dieguito Lagoon (243.2) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)
100-Year Flood, 3' SLR Bridges With the 100-Year Flood Above the Ballast Subgrade	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) San Dieguito Lagoon (243.2) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)
100-Year Flood, 5.5' SLR Bridges With the 100-Year Flood Above the Ballast Subgrade	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) San Dieguito River (243.2) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)	Buena Vista Lagoon (228.6) San Elijo Lagoon (240.4) Los Penasquitos Lagoon (246.1) Los Penasquitos Lagoon (246.9) Los Penasquitos Lagoon (247.1) Los Penasquitos Lagoon (Sorrento Valley) (247.7)

Note: All modeling was done using steady-state models except for Buena Vista and San Dieguito Lagoons.

Bridges on I-5 were also assessed for high water levels. Several bridges also appear to potentially have issues with freeboard in relation to design guidelines. Table 7-9 through Table 7-11 summarize 50-year and 100-year water levels and freeboard for the existing and proposed I-5 bridges. Values include a mix of results using both steady state and unsteady state numerical models. If standardized results are to be compared between bridges and any information gaps filled, then new modeling studies conducted with consistent numerical models and boundary conditions would need to be performed. This work could be conducted as part of future bridge design efforts.

In unsteady state model simulations, the maximum flood elevations at a specific bridge crossing are sensitive to the timing of the flood hydrograph and peak high tide. The worst-case flood elevation occurs when the peak of the flood wave coincides with the peak tide at a specific bridge location. For Batiquitos and San Elijo Lagoons, the 50- and 100-year storm water levels were simulated such that the peak of the 50- and 100-year hydrograph coincides with the peak tide elevation at a specific crossing to model the highest water level of flooding at each bridge crossing. For the proposed I-5 bridge

over the Buena Vista Lagoon, the 100-year flood water level was also simulated such that the peak of the 100-year hydrograph coincides with the peak high tide elevation at the I-5 bridge crossing.

The freeboards between the water levels and I-5 bridges are also shown in the tables. Caltrans design guidelines for freeboard indicate the following:

- The hydraulic design of bridges is that they should pass a 2 percent probability flood (50-year). Freeboard, vertical clearance between the lowest structural member and the water surface elevation of the design flood, sufficient to accommodate the effects of bedload and debris should be provided; and
- Alternatively, a waterway area sufficient to pass the 1 percent probability flood (100-year) without freeboard should be provided. Two feet of freeboard is often assumed for preliminary bridge designs. The effects of bedload and debris should be considered in the design of the bridge waterway.

Table 7-9: Water Levels at Existing I-5 Bridges for 50-Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information			Water Surface Elevation With 50-Year Fluvial Flood												Water Surface Elevation During Dry Weather Extreme Tide	
			Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR
Floodplain/Bridge	Year Built Year Widened	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
San Luis Rey River - Bridge Outside of Tidal Influence Due to Bridge Height	1971	54.5	Bridge Outside Zone of Tidal Influence													10.9	43.7
Loma Alta Creek - Bridge Outside of Tidal Influence Due to Bridge Height	1953 1971	50.0	Bridge Outside Zone of Tidal Influence													10.9	39.1
Buena Vista Lagoon	1953 1970	21.1	14.1	7.0	KAI Unsteady	+5.6 (weir crest)	Caltrans 2012	15.6	5.5	17.1	4.0	18.7	2.4	19.6	1.5	10.9	10.2
Agua Hedionda Lagoon	1953 1970	20.5	No Data													10.9	9.6
Batiquitos Lagoon	1965	16.1	7.6	8.5	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	9.1	7.0	10.6	5.5	12.1	4.0	13.1	3.0	10.9	5.2
San Elijo Lagoon	1963	31.5	9.6	21.9	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012b	11.1	20.4	12.6	18.9	14.2	17.3	15.1	16.4	10.9	20.6
San Dieguito River	1964 1994	21.6	No Data													10.9	10.7
Carmel Valley Creek Bike Bridge	No Data	21.7	No Data													10.9	10.8
Carmel Valley Creek Widening		23.3	No Data													10.9	12.5
Los Penasquitos Creek NB 805/5 Connector		53.0	Bridge Outside Zone of Tidal Influence													10.9	42.1
Los Penasquitos Creek I-805		40.5	Bridge Outside Zone of Tidal Influence													10.9	29.6
Los Penasquitos Creek	1970	73.0	Bridge Outside Zone of Tidal Influence													10.9	62.1

Legend

WSE= Water Surface Elevation

SLR = Sea Level Rise

Blank cells indicate that no data are available.

Table 7-10: Water Levels at Existing I-5 Bridges for 100 - Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information			Water Surface Elevation With 100-Year Fluvial Flood													Water Surface Elevation During Dry Weather Extreme Tide	
			Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR	
Floodplain/Bridge	Year Built Year Widened	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
San Luis Rey River	1971	54.5	Bridge Outside Zone of Tidal Influence													10.9	43.7
Loma Alta Creek	1953 1971	50.0	Bridge Outside Zone of Tidal Influence													10.9	39.1
Buena Vista Lagoon	1953 1970	21.1	17.2	3.9	KAI Unsteady	+5.6 (weir crest)	Caltrans 2012	18.7	2.4	20.2	0.9	21.8	(0.7)	22.7	(1.6)	10.9	10.2
Agua Hedionda Lagoon	1953 1970	20.5	12.3	8.2	HEC-RAS Steady	Normal Depth	Hanson-Wilson 2004 Caltrans 2012	13.8	6.7	15.3	5.2	16.9	3.6	17.8	2.7	10.9	9.6
Batiquitos Lagoon	1965	16.1	8.9	7.2	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	10.4	5.7	11.9	4.2	13.5	2.6	14.4	1.7	10.9	5.2
San Elijo Lagoon	1963	31.5	18.3	13.2	HEC-RAS Steady		HDR 2011a	19.8	11.7	21.3	10.2	22.8	8.7	23.8	7.7	10.9	20.6
			11.3	20.2	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012b[1]	12.8	18.7	14.3	17.2	15.9	15.6	16.8	14.7	10.9	20.6
San Dieguito River	1964 1994	21.6	20.9	0.7			Caltrans 2012	22.4	(0.8)	23.9	(2.3)	25.4	(3.9)	26.4	(4.8)	10.9	10.7
Carmel Valley Creek Bike Bridge		21.7	18.5	3.2			Caltrans 2012	20.0	1.7	21.5	0.2	23.0	(1.4)	24.0	(2.3)	10.9	10.8
Carmel Valley Creek Widening		23.3	23.9	(0.5)			Caltrans 2012	25.4	(2.0)	26.9	(3.5)	28.5	(5.1)	29.4	(6.0)	10.9	12.5
Los Penasquitos Creek NB 805/5 Connector		53.0	Bridge Outside Zone of Tidal Influence													10.9	42.1
Los Penasquitos Creek I-805		40.5	Bridge Outside Zone of Tidal Influence													10.9	29.6
Los Penasquitos Creek	1970	73.0	Bridge Outside Zone of Tidal Influence													10.9	62.1

Legend	Note
WSE= Water Surface Elevation	[1]M&N conducted modeling with RMA-2 for the 55-inch SLR scenario and the WSE result was 11.8 ft, NGVD29, which is 4.1 ft less than the conservative approach result presented here.
SLR = Sea Level Rise	

Blank cells indicate that no data are available.

Table 7-11: Water Levels at Proposed I-5 Bridges for 100-Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information			Water Surface Elevation With 100-Year Fluvial Flood										Water Surface Elevation During Dry Weather Extreme Tide	
			Under Existing Sea Level			With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR	
Floodplain/Bridge	Year Built Year Widened	Soffit Elevation	WSE	Freeboard	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
San Luis Rey River	Not Applicable (N/A)	54.5	Bridge Outside Zone of Tidal Influence											10.9	43.6
Loma Alta Creek	N/A	50.0	Bridge Outside Zone of Tidal Influence											10.9	39.1
Buena Vista Lagoon	N/A	16.5	14.1	2.4	Caltrans 2012	15.6	0.9	17.1	(0.6)	18.7	(2.1)	19.6	(3.1)	10.9	5.7
Agua Hedionda Lagoon	N/A	17.0	14.2	2.8	Caltrans 2012	15.7	1.3	17.2	(0.2)	18.8	(1.8)	19.7	(2.7)	10.9	6.2
Batiquitos Lagoon	N/A	15.3	10.3	5.0	Caltrans 2012	11.8	3.5	13.3	2.0	14.9	0.4	15.8	(0.5)	10.9	4.5
San Elijo Lagoon	N/A	29.9	18.3	11.6	Caltrans 2012	19.8	10.1	21.3	8.6	22.8	7.1	23.8	6.1	10.9	19.0
			12.1	17.8	Caltrans 2012	13.6	16.3	15.1	14.8	16.6	13.3	17.6	12.3	10.9	19.0
San Dieguito River	N/A	18.9	15.4	3.5	Caltrans 2012	16.9	2.0	18.4	0.5	20.0	(1.1)	20.9	(2.0)	10.9	8.0
Carmel Valley Creek Bike Bridge	N/A	20.6	16.4	4.2	Caltrans 2012	17.9	2.7	19.4	1.2	21.0	(0.4)	21.9	(1.3)	10.9	9.8
Carmel Valley Creek Widening	N/A	20.2	20.4	(0.2)	Caltrans 2012	21.9	(1.7)	23.4	(3.2)	25.0	(4.8)	25.9	(5.7)	10.9	9.3
Los Penasquitos Creek NB 805/5 Connector	N/A		Bridge Outside Zone of Tidal Influence											10.9	No Soffit Data
Los Penasquitos Creek I-805	N/A		Bridge Outside Zone of Tidal Influence											10.9	No Soffit Data
Los Penasquitos Creek	N/A	64.2	Bridge Outside Zone of Tidal Influence											10.9	53.3

Legend

WSE= Water Surface Elevation

SLR = Sea Level Rise

PWP Phase 1 bridges

Blank cells indicate that no data are available.

Caltrans may also wish to consider updating modeling of areas done with steady state models to provide consistent results with more recent unsteady state modeling efforts. If problems with freeboards still exist with unsteady state modeling, then adaptation strategies could be needed or bridge design elevations might have to increase, or risk tolerance considerations may lead to a conclusion that a lower water surface elevation is the most reasonable to use for a design parameter due to environmental and economic impacts if a higher design elevation were pursued. In addition, Caltrans could re-assess these individual bridges in the future when their replacement becomes necessary according to the NCC Program plan. A method is put forth subsequently in this study to consider more detailed analyses of every bridge to a greater degree. Finally, even if adequate freeboard per design guidelines may not exist under the 100-year flood, it may be possible to keep the bridge open to travel if lanes are not flooded. Due to the infrequent occurrence of this event, actions of this type (i.e., operational actions) may form part of the SLR adaptive management strategy.

Table 7-12: I-5 Bridges With High Water Reaching Bridge Soffit During Fluvial Event with SLR Scenarios

Scenario	Existing I-5 Bridges	Proposed I-5 Bridges
50-Year Flood, 1.5' SLR	None	No Data
50-Year Flood, 3' SLR	None	No Data
50-Year Flood, 5.5' SLR	None	No Data
100-Year Flood, 1.5' SLR	San Dieguito River Carmel Valley Creek (Widening)	Carmel Valley Creek (Widening)
100-Year Flood, 3' SLR	San Dieguito River Carmel Valley Creek (Widening)	Buena Vista Lagoon Agua Hedionda Lagoon Carmel Valley Creek (Widening)
100-Year Flood, 5.5' SLR	Buena Vista Lagoon San Dieguito River Carmel Valley Creek (Bike Bridge) Carmel Valley Creek (Widening)	Buena Vista Lagoon Agua Hedionda Lagoon Batiquitos Lagoon San Dieguito River Carmel Valley Creek (Bike Bridge) Carmel Valley Creek (Widening)

Table 7-13 and Table 7-14 summarize 50-year and 100-year water levels and freeboard for existing Highway 101 bridges from existing studies. Local agencies are responsible for addressing issues along Highway 101, so this study does not address adaptive management strategies for these structures.

Table 7-13: Water Levels at Existing HW101 Bridges for 50-Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Bridge Information			Water Surface Elevation With 50-Year Fluvial Flood														Water Surface Elevation During Dry Weather Extreme Tide	
			Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR	
Floodplain/Bridge	Year Built Year Widened	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
San Luis Rey River	2007	22.0	13.3	8.7	HEC-RAS Unsteady	-2.3 to 3.0	HNTB 2012	14.8	7.2	16.3	5.7	17.9	4.1	18.8	3.2	10.9	11.1
Loma Alta Creek	2004	10.4			HEC-RAS Steady		Rick Eng. 2010									10.9	(0.5)
Buena Vista Lagoon	??? 1972	8.2	10.4	(2.2)	KAI Unsteady	+5.6 (weir crest)	EIC 2004	11.9	(3.7)	13.4	(5.2)	15.0	(6.8)	15.9	(7.7)	10.9	(2.7)
Agua Hedionda Lagoon	1985	12.0	No Data													10.9	1.2
Batiquitos Lagoon (East)	1996	9.2	7.1	2.2	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	8.6	0.6	10.1	(0.9)	11.6	(2.4)	12.6	(3.4)	10.9	(1.7)
Batiquitos Lagoon (West)	1996	9.2	7.0	2.2	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	8.5	0.7	10.0	(0.8)	11.6	(2.4)	12.5	(3.3)	10.9	(1.7)
San Elijo Lagoon	1934 1960	10.0	7.1	2.9	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012b	8.6	1.4	10.1	(0.1)	11.7	(1.7)	12.6	(2.6)	10.9	(0.9)
San Dieguito River	1931 1952	6.1	No Data													10.9	(4.8)
Los Penasquitos Lagoon Inlet	2005	No Data	No Data													10.9	No Soffit Data

Legend
WSE= Water Surface Elevation
SLR = Sea Level Rise

Blank cells indicate that no data are available.

Table 7-14: Water Levels at Existing HW101 Bridges for 100-Year Fluvial Storm Events (Units: feet; Datum: NGVD29)

Water Surface Elevation and Freeboard Under Existing Sea Level And With Sea Level Rise For Existing Highway 101 Bridges (Units: feet; Vertical Datum: NGVD29)

Bridge Information			Water Surface Elevation With 100-Year Fluvial Flood													Water Surface Elevation During Dry Weather Extreme Tide	
			Under Existing Sea Level					With 18-Inch SLR Added To Existing WSE		With 36-Inch SLR Added To Existing WSE		With 55-Inch SLR Added To Existing WSE		With 66-Inch SLR Added To Existing WSE		With 66-Inch SLR	
Floodplain/Bridge	Year Built Year Widened	Soffit Elevation	WSE	Freeboard	Method	Downstream Control Level	Sources	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard	WSE	Freeboard
San Luis Rey River	2007	22.0	17.3	4.7	HEC-RAS Unsteady	-2.3 to 3.0	HNTB 2012	18.8	3.2	20.3	1.7	21.9	0.1	22.8	(0.8)	10.9	11.1
Loma Alta Creek	2004	10.4	13.7	(3.3)	HEC-RAS Steady		Rick Eng. 2010	15.2	(4.8)	16.7	(6.3)	18.3	(7.9)	19.2	(8.8)	10.9	(0.5)
Buena Vista Lagoon	??? 1972	8.2	11.1	(2.9)	KAI Unsteady	+5.6 (weir crest)	EIC 2004	12.6	(4.4)	14.1	(5.9)	15.7	(7.5)	16.6	(8.4)	10.9	(2.7)
Agua Hedionda Lagoon	1985	12.0		No Data												10.9	1.2
Batiquitos Lagoon (East)	1996	9.2	7.1	2.1	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	8.6	0.6	10.1	(0.9)	11.7	(2.5)	12.6	(3.4)	10.9	(1.7)
Batiquitos Lagoon (West)	1996	9.2	7.1	2.1	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012a	8.6	0.6	10.1	(0.9)	11.7	(2.5)	12.6	(3.4)	10.9	(1.7)
San Elijo Lagoon	1934 1960	10.0	7.3	2.7	RMA-2 Unsteady	-1.4 to 7.0	M&N 2012b	8.8	1.2	10.3	(0.3)	11.9	(1.9)	12.8	(2.8)	10.9	(0.9)
San Dieguito River	1931 1952	6.1	12.9	(6.8)	HEC-RAS Unsteady	-2.3 to 3.0	EIC 2009	14.4	(8.3)	15.9	(9.8)	17.5	(11.4)	18.4	(12.3)	10.9	(4.8)
Los Penasquitos Lagoon Inlet	2005	No Data		No Data												10.9	No Soffit Data
Legend																	
WSE= Water Surface Elevation																	
SLR = Sea Level Rise																	

Blank cells indicate that no data are available.

7.5 Combined Water Levels

7.5.1 NCC Project Bridges

The water level(s) to be used for design of the NCC Program Phase 1 bridge structures (Interstate 5 and LOSSAN) should take into consideration all the information presented above, as summarized in Table 7-15, for each lagoon/river/creek. Different models and study methods were used for several lagoons, leading to different results. Although different models and study methods were utilized, the results are useful for understanding the magnitude of water surface elevations and needed design approaches.

Table 7-15. Design Parameters for NCC Program Bridges

Design Parameters	Values	Unit / Datum
100-year Extreme Ocean Water Level	5.3	feet / NGVD29
SLR Increase w/Adaptation in Year 2100	To be determined based on site-specific analyses	feet
SLR Increase w/o Adaptation in Year 2100	5.5	feet
Observed Maximum Tsunami Wave Height	1.5	feet
Fluvial Water Levels	Tables 7-4 Through 7-11	feet / NGVD29

To simplify the complexities of rectifying previous analyses, this report recommends using the water surface elevation results for the 50- and 100-year storm floods under existing sea level conditions calculated by Caltrans modelers and adding the SLR projections from the March 2013 CO-CAT guidance document to account for sea level rise between 2000 and 2030, 2050, and 2100.

For tsunamis, designs should consider shore protection and embankment protection to address other processes such as high flow velocities, deep pile designs to provide lateral support for impact during tsunami drainage, and possibly bolting of the bridge to the foundation to prevent uplift.

Based on the available information presented in Table 7-4 through Table 7-14, it can be seen that fluvial water levels during a 100-year storm represent the highest water level analyzed at the bridges. It is recommended that the bridges be designed for the fluvial water levels that occur during 50-year and 100-year storms under both existing sea levels (in Year 2013) and future design sea levels with SLR. This should be done through unsteady state hydraulic modeling of each river/creek/lagoon system for the 50- and 100-year floods occurring for both existing and future sea levels. Alternatively, if existing modeling results of floods are to be used, then the relevant SLR values (e.g., March 2013 CO-CAT) can be simply added to the flood water level, but this result will be more conservative than modeling results with an unsteady state model. It should be

noted that this approach is based on the assumption that the 50-year and 100-year storms in Year 2100 are identical to the 50-year and 100-year storms in Year 2013.

Due to their relatively low magnitude of influence on water levels in the San Diego region based on historic data (Attachment A), tsunamis should be excluded and treated as a separate event and not be combined with any other events (e.g., extreme ocean water level or extreme fluvial water level).

If model results show that water levels are so high that bridges cannot be designed to be high enough to provide sufficient freeboard, then adaptation strategies will be needed. Restrictions on bridge elevations would involve views, aesthetics, habitat, and possibly other considerations. Examples of adaptation measures for the railroad may include jacking up railroad bridges and correspondingly raising berms with the tracks. If the PDT decides to rely on adaptation strategies in the design of bridges, rather than elevating bridges to clear high water, then they could be designed to initially clear water levels as high as feasible, but possibly not to the 5.5 feet value of elevation increase called out in State guidance, particularly if environmental and economic impacts outweigh the benefit derived by designing to the full SLR projected increase. Additionally, the risk involved with temporarily closing the bridge to travel if the closure duration is only a few hours (less than 6) can be assessed relative to impacts and costs of elevating infrastructure above all highest combined water levels, and decisions made accordingly.

Integrating the high storm water level data into bridge design also results in bridge soffit elevations sufficient to provide the required clearance from high waters as a result of SLR. Table 7-3 shows a generic rail bridge profile relative to design water levels. Consideration of the various constituents that comprise high water levels is critical to selecting the appropriate elevation for a particular bridge location. Several ocean-related components (except design waves, wave set-up, and tsunamis) are not site-specific and can, therefore, be applied uniformly throughout the region. The flood-related component is site-specific and requires analyses to quantify its contribution to water levels.

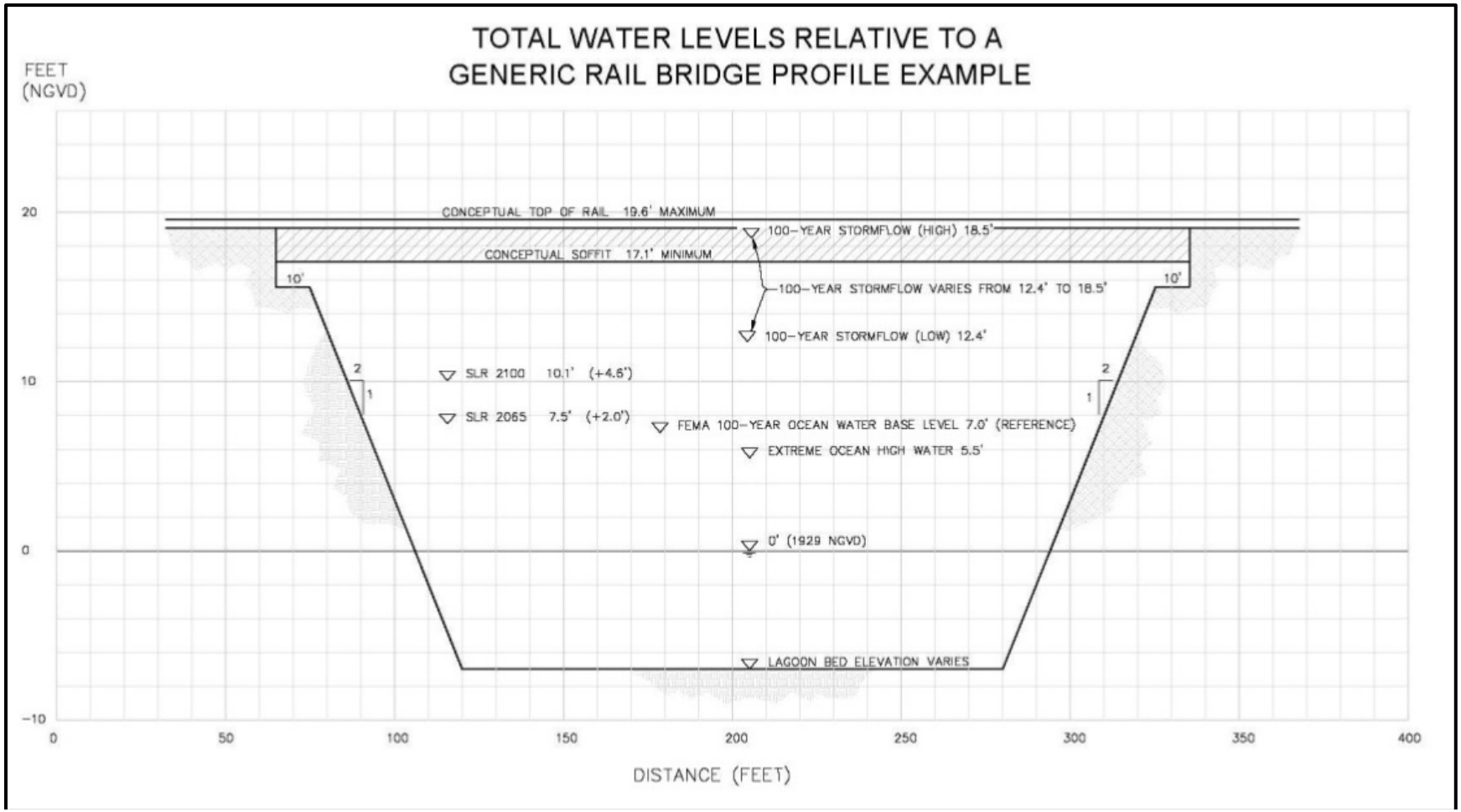


Figure 7-3: Generic Bridge Profile Relative to Various Water Level Parameters

7.5.2 Highway 101 Bridges

Highway 101 bridge designs are the responsibility of local agencies. The information presented below is potential guidance for consideration by the local agencies for design of these bridges. Most Highway 101 bridges cross lagoons over the tidal inlet and are adjacent to the coastline. These bridges are subject to both coastal and fluvial storm impacts. Therefore, the design for Highway 101 bridges should consider both fluvial and coastal processes. The bridge design should use the higher of design water levels determined in these two independent processes.

- The Fluvial Process: As discussed in Section 7.4 and shown on the right half of Figure 7-4, the design water level with SLR is determined by adding the SLR projection to the design ocean water level to form a new downstream boundary condition for the fluvial model runs. The final design water level under the 50- or 100-year storm event is determined through the use of fluvial hydraulic models that route river flows from upstream to downstream. Table 7-14 summarizes 50-year and 100-year water levels, respectively, and the freeboard under the 100-year storm for existing/current Highway 101 bridges from existing studies. Additional unsteady state numerical modeling studies for the purpose of bridge design may need to be performed to fill data gaps and to yield consistent results. If no new modeling occurs, then the user can use existing stormflow elevations and add the SLR contributions between 2000 and 2030, 2050, and 2100 (a conservative approach).

- The Coastal Process: As shown in the left half of Figure 7-4 the final design water level of the coastal process is the wave crest elevation of the design wave while considering the projected SLR and wave setup in the design water depth. The design wave height is most likely depth-limited and the water depth at each Highway 101 bridge crossing is different; therefore, the design wave height needs to be calculated for each Highway 101 bridge. The wave setup is elevated water alongshore from high waves, and depends on the design wave condition and beach slope. The wave setup also needs to be determined for each bridge.

The water level(s) to be used for design of the Highway 101 Project bridge structures should take into consideration all the information presented above, as summarized in Table 7-16 for each lagoon/river/creek.

Although the guidance provided above for tsunamis did not recommend using the tsunami water levels for design, the information is provided in the table below for completeness. Caltrans design guidance for tsunamis is provided in a previous section of this report (Caltrans 2010). Tsunamis should be considered as isolated events due to their relatively infrequent occurrence and potential severity. Although planning for their occurrence is warranted, the construction costs of infrastructure elevated for possible high tsunami water elevations is excessive. Therefore, designs should consider other

processes such as high flow velocities and lateral support for impact during tsunami drainage.

As none of these bridges are being permitted as part of the PWP, a site-specific risk assessment approach may be needed to address future conditions. This type of assessment is presented in Section 8 of this document, and entails determining site-specific needs for freeboard, and weighing the risk involved with temporary closure of the bridge to travel if the closure duration is only a few hours (less than 6). Assessing the impact of potential closures relative to environmental impacts and costs of elevating infrastructure above all highest combined water levels can help engineers determine appropriate “compromise” bridge elevations.

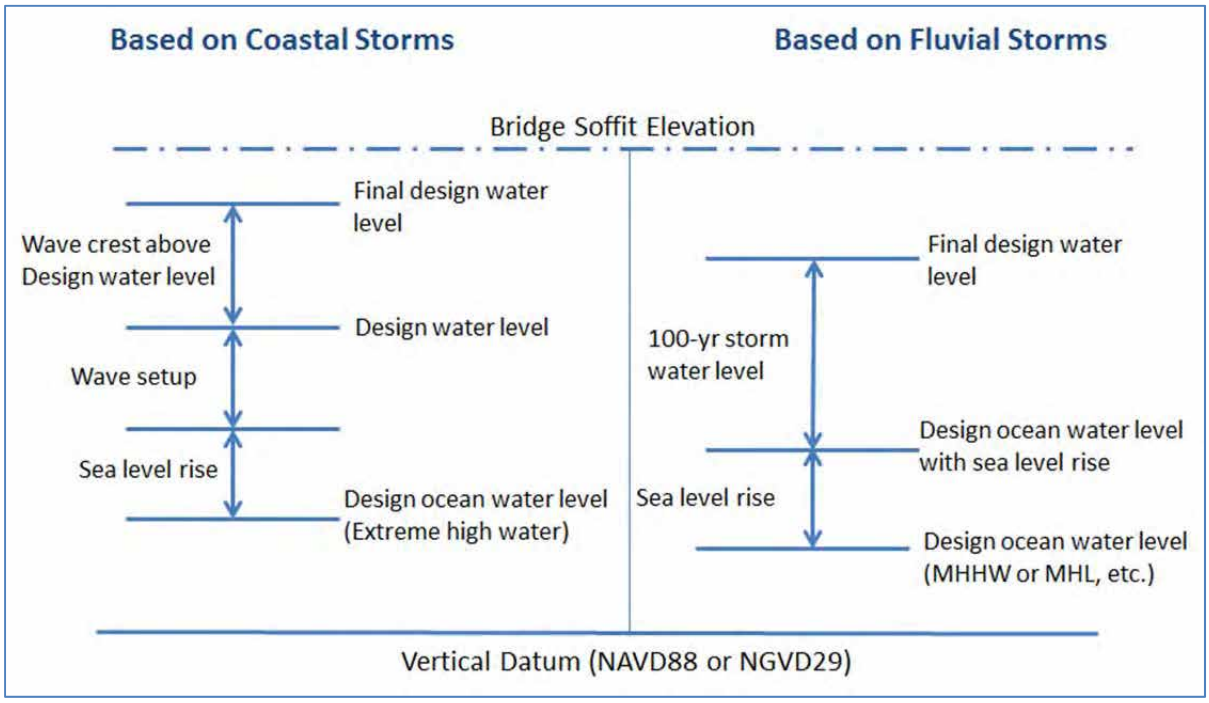


Figure 7-4: Generic Design Water Levels for HW101 Bridges

Table 7-16: Design Parameters for HW101 Project Bridges

Design Parameters	Values	Unit / Datum
100-year Extreme Ocean Water Level	5.3	feet / NGVD29
SLR Increase w/Adaptation in Year 2100	1.5	Feet
SLR Increase w/o Adaptation in Year 2100	3.0	Feet
Observed Maximum Tsunami Wave Height	1.5	feet
Fluvial Water Levels	Tables 7-13 and 7-14	feet / NGVD29
Design Wave Crest Elevation	TBD	feet / NGVD29
Wave Setup	TBD	Feet

7.5.3 Bridge Freeboards

Existing bridge freeboards were estimated using existing data for combined stormflows and existing and future sea level conditions. Table 7-4 through Table 7-14 show the freeboard for bridges on the railroad, I-5, and Highway 101 for water levels including up to 5.5 feet of sea level rise. The tables show that under these conditions, six existing I-5 bridges may have freeboard issues in 2100 without replacement, while eight existing railroad bridges and seven existing Highway 101 bridges may have freeboard to be addressed.

8.0 ADAPTIVE MANAGEMENT STRATEGY

Planning for SLR is a significant challenge due to the uncertainty of future SLR projections. Approaches can vary from "do nothing," to full preparation for the worst possible case, with multiple options between these extremes. Extreme approaches may or may not prove to be the most cost-effective solutions. The "do nothing" approach ignores the reality of SLR throughout the 20th Century along California and could prove problematic if even moderate SLR projections eventually occur. Conversely, full preparation for the worst possible scenario, which may never occur, may cause unnecessary environmental impacts to wetlands and exceed available project budgets. A more moderate and flexible approach can be taken that provides agencies with opportunities to proactively plan in a cost-effective manner.

The main recommended approaches are listed below:

1) when feasible, design for the full range of sea levels for the life of the bridge structure;

2) where not feasible due to some type of limitation (e.g., environmental, economic, social, etc.), design to the highest water level feasible and incorporate appropriate adaptive management strategies to enable raising infrastructure in the future; and

3) site-specific analysis of conditions to set bridge elevations appropriately, given local conditions, potential environmental impacts and costs of higher bridges, and the risks posed by closing bridges for several hours infrequently due to a short-term fluvial event.

During the alternatives analysis phase, the full range of projected SLR scenarios should be considered and, if possible, the NCC Program projects should be designed to accommodate the high SLR projection of 5.5 feet between 2000 and 2100. If conflicting design requirements, like adjacent overhead bridges or impacts to sensitive wetlands, pose a project constraint limiting the PDT from designing to this projection, then adaptation strategies need to be considered.

Where adaptation strategies need to be considered for bridges, pre-cast structures are preferred over cast in-place structures that cannot be raised in the future. More adaptive management approaches are provided below to implement changes incrementally in anticipation of progressively increasing water levels. The suggestions below could be implemented together to increase effectiveness.

8.1 Elevate New Infrastructure for Higher Sea Level Rise Scenarios

As aging infrastructure is gradually phased out and replaced with new construction, the new projects should be elevated to consider future higher water levels. Planning for high water levels is prudent during this period of high uncertainty. The appropriate high water

level will vary from site to site, but common high water level conditions exist between sites that can be used in the estimate. Determination of the relatively higher probability high water levels for a particular location will require work by the implementing agency.

Designs should consider modeling results based on the ocean elevation of spring MHHW with the addition of the SLR projection of 5.5 feet between 2000 and 2100 using the NRC study, for a combined downstream high water level for flood modeling.

For Interstate 5 and NCC bridges, the final component of the high water level is stormflow. As this component is unique to each site, it needs to be estimated using a suitable approach. This fluvial value ranges depending on the site considered and the modeling approach used. This study recommends considering modeling of the 100-year flood with an unsteady state model, combined with a high downstream water level specified above. However, a more simplified and conservative approach is to use existing stormflow elevation predictions by Caltrans and others, and adding 5.5 feet for SLR in 2100 on top of the model result. This resulting elevation could serve as the target bridge soffit elevation at a minimum. If FEMA requires additional freeboard, then that value should also be added.

Due to their proximity to the coastline, the final component of the high water level for Highway 101 bridges can be either the elevation of: 1) 100-year stormflow, or 2) the elevation of the design wave crest plus wave set-up under future sea level conditions. Therefore, the project design for Highway 101 bridges needs to consider both fluvial and coastal processes. The higher design water level determined in these two independent processes should be used as the final bridge design water level. To determine the design water level (wave crest plus wave set-up elevation) of the coastal process, the design wave height and wave setup need to be calculated for each bridge, and the appropriate SLR value (e.g., 5.5 feet at 2100) should be considered in the calculations of the design wave height and wave setup.

8.2 Install Adaptable Bridges and Approaches

Adaptive management of infrastructure is a likely requirement to address SLR. One possible adaptive management strategy is to design bridge structures and approaches now that can be raised in the future. Adapting the bridge structures and approaches to incrementally higher water levels over time may be less costly and less impacting to the environment than completely replacing bridges and raising approaches. A rough generic concept of an adaptable bridge structure is provided in Figure 8-1 and Figure 8-2. The concept can be applied to different bridge locations at the LOSSAN railway. Interstate 5 is sufficiently high to not need this approach.

The concept shows a pre-cast bridge with a larger foundation than would be required for existing conditions and bridge elevations. The larger foundation would serve to support the short-term bridge structure, as well as being capable of supporting a higher bridge structure if it needed to be elevated due to future SLR.

The LOSSAN corridor is planned for double-tracking. Figure 8-2 shows a single track bridge, assuming the second track of a double track bridge is carried by a parallel bridge; however, the concept would also work with a wider double track bridge. The bridge and approaches would be constructed at the appropriate elevation for design conditions, and then raised in the future to accommodate changed sea level conditions as needed. The sketch shows an increase in elevation of approximately five feet, similar to the high projection of SLR in year 2100 (5.5 feet).

General features that would help facilitate raising the bridge at a future time are listed below.

- Simple span precast box beams (this is a standard BNSF/UPRR bridge type for LOSSAN);
- Bearing pads under the box beams so that beams are not permanently connected to the substructure;
- Oversized end diaphragms of the box beams to allow space to jack the bridge;
- Substructure (piers, abutments, foundations) designed for the final raised condition;
- Pier walls (if not a pile structure) that readily accommodate an increase in elevation on the order of five feet;
- Pile caps that extend beyond the face of the pier wall to make it easy to jack the bridge utilizing the bridge's own foundations for bearing. No temporary piling would be required (driving temporary piles under the completed bridge would be difficult);
- Pile caps designed to support the future jacking loads; and
- Widened earthen berms at bridge approaches during initial construction to allow for raising of the berms in the future to support a higher rail line to meet the raised rail bridges. The design of widened berms needs to be done in consideration of site-specific conditions.

Jacking up of the rail bridge, as shown in Figure 8-2, would be done incrementally with shims inserted between a series of smaller-scale vertical motions of the bridge.

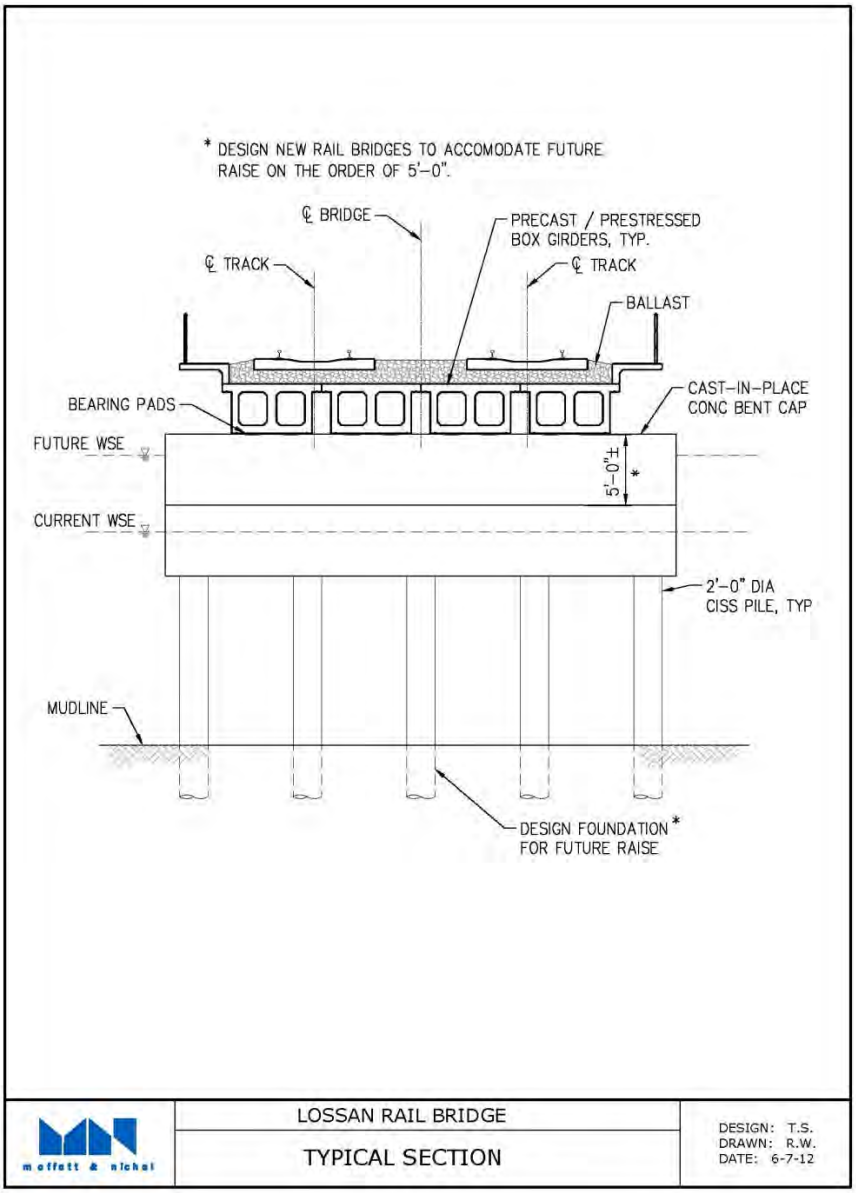


Figure 8-1: Typical Section of Adaptable Bridge Structure Concept

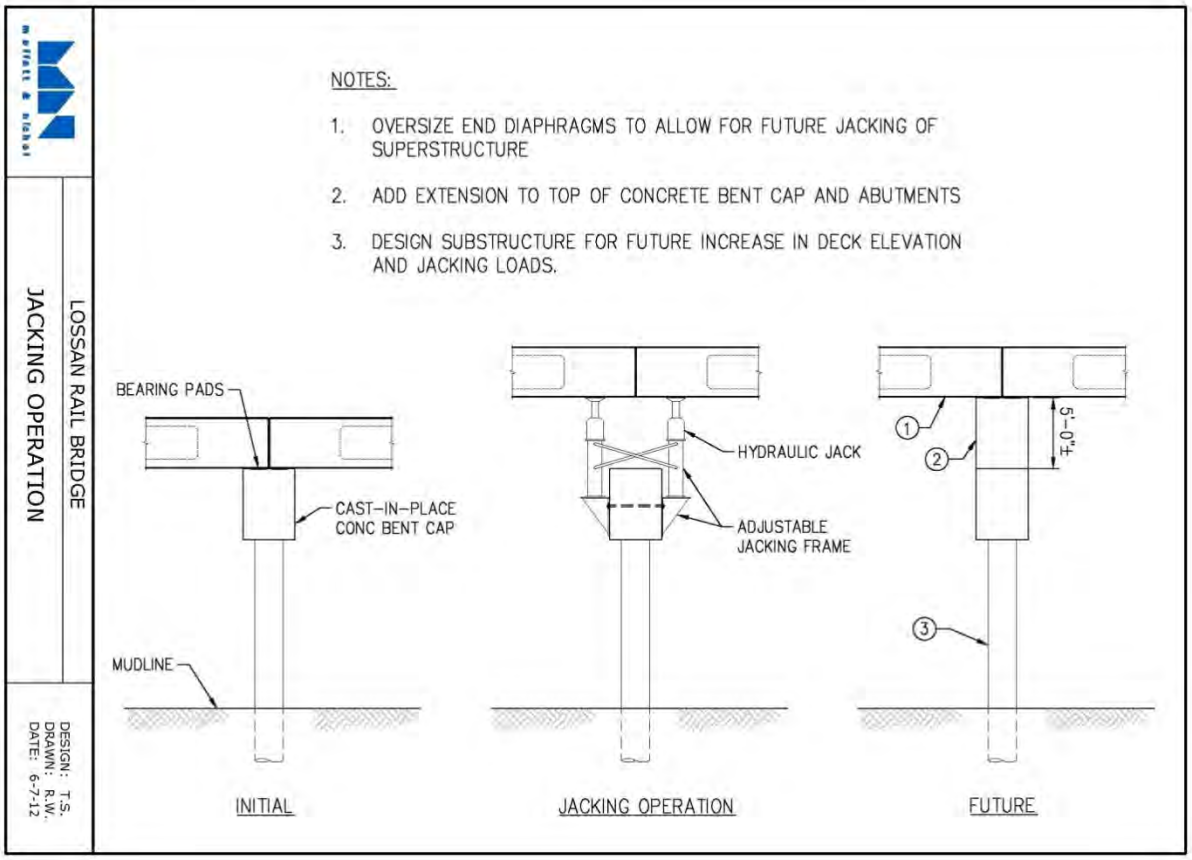


Figure 8-2: Pier Elevation of Adaptable Bridge Structure Concept

Utilizing a movable bridge concept in combination with elevating new infrastructure should provide the PDT with sufficient latitude to implement projects that can change over time more cost-effectively than total replacements. It allows for the structures to remain in use throughout their typical lifespans for maximum utility, and provides additional time for the PDT to gather new information about future high water levels for future projects.

8.3 Estimate Conservatively High Water Levels and Raise New Bridges on I-5

A conservative method to calculate high water levels under I-5 bridges would be to add 5.5 feet of SLR in 2100 to the predicted 100-yr design stormflow water elevations for existing sea level conditions. New bridges to be installed on I-5 could be elevated to sufficiently clear this condition, plus any required freeboard value of FEMA. Several bridges need to be addressed, and may require design features to consider the higher water levels.

8.4 Estimate New and Less Conservative High Water Levels and Raise New Bridges on I-5 – Conduct a Site-Specific

If I-5 bridge elevations would be too high from the previous approach and not considered feasible for appropriate reasons, then re-model the sites using the same methods as those employed in the bridge optimization studies by Caltrans (EIC 2011, M&N 2012a and 2012b). These new elevation values would then be the new design basis for bridge designs. New bridges to be installed on I-5 could be elevated in an effort to clear this condition, plus any required freeboard value of FEMA. New modeling with an unsteady state model would potentially yield lower water levels than the simple addition of SLR (e.g., 5.5 feet by 2100) to the 100-year flood elevation because of effects on lagoon geometry on hydraulics.

8.5 Conduct a Site-Specific Design Water Level Analysis Methodology Considering Sea Level Rise

A site-specific analysis approach is presented below that can be used to help guide future design efforts for bridges and embankments located within the NCC. The steps summarized below would be completed to establish the future mean sea level range to be considered in the development of design water levels for the bridge and embankment structures.

1. 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 this San Diego Region Coastal Sea Level Analysis Report to the current scientific estimates, or following the steps listed below:

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

    b. 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.

    c. 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.

    d. 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.

2. 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., MHHW or the 50-year ocean water level, or following design guidelines by Caltrans or Railroad agencies) which would either be the ocean or lagoon. This step should be repeated across the range of future regional/local, relative mean sea level change projections established under Step 1 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. It might even be helpful to analyze intermediate conditions if such information would be useful for conducting optimization analyses for such issues as potential environmental impacts and economic considerations (e.g., Step 4 below).

3. 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 should use the higher of design water levels determined in these two independent processes.

    a. The Fluvial Process: Use procedures described in Step 2 above to determine the design water level under the fluvial process.

    b. The Coastal Process: The high design water level should include contributions from astronomical tide, barometric pressure, wave crest elevation, wave set-up, El Nino Southern Oscillation (ENSO), and Pacific Decadal Oscillation (PDO). 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 should be repeated across the range of future regional/local, relative mean sea level change projections established under Step 1 above. This could 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. It might even be helpful to analyze intermediate conditions 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).

4. 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 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. For example, the duration of the freeboard exceedance of 0.5 feet at the proposed I-5 bridge over Batiquitos Lagoon shown in Table 7-11 is 2 hours (M&N 2012a). This approach may not be feasible due to the potential for permanent environmental impacts to wetlands caused by construction of a project to prevent a very short duration bridge closure. At this step, the PDT would have to decide 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 this risk assessment.

8.6 Periodically Update Design Guidelines for High Water Levels

These design guidelines for high water levels should be periodically updated to incorporate new information as it becomes available and as local conditions change. The guidelines should reconsider all high water level values so that changes to any components can be made if climate change occurs and sufficient data are available for analyses. Climate change may cause variations in each component, except for tsunamis. The frequency of updating design guidelines may need to be every 10 years initially, and then modified after that depending on existing trends of high water levels components, updated SLR predictions of the future, and probabilities (once available) associated with SLR predictions.

A combined approach of all of the above-mentioned adaptation strategies may serve the PDT's best and provide the greatest degree of flexibility. Additional adaptation strategies could be added to this list, as appropriate, when the design guidelines are updated. The broadest range of possible actions will give SANDAG and Caltrans the greatest suite of tools to apply to this complex challenge.

9.0 GENERAL CONCLUSIONS AND RECOMMENDATIONS

The NCC Program requires planning and engineering of coastal rail and highway infrastructure to potential future high water levels as a result of SLR. SLR represents a significant variable influencing the NCC Program highway and rail bridge design as well as the future success of the Program. Data are presented to show bridge soffit elevations for the railroad, I-5, and Highway 101 under high water scenarios combined with future sea level rise. Multiple bridges in each transportation corridor show concerns relative to elevation versus combined high water in the future.

The following recommendations are offered for consideration of SLR in the design of the individual components of the Program:

1. PDTs should consider the full range of SLR projections in the alternatives analysis phase for the design life of various projects under the Program (75 years plus 10 years, assuming proper maintenance). Based on the results of the alternatives analysis, the preliminary design either will: 1) accommodate the maximum SLR projection of 5.5 feet by 2100; 2) be designed with adaptation strategies and a SLR rate that is as high as can be accommodated; 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 i]on an infrequent basis. Adaptive strategies would allow bridge structures and approaches to be raised in the future should the projections occur.

2. Since the Program has the potential to receive funding from both state and federal sources, it is recommended that it be consistent with the most recent guidance from both of these sources.

    a. Consider a range of SLR projections at years 2050 and 2100 to satisfy State guidance from 2013. It is recommended that SLR projections from State guidelines be applied to fulfill this requirement. At 2050, the maximum SLR projection is 2 feet, and at 2100, the SLR projection is 5.5 feet.

    b. For the LOSSAN railroad and Interstate 5 bridges, the PDTs should consider SLR scenarios in combination with 50-year and 100-year storm flow events since these events are higher than extreme ocean high water events (e.g., high tides and storm surge). The 100-year stormflows from North County coastal streams result in water levels that increase significantly above the extreme tide. Existing stormflow modeling results should be used with a value of 5.5 feet for SLR at 2100 to provide conservative high water values for planning and design. Detailed modeling with an unsteady state model could be done to produce more accurate and consistent values if appropriate. Several coastal streams have been recently modeled to determine accurate and more comparable water

levels during high flood waters. Other Lagoon and/or Creeks would need to be modeled with an approach similar to the approach used in the bridge optimization studies conducted for Caltrans to determine their respective more comparable high flood water levels.

3. Highway 101 bridges warrant site-specific analyses to identify the condition of highest combined water levels, and design guidelines need to be developed. Due to their proximity to the coastline, both the 100-year fluvial storm flood level and extreme wave crest and set-up elevation need to be calculated for each bridge since they are unique to each bridge. The higher design water level determined in these two independent processes should be used as the final bridge design water level. For the fluvial storm flood levels, the same approach as indicated above should be applied. New site-specific modeling could be done with an unsteady state model to produce more accurate and consistent results with other studies. Several coastal streams have been recently modeled to determine accurate and comparable water levels during high flood waters. Other lagoons and creeks would need to be modeled with an approach similar to the approach used in the bridge optimization studies conducted for Caltrans as indicated above to determine their respective and comparable high flood water levels. All such work for Highway 101 bridges would be done by local agencies. Improving the hydraulic conveyance conditions of Highway 101 bridges would likely lower water levels upstream at rail and I-5 bridges during 100-year floods.

4. Tsunamis have the potential to impact the study area. Based on observed data, the study area could be impacted by a tsunami with a maximum wave height of approximately 3 feet every ten years. This wave will diminish in height as it propagates into a lagoon and would likely be below the elevation of the 100-year stormflow, so its height is not the primary design concern. The concern from a tsunami is the increase in flow velocities under bridges from high current velocities. Consequently, bridges should be designed with additional scour protection on both sides of the bridge abutments and be supported on piles/piers to resist erosion associated with the high water velocities that are expected to occur during tsunamis. A secondary concern may be lateral forces exerted by any impact, and potential uplift, requiring bolting to the foundation. Bridge design should consider additional lateral support and uplift to resist tsunamis, should they occur.

5. SANDAG should review upcoming updates to California and Federal guidance to continually update bridge design guidance. Upcoming guidance of interest includes the following:

    a. IPCC Fifth Assessment Report (due in 2013);

b. U.S. Climate Change Science Program synthesis and assessment studies; and

c. FEMA National Climate Change Study.

6. Since the magnitude of SLR is highly uncertain, an adaptive management approach should be adopted toward development of new infrastructure within the region. This approach may include:

   a. Design new structures to be high enough to accommodate the high SLR scenarios offered by the State and Federal guidance, if feasible. The latest higher limit projection by the NRC is 5.5 feet in 2100.

   b. For railroad bridges, if it is not feasible to accommodate high SLR projections, incorporate adaptable components into railroad bridge designs to enable jacking of the structures upward and raising approaches to accommodate future higher water level conditions, should they occur. Foundations can be designed to allow adaptation of the bridge and approaches in the future. Railroad bridge approaches should be designed to allow sufficient footprint for increasing the elevation and width of berms to match elevated bridges. Incorporation of this design feature may be less costly and less impacting than bridge replacement in the future, if elevated water levels occur. This approach enables the PDT to make maximum use of new bridges and provides additional time to consider water level data in the future.

   c. For I-5 bridges, strategies could be to evaluate bridges in more detail when their replacement date arrives and use an unsteady state model to better understand water levels. Also, bridges may be able to experience high water in contact with the structure for a short duration (during the peak of the flood in future SLR conditions) while remaining open to traffic if the travel lanes remain dry. Finally, certain less critical bridges (e.g., bicycle bridge in Los Penasquitos Lagoon) may need to be temporarily closed during such an event.

   d. For all bridges, conduct site-specific design water level analysis considering sea level rise to set the appropriate design water level at each bridge when needed. The analysis would focus on identifying the dominant process causing high water levels at each bridge, the resulting water surface elevation, and risk assessment of construction to accommodate the high water level projection. Risk assessment would consider level of protection versus costs, impacts, and duration of bridge closures, considering the probability of occurrence.

e. Update water level guidance documents as new sea level rise projections are made available from progressing science and/or guidance.

f. For bridges that may not meet water level guidelines, consider site-specific analyses for the Public Works Plan document such as:

   i. As indicated previously, updating modeling to generate more accurate and consistent results with unsteady state models, and consider results in designs.

   ii. Comparing water levels with criteria other than bridge soffits, such as the ballast for the railroad and travel lanes for I-5, and plan management actions according to engineering judgment; actions could include closing bridges for the time period (as mentioned above) when water levels exceed elevations of rail ballast or I-5 travel lanes, respectively, and reopen the bridges when water levels drop below these thresholds.

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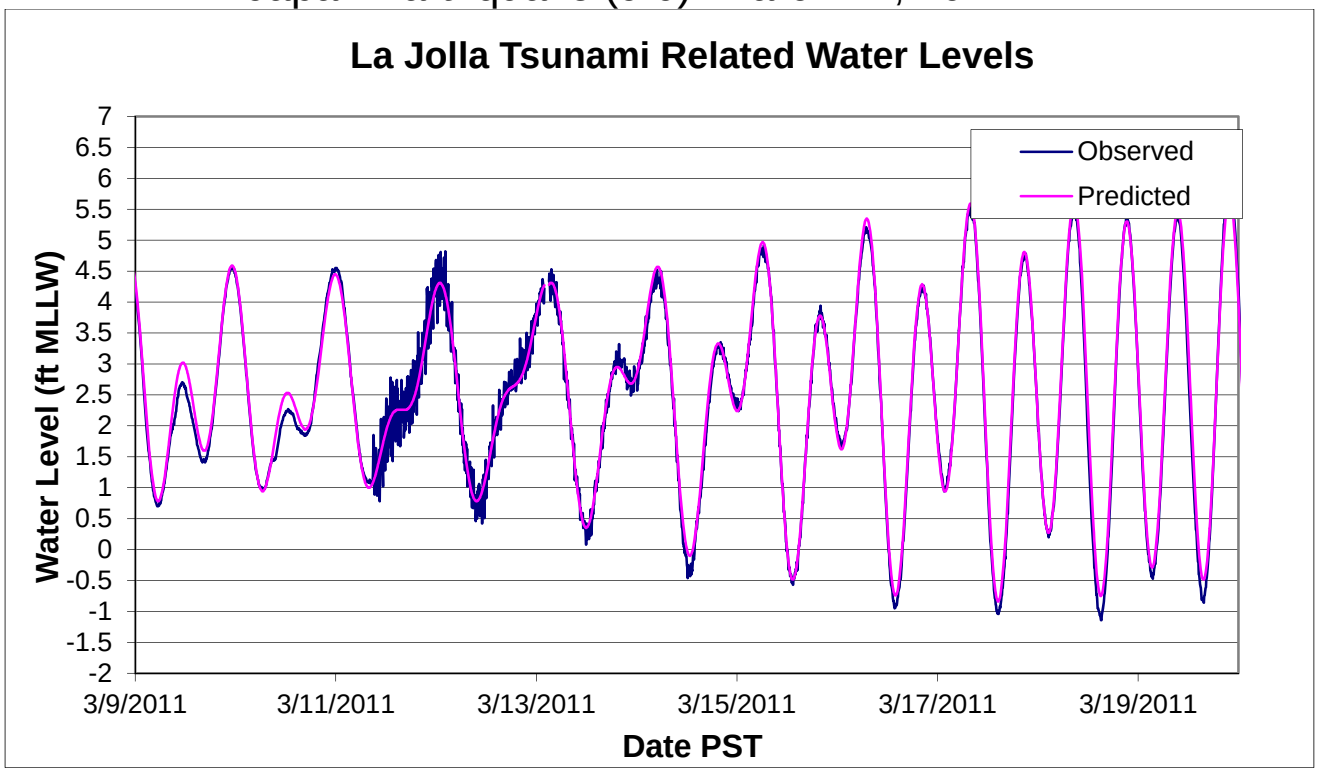
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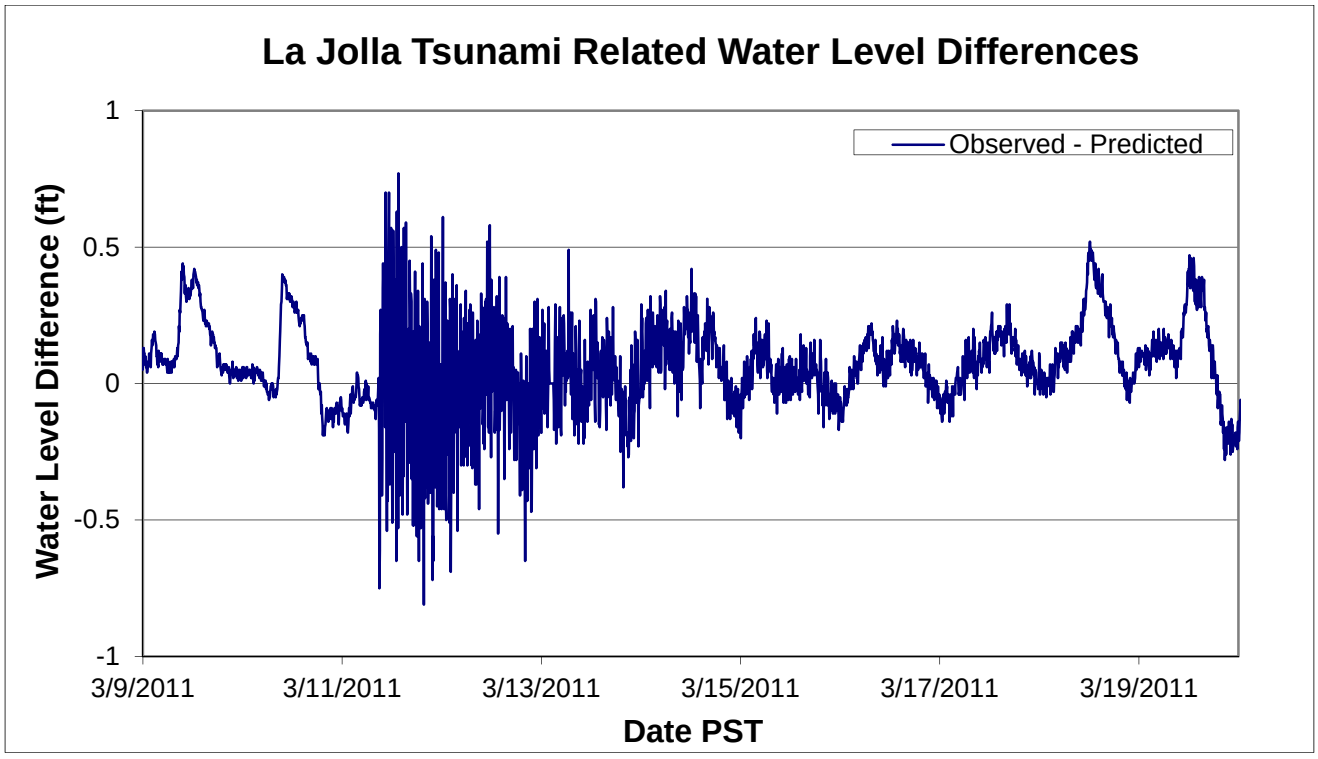
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ATTACHMENT A

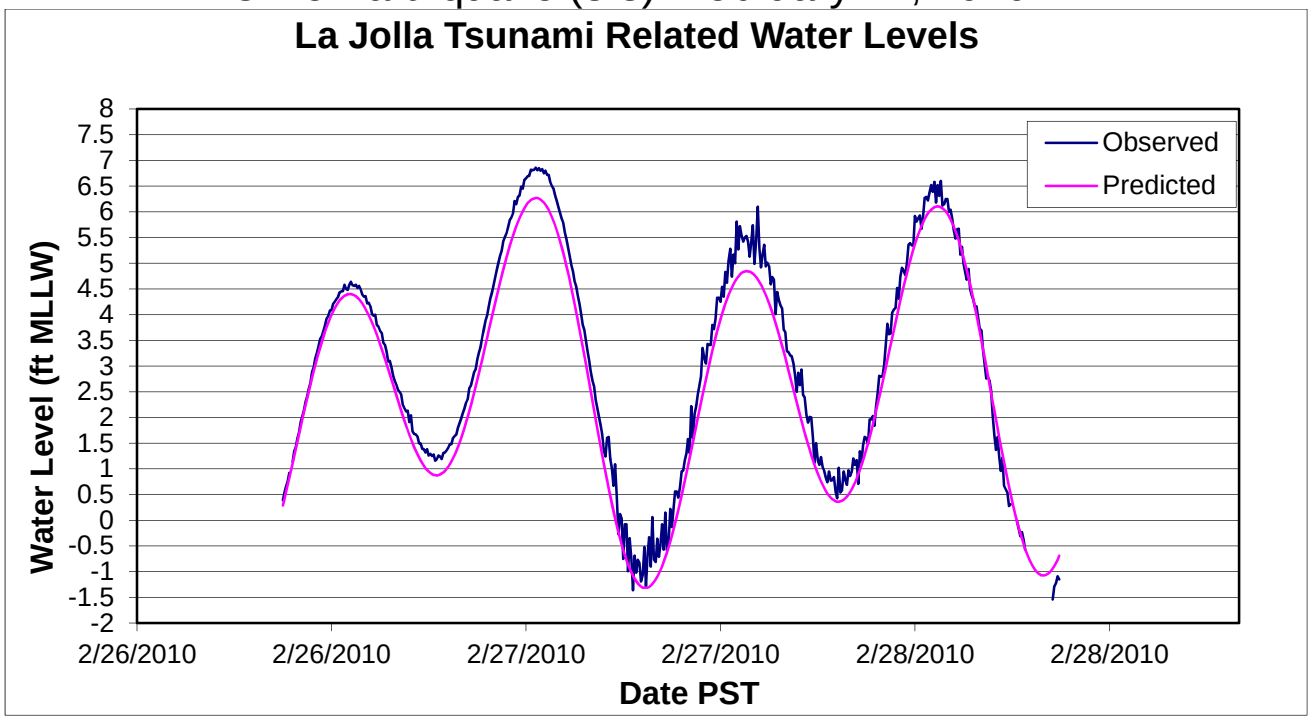
Historical Tsunami Events Observed in Southern California

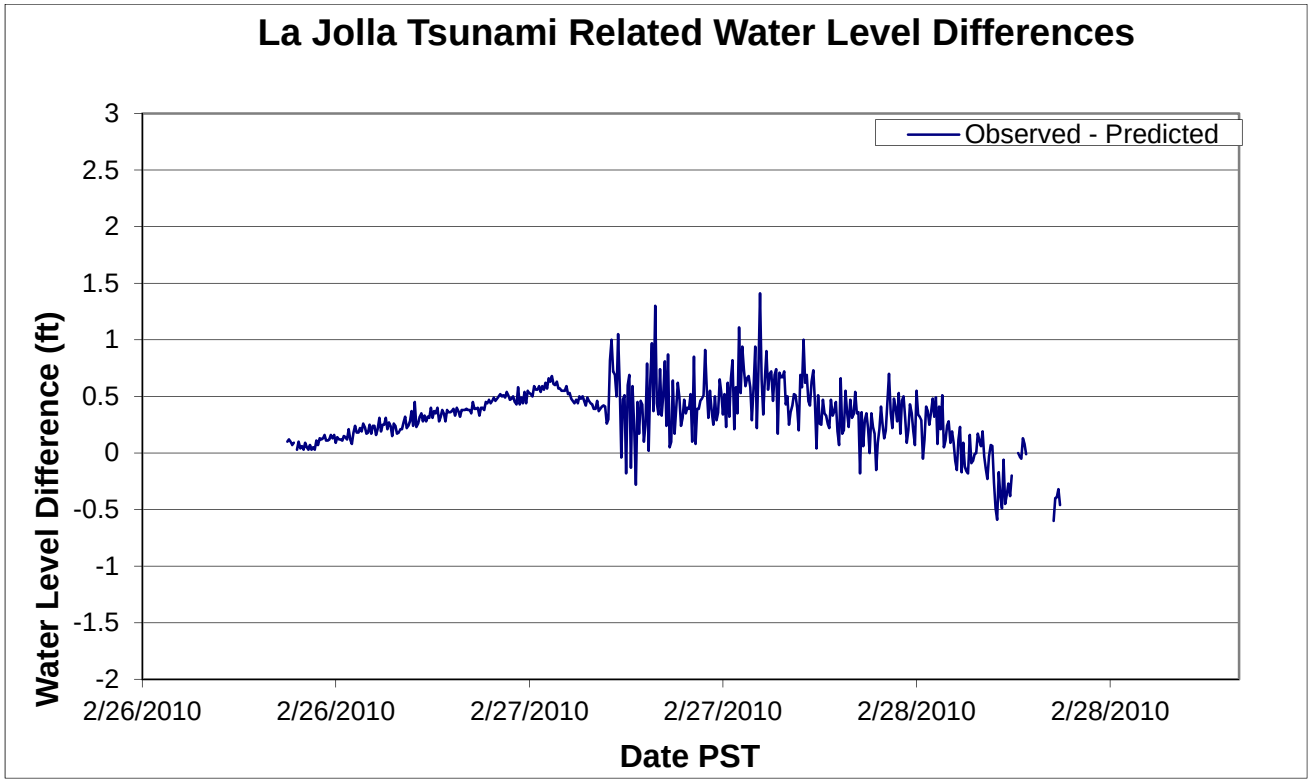
Japan Earthquake (9.0): March 11, 2012



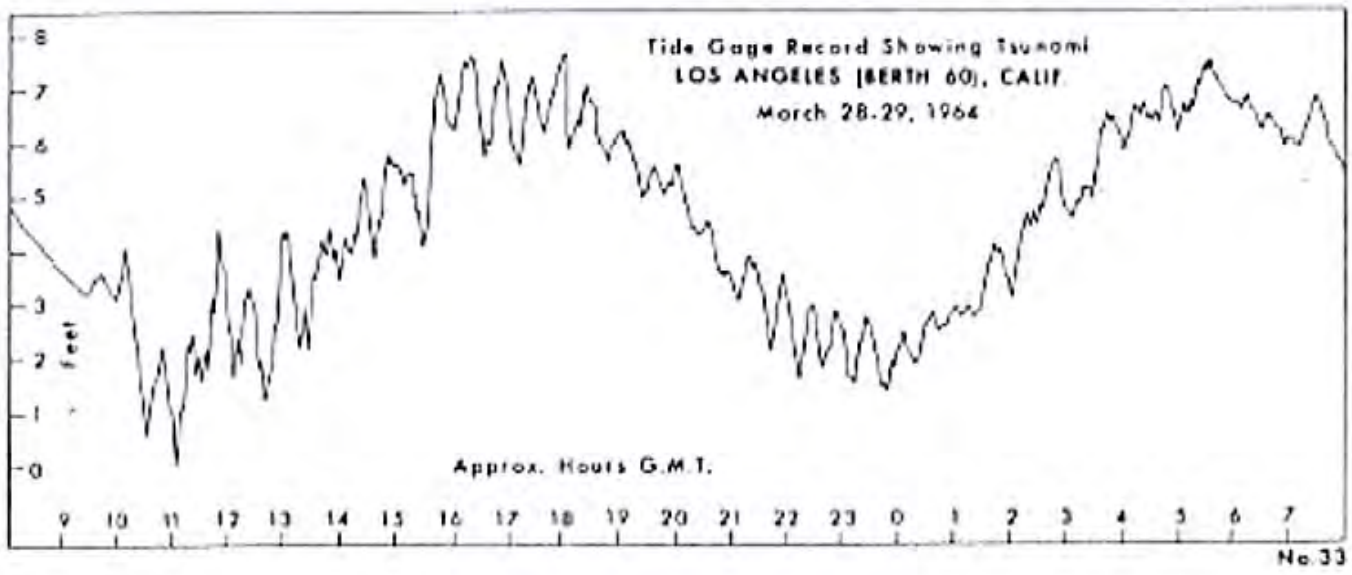


Chile Earthquake (8.8): February 27, 2010

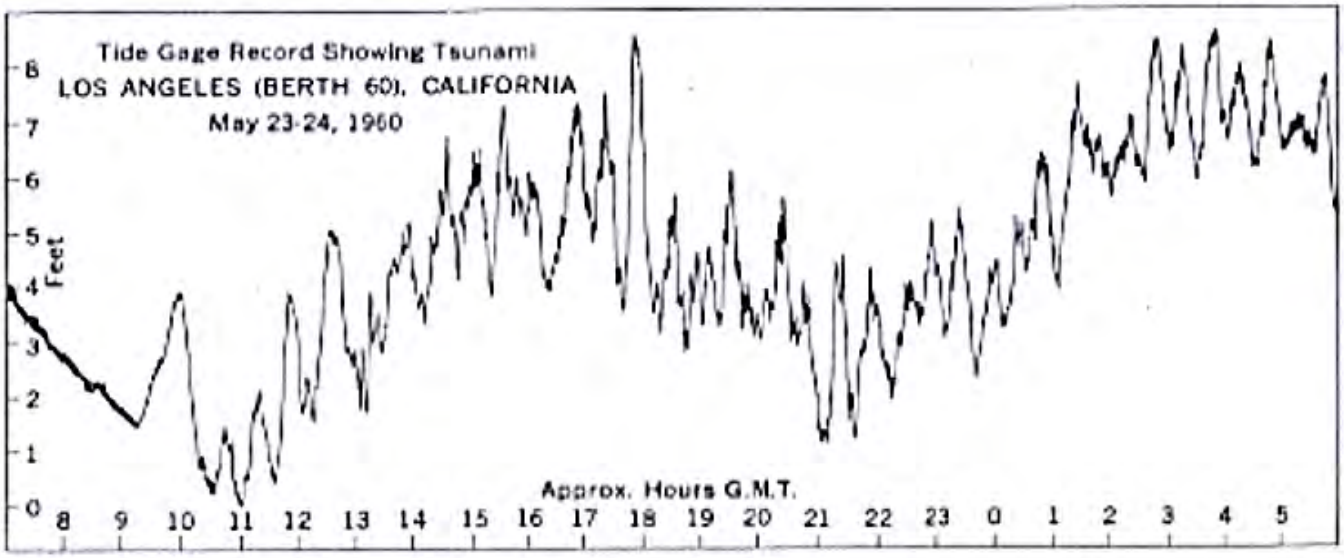




Alaska Earthquake (9.2): March 28, 1964



Chile Earthquake (9.5): May 23, 1960



Aleutian Trench Earthquake (7.4): April 1, 1946

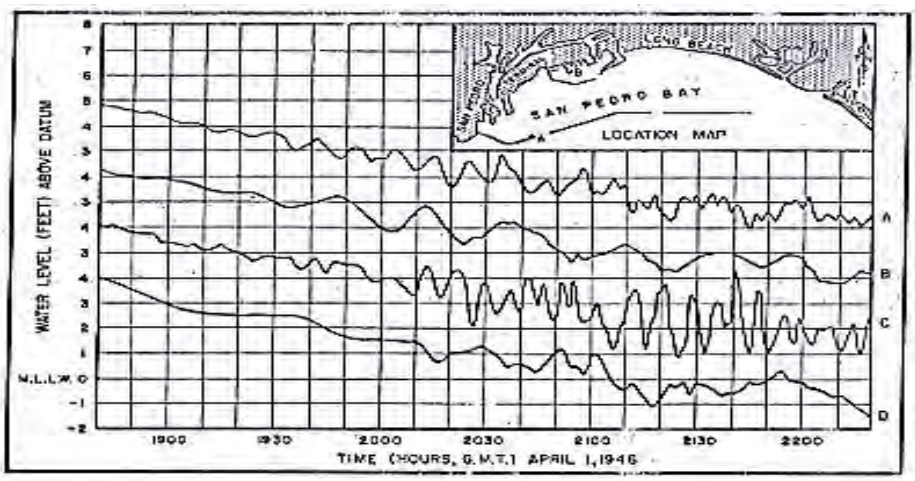


FIG. 7.—MARIGRAMS FROM FOUR LOCATIONS IN LOS ANGELES–LONG BEACH HARBORS SHOWING SIMULTANEOUS EFFECTS FROM ALEUTIAN TRENCH TSUNAMI OF APRIL 1, 1946 (22)

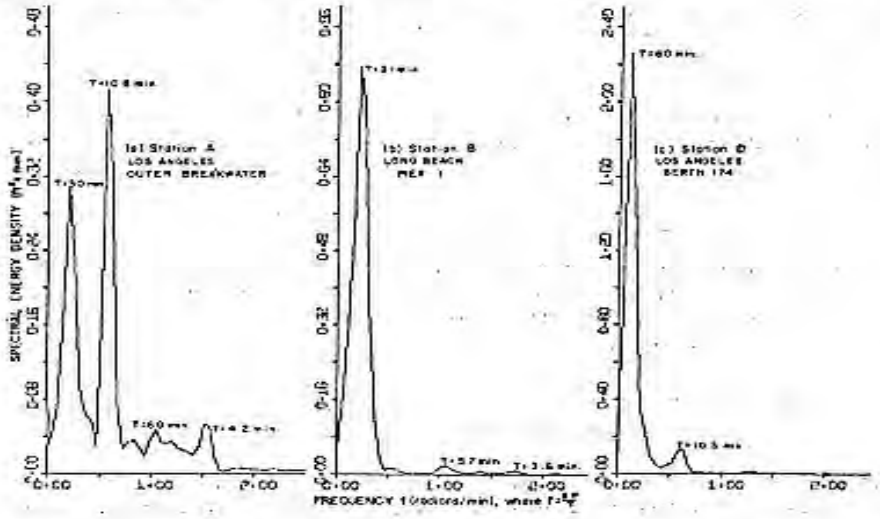
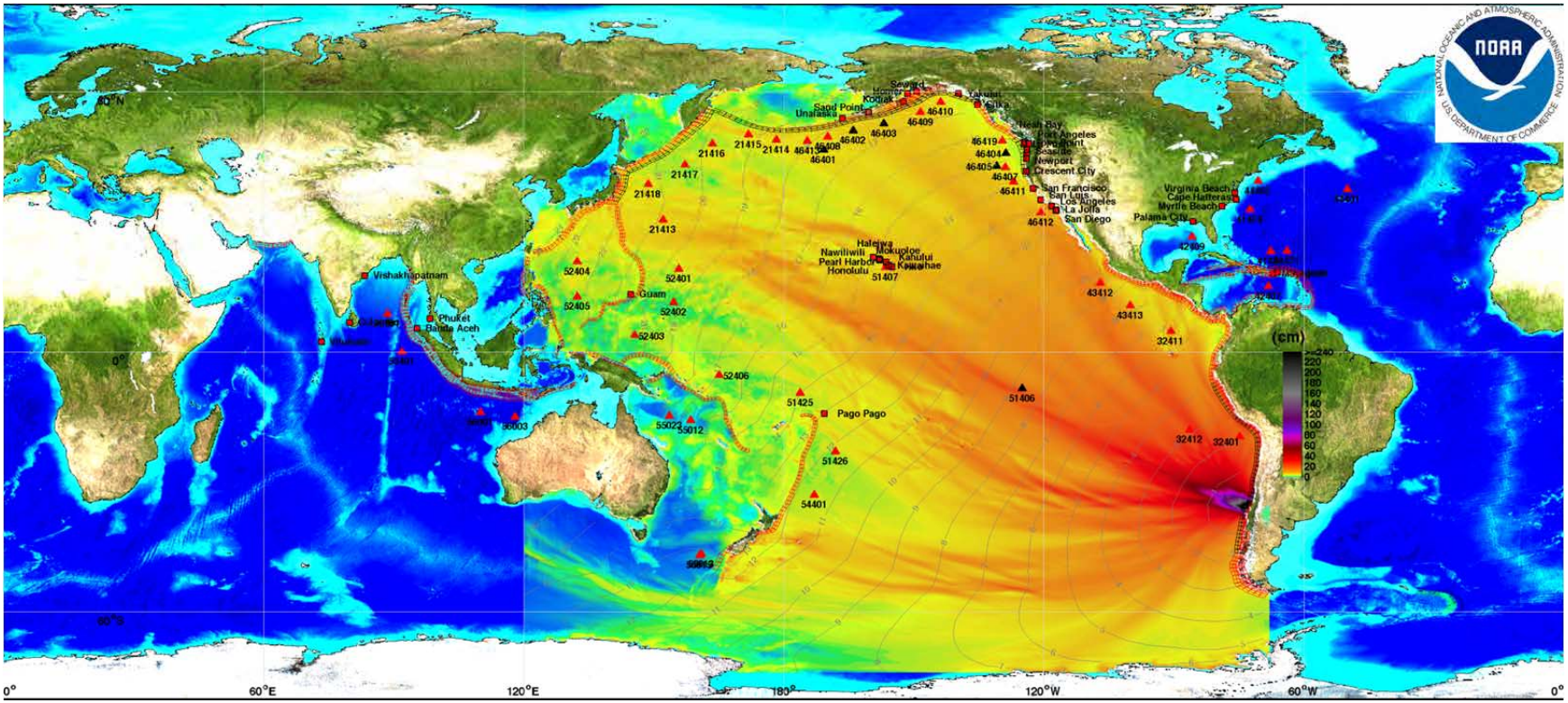
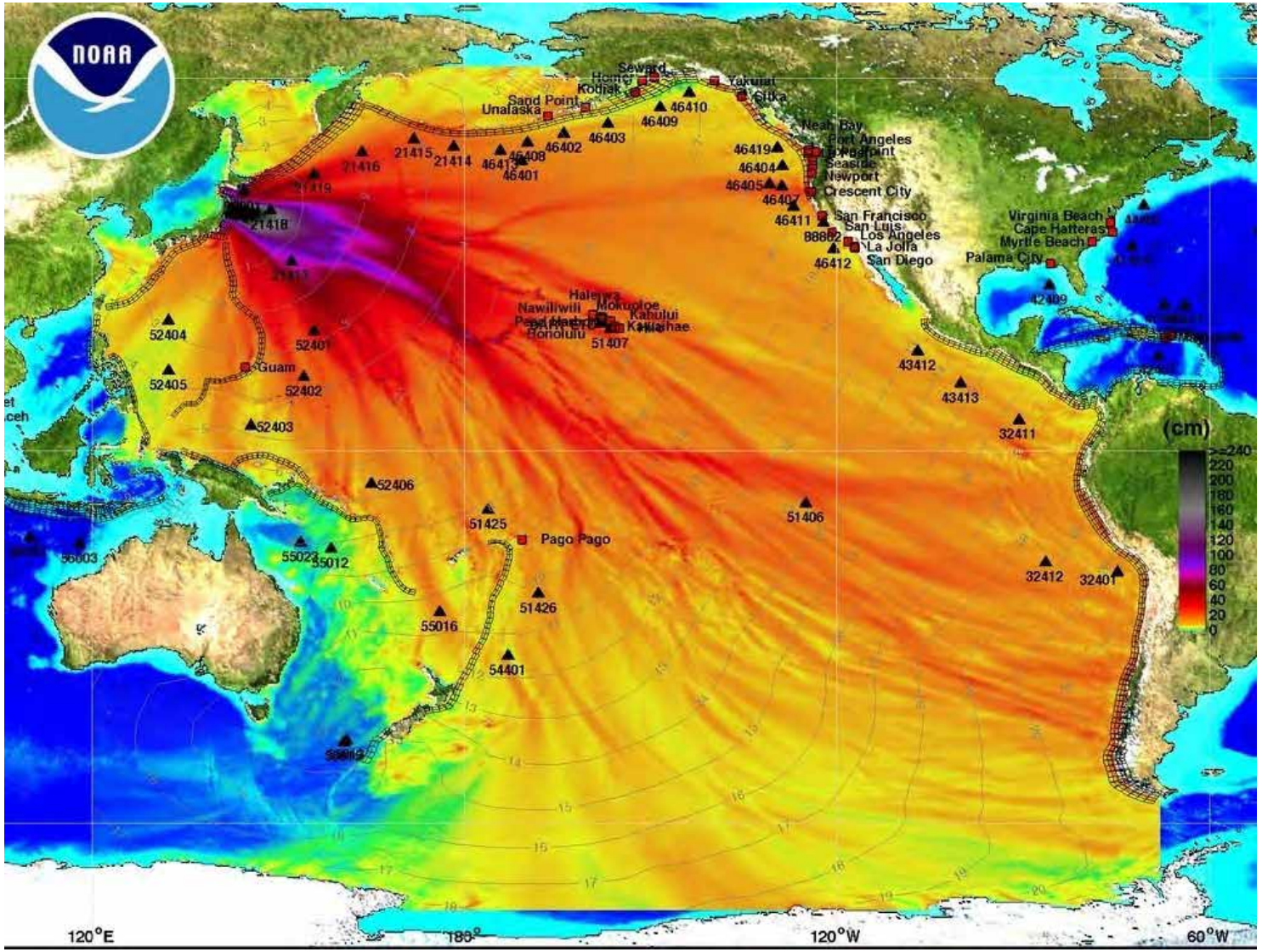


FIG. 8.—WAVE ENERGY SPECTRA AT STATIONS A, B AND D, LOS ANGELES–LONG BEACH HARBORS, FOR ALEUTIAN TRENCH TSUNAMI OF APRIL 1, 1946


NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
US DEPARTMENT OF COMMERCE
(cm)
240
220
200
180
160
140
120
100
80
60
40
20
0
60°N
0°
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0°
60°E
120°E
180°
120°W
60°W
0°
Pago Pago
Guam
Honolulu
Kahului
Hilo
Kodiak
Unalaska
Seward
Nawiliwili
Mokuoloe
Kawaihae
Pearl Harbor
Hanapepe
Port Angeles
Westport
Seaside
Newport
Crescent City
San Francisco
San Luis
Los Angeles
La Jolla
San Diego
Virginia Beach
Cape Hatteras
Myrtle Beach
Palama City
Vishakhapatnam
Phuket
Bande Aceh
46410
46409
46402
46403
46419
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46405
46407
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46412
46408
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21413
52404
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52403
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51425
55023
55012
51426
54401
51406
43412
43413
32411
32412
32401
51407

Chile 2010


NOAA
Seward
Homer
Kodiak
Sand Point
Unalaska
Yakutat
Sitka
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46408
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46407
46411
46412
Neah Bay
Port Angeles
Westport
Seaside
Newport
Crescent City
San Francisco
San Luis
Los Angeles
La Jolla
San Diego
88882
Virginia Beach
Cape Hatteras
Myrtle Beach
Palama City
42409
Halelm3
Nawiliwili
Mokuoloe
Kahului
Kaneohe
Honolulu
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52401
52405
Guam
52402
52403
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Tohoku 2011

Water Quality
Technical Memorandum

For

I-5 North Coast Corridor project

I-5 NCC
11- SD- I-5
PM 28.4-55.4
EA: 235800

March 2013

D11 NPDES Branch

2009 WQR Supplement
Revised August 2013
(Table II.2 only)

Executive Summary

This Technical Report is being prepared to update and supplement the Water Quality Report (WQR) prepared in 2009 for the I-5 North Coast Corridor (NCC) project. The purpose of this technical report is to provide additional information related to the recently adopted Caltrans NPDES permit and to describe the Department's practices and policies that are implemented by the various divisions to ensure all NPDES Permit mandates are complied with and documented.

The limits and description of the project have not changed since the WQR was completed. A Locally Preferred Alternative (LPA) has been selected and information presented in this technical report centers around the work being conducted in support of the LPA.

Caltrans permit was adopted by the State Water Resources Control Board (currently pending final approval of the Environmental Protection Agency and Office of Administrative Law), and is discussed in this technical report to ensure compliance with latest Permit requirements is identified and referenced during the project development process by the Department's Design Division and other functional units involved with the project development team. Furthermore, the SWRCB adopted a revised Construction General Permit (CGP) in 2009 which Caltrans projects are subject to. Specific CGP mandates not discussed in the 2009 WQR are addressed in this Technical Memorandum.

In 2010, EPA approved the latest CWA Section 303d impaired water listing and scheduling for assignment of TMDL requirements; a revised table is included showing impaired water bodies within the project limits. The Total maximum Daily Load (TMDL) work that is being addressed by the named dischargers (Caltrans, municipalities and other named stakeholders) is ongoing and Comprehensive Load Reduction Plans (CLRPs) are proposed to comply with Waste Load Allocations and other impairments. This technical report also discusses specific design procedures such as Caltrans infiltration tool calculation, low impact development, hydromodification and other requirements that are being assessed and documented for project implementation.

Design has prepared drainage basin delineation for both existing and preliminary design of the LPA. Current design has placed an emphasis on minimizing pavement areas; previous I-5 NCC documents such as the draft environmental document or the 2009 WQR included a larger impervious footprint than the current LPA. This technical memorandum discusses differences between existing and proposed impervious areas as well as existing treatment within the corridor which accounts for approximately 7% for the whole project footprint while after completion of the I-5 NCC, there will be approximately 27% of treatment of the total combined pavement based on preliminary design.

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I. NPDES PERMITS

I.1 Caltrans Statewide NPDES Permit

The State Water Resources Control Board adopted Order No. 99-06–DWQ, NPDES No. CAS000003 NPDES Permit Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) For the State of California, Department Of Transportation (Caltrans) properties, facilities and activities herein referred to as Permit. The permit requires the Department to implement a Storm Water Management Plan, SWMP; which purpose is to protect and achieve water quality standards at all times. The minimum requirement is to ensure that pollutants in discharges from storm drain systems owned or operated by Caltrans are reduced to the maximum extent practicable (MEP) and that pollutants in discharges from construction activities covered by the General Construction Permit are reduced by employing Best Available Technology /Best Conventional Technology (BAT/BCT) performance standards. The MEP analysis is the process of evaluating the selected BMPs based on legal and institutional constraints, technical feasibility, relative effectiveness, and cost/benefit ratio.

The Department continues to comply with CWA§402 by complying with the requirements of the statewide NPDES permit The permit and the approved SWMP consolidated the Department's stormwater compliance activities under one permit and provided a framework for consistent and effective implementation of stormwater management practices on a statewide basis. This permit has been re-issued (Order 20012-011 DWQ) as of September 2012 and will have an effective date of July 1, 2013.

The Department continues to modify its guidance documents including, but not limited to, the Project Planning and Design Guide, Construction Storm Water Manuals and is currently in process of updating the Department's SWMP in coordination with SWRCB and RWQCBs to reflect latest Caltrans permit requirements.

I.2 Construction General NPDES Permit

The State Water Resources Control Board adopted Order No. 2009-0009–DWQ, NPDES No. CAS000002 NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities on September 2, 2009 with an effective date of July 1, 2010. The permit covers construction activities that result in land disturbance of equal or greater than one acre or construction activities that result in land surface disturbance of less than one acre if the construction activity is part of a common plan of development.

The permit requires the dischargers to implement a Storm Water Pollution Prevention Plan (SWPPP) that contains BMPs that will prevent construction pollutants from entering a receiving water body.

The SWPPP has the following objectives:

- All pollutants and their sources, including sources of sediment associated with construction, site erosion and other activities associated with construction are controlled;

- Where not otherwise required to be under a Regional Water Board permit, all non-storm water discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in storm water discharges and authorized non-storm water discharges from construction activity to the BAT/BCT standard;
- Calculations and design details as well as BMP controls for site run-on are complete and correct, and
- Stabilization BMPs installed to reduce or eliminate pollutants after construction.

I.2.1 Risk Level Determination

The new Construction General Permit is a risk-based permit that establishes three levels of environmental risk possible for a construction site. The Risk Level (RL) is calculated in two parts: 1) Project Sediment Risk, and 2) Receiving Water Risk. The RL determination quantifies sediment and receiving water characteristics and uses these results to determine the project's overall RL. Highly erodible soils, in higher rainfall areas, on steep slopes increase the 'sediment risk'. Monitoring and reporting requirements increase as the RL goes from 1 to 3.

The Department's stormwater program complies with the substantive provisions of the Construction General Permit on projects. The permit requirements are implemented during the design phase through the water pollution control plans and project's specifications. During the construction phase, the requirements will be met through the implementation of the Stormwater Pollution Prevention Plans (SWPPPs) prepared for each project under the construction phase of the project and compliance with the project's specifications.

I.2.2 RUSLE 2

Once the construction phase is complete and the project is stabilized, the Resident Engineer will work with the storm water group to complete a Notice Of Termination (NOT) and file with the SDRWQCB. This lets the regional board know that the project is no longer subject to CGP requirements but will still be in compliance with the Caltrans NPDES Permit.

One of the means of providing the validation of final soil stabilization is to provide computational proof using the Erosion Prediction Procedure (EPP) developed by Caltrans in 2008. The EPP uses the RUSLE2 computer program to estimate soil erosion loss and sediment transport in natural and disturbed construction sites. The EPP achieves "site stabilization" for a project through the use of simulated temporary and permanent BMPs, allowing the Project Engineer (PE) to assess the effect of the design parameters on soil erosion and sediment transport.

As part of designing the final stabilization of project surfaces, the PE uses RUSLE2 to generate the computation proof that sediment yield and stabilization are equivalent or better than pre-construction conditions. The information is produced from representative cross-sections of slope surfaces that validate the erosion control design as having equal or better protection than existing conditions (pre-construction). This information is included as part of the project's SWDR.

II. AFFECTED WATERSHED

Table II.1 below lists the hydrologic areas/subareas that are within the proposed *I-5 NCC Project*. The table compares the area of each of the hydrologic areas or sub-areas versus existing Caltrans right of way within the I-5 project limits. The table shows that the maximum Caltrans tributary area to any of the hydrologic subareas is less than two percent.

Table II.1 Existing I-5 Contribution to the watershed within project limits

Watershed	Hydrologic Area/Sub Area Name	HA/HSA Number	HA/HSA (Acres)	Existing I-5 Tributary Area* (Acres)	Existing I-5 Contribution to HA/HSA (%)
Penasquitos	Miramar HA	906.40	25924	288	1.10%
	Miramar Reservoir HA	906.10	32,594.8	332	1.02%
San Dieguito	Rancho Santa Fe HSA	905.11	22,610.5	221	0.98%
Carlsbad	San Elijo HSA	904.61	20,721.5	181	0.88%
	Batiquitos HSA	904.51	17,819.4	330	1.85%
	Encinas HA	904.40	2,991.4	47	1.56%
	Los Monos HSA	904.31	11,904.4	95	0.8%
	El Salto HSA	904.21	7,476.4	134	1.79%
	Loma Alta HA	904.10	5,199.6	40	0.78%
San Luis Rey	Mission HSA	903.11	29,930	114	0.38%
Santa Margarita	Lower Ysidora HSA	902.11	6710	38	0.57%

* Source: sangis/landuse/right_of_way.shp

II.1 Section 303 (d) of the Clean Water Act and & the Targeted Design Constituent

The CWA requires States to identify and make a list of surface water bodies that do not meet water quality standards, also referred to as "water quality limited segments", even after discharges of wastes from point sources have been treated by the minimum required levels of pollution control technology. States are required to compile these water bodies into a list, referred to as the "Clean Water Act Section 303(d) List of Water Quality Limited Segments" (List).

As part of Caltrans runoff characterization studies, The Department has identified pollutants that are discharging with a load or a concentration that commonly exceeds allowable standards and which are considered treatable by Caltrans approved treatment BMPs. These pollutants are referred to as Targeted Design Constituents (TDCs), which include sediment, metals (total and dissolved zinc, lead and copper), nitrogen, phosphorus and general metals.

Table II.2 below lists the 303(d) listed water bodies that will be potentially impacted by the proposed I-5 north coast corridor-widening project.

Table II.2 303(d) Impaired Water Bodies within project limits

Hydrologic Area	Water Body Name	HA/ HSA	Size	Pollutant	Caltrans TDC
Penasquitos	Soledad Canyon	906.10	2 Miles	Selenium, Sediment Toxicity	NA
	Los Penasquitos Creek	906.10	12 Miles	Total Dissolved Solids, Selenium, Toxicity, Total Nitrogen as N, Fecal Coliform, Enterococcus, ~~Phosphorus~~	Sediment, Nitrogen ~~Phosphorus~~
	Los Penasquitos Lagoon	906.10	469 Acres	Sedimentation/Siltation	Sediment
	Rose Creek	906.4	13 Miles	Selenium, Toxicity	NA
San Dieguito	San Dieguito River	905.11	19 Miles	Total Dissolved Solids, Toxicity, Nitrogen, Fecal Coliform, Enterococcus, Phosphorus	Sediment, Nitrogen Phosphorus
Carlsbad	Loma Alta Creek	904.10	8 Miles	Selenium, Toxicity	NA
	Buena Vista Creek	904.210	11 Miles	Selenium, Sediment Toxicity	NA
	Buena Vista Lagoon	904.21	202 Acres	Indicator Bacteria, Nutrients, Sedimentation/Siltation	Sediment, Nutrients (N and P)
	Agua Hedionda Creek	904.31	7 Miles	Total Dissolved Solids, Selenium, Toxicity, Total Nitrogen as N, Fecal Coliform, Enterococcus, Phosphorus, Manganese	Sediment, Nitrogen Phosphorus
	Cottonwood Creek	904.51	2 Miles	Sediment Toxicity, Selenium, DDT	NA
	Encinitas Creek	904.51	3 Miles	Toxicity, Selenium	NA
	San Marcos Creek	904.51	19 Miles	Selenium, Sediment Toxicity, Phosphorus, DDE	Phosphorus
	San Elijo Lagoon	904.61	566 Acres	Sedimentation/Siltation, Indicator Bacteria, Eutrophic	Sediment
	Escondido Creek	904.62	26 Miles	Total Dissolved Solids, Selenium, Toxicity, Total Nitrogen as N, Fecal Coliform, Enterococcus, DDT Phosphate, Sulfates, Manganese	Sediment, Nitrogen Phosphorus
San Luis Rey	San Luis Rey River, Lower (west of I-15)	903.11	19 Miles	Chloride, Fecal Coliform, Phosphorus, Total Dissolved Solids, Total Nitrogen as N, Toxicity, Enterococcus	Phosphorus, Nitrogen
	Pacific Ocean Shoreline, at San Luis Rey River mouth		0 Miles	Enterococcus, Total Coliform	NA
Santa Margarita	Oceanside Harbor	902.11	52 acres	Copper	Copper

Source: http://www.waterboards.ca.gov/sandiego/water_issues/programs/303d_list/index.shtml
NA Not Applicable

III. BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are considered to address potential water quality impacts during the planning and design, construction, and operational and maintenance phases. The SWMP divides the BMPs into separate categories from the planning and design phase to the operational and maintenance phase.

Short term potential impacts to water quality during the construction phase are avoided and or minimized through the use of Construction Site BMPs while the long term potential impacts, due to operation and maintenance of the freeway or other Department facilities, are avoided/minimized through the use of Design Pollution Prevention BMPs, Treatment BMPs and Maintenance BMPs

The general categories of BMPs have been identified for use in the Project Planning and Design Guide (PPDG) Manual and are shown in *Table III.1 BMP Descriptions*.

Table III.1 BMP Descriptions

BMP	Description
Design Pollution Prevention BMPs	Preservation of existing vegetation, concentrated flow conveyance, slope/surface protection, etc.
Treatment BMPs	Treatment Devices and facilities.
Construction Site BMPs	Temporary soil stabilization and sediment control, non-storm water management, and waste management. Refer to the Construction BMP Manual.
Maintenance BMPs	Litter pick up, waste management, street sweeping, etc.

Source: PPDG Manual, Table 2-3, July 2010

III.1 Department Standard Procedures and Practices

III.1.1 Project Planning and Design

During the process of planning and design of all new facilities and reconstruction or expansion of existing facilities, the Project Engineer considers and, as appropriate, incorporates BMPs. Design Pollution Prevention BMPs are permanent measures to reduce pollution discharges after construction is completed; while Treatment BMPs are permanent measures to improve/maintain storm water quality after construction is completed.

Project-specific BMP consideration is an iterative process that begins with initial project planning and scoping activities. As the project moves into detailed design, the Department's design division revisits the BMP consideration process and goes through a detailed BMP selection methodology that works efficiently with the design of the highway and drainage facilities. This process is documented in the Storm Water Data Report.

III.1.2 Storm Water Data Report

Every Caltrans project is required to complete a Storm Water Data Report (SWDR), which summarizes the storm water decisions made by the Project Development Team. These decision are made taking into consideration grading, environmental constrains, utility issues and any other conflicts that might arise when designing a project. The SWDR documentation includes various checklists to help project engineers determine feasibility of BMPs and any potential conflicts related to their implementation. The SWDR is initiated at the beginning of the project and is updated as the project progresses through design. The final SWDR not only documents the decisions made throughout the phases of the project but also include exhibits showing tributary drainage areas, percentages of treatment, water quality impairments and types of design pollution prevention, construction and maintenance BMPs that will be incorporated into the project.

A PA/ED level SWDR is being prepared for this project and is in process of being finalized for the initial phase of design. The work done to date includes delineation of impervious surface tributary drainage areas and preliminary siting and selection of potential treatment BMPs.

III.1.3 Design Pollution Prevention (DPP) BMPs

During the project development process, the Project Engineer will incorporate specific DPP BMPs into a project to minimize potential impacts to water quality. The design objectives of the DPP BMPs are as follows:

- *Prevent Downstream Erosion.*
- *Stabilize Disturbed Soil Areas.*
- *Maximize Vegetated Surfaces Consistent with Existing Caltrans Policies.*

The table below lists the DPP BMPs to achieve the above design objectives. The SWDR will include discussion of applicable DPPs and also document through completed checklist the process used to determine DPP applicability.

Table III.1.3.1 Design Pollution Prevention BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow	
Peak Flow Attenuation Basins	Soil Modification
Reduction of Paved Surface (i.e., increase pervious area)	Energy Dissipation Devices
Preservation of Existing Vegetation	
Concentrated Flow Conveyance Systems	
Ditches, Berms, Dikes and Swales	Channel Linings
Overside Drains, Downdrains, Paved Spillways	Flared Culvert End Sections
Outlet Protection/Velocity Dissipation Devices	
Slope/Surface Protection Systems	
Vegetated Surfaces	Flared Culvert End Sections
Hard Surfaces	

Source: PPDG Manual, Table 2-4, 2010

III.1.4 Low Impact Development (LID)

Caltrans encourages the use LID features, which can mutually serve as both Design Pollution Prevention BMPs and Treatment BMPs; Due to limited right of way and the linear nature of the typical Caltrans project, the design must ensure that any design features do not create a safety hazard for the public or maintenance forces. LID uses site design and storm water management to maintain the site's pre-project runoff rates and volumes by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to the source.

Features that function as LID measures include, but are not limited to:
- Surface vegetation, such as biofiltration swales and strips;
- Soil amendments, such as compost and surface roughening;
- Subsurface storage, such as dry-wells, infiltration trenches, or swales underlain with permeable soil layers;
- Small detention areas, such as cisterns, traps, and check dams;
- Pervious materials, such as paving stone and porous concrete, when used in lieu of impervious materials at locations outside the highway prism;
- Disconnected drainage that relies upon overland flow rather than pipe networks to convey runoff to discharge locations; and,
- Contour Grading, grading that follows natural flow paths and terrain with an emphasis upon slope rounding and gradual elevation changes.

This project will review and propose LID features throughout the project footprint. Final selection will be made during final design once drainage, grading and other design features are determined and used as basis for feasibility and siting locations.

III.1.5 Hydromodification

The Department under its recently adopted statewide permit (Order 2012-0011-DWQ- effective date of July 1, 2013) is required to conduct a risk-based approach to ensure the project does not cause a decrease in lateral (bank) and vertical (channel bed) stability in receiving stream channels. The Department will assess pre-project channel stability and implementing mitigation measures that are appropriate to protect structures and minimize stream channel bank and bed erosion.

The permit requires that projects that add 1 acre or more of new impervious surface with any impervious portion of the project located within a Threshold Drainage Area (area draining to a location at least 20 channel widths downstream of a stream crossing (pipe, swale, culvert, or bridge) within Project Limits) must conduct a rapid assessment of stream stability at each stream crossing (e.g., pipe, culvert, swale or bridge) within that Threshold Drainage Area. If the stream crossing is a bridge, a follow up rapid assessment of stream stability is also required.

- If the results of the rapid assessment indicate that the representative reach is laterally and vertically stable (i.e., a rating of excellent or good) the Department does not have to conduct further analyses and must implement the Design Pollution Prevention and Treatment BMPs.
- If the results of the rapid assessment indicate that the representative reach will not be laterally and vertically stable (i.e., a rating of excellent or good), the Department must

determine whether the instability, in conjunction with the proposed project, poses a risk to existing or proposed highway structures by conducting appropriate Level 2 (and, if necessary, Level 3) analyses.

- If the results of the Level 2 and 3 analysis indicate that the instability, in conjunction with the proposed project, poses a risk to existing or proposed highway structures, other options must be implemented, including, but not limited to, in-stream and floodplain enhancement/restoration, fish barrier removal as identified in the report required under Article 3.5 of the Streets and Highways Code, regional flow control, off-site BMPs, and, if necessary, project re-design.

The project engineer will work with the hydraulics unit and other design support units such as geotechnical to conduct and document the assessment. This evaluation will be included as part of the SWDR at the PSE phase.

III.1.6 Treatment BMPs

Approved Treatment BMPs must be considered for this project as required under the SWMP to avoid or minimize the potential long term impacts from any Department facilities or activities. The approved treatment BMPs listed below are considered to be technically and fiscally feasible. Department experience has found these BMPs to be constructible, maintainable, and effective at removing pollutants to the maximum extent practicable.

The designer will follow Appendix E and the T-checklists found in the PPDG to select and determine specific treatment BMP feasibility. This assessment can be crudely described as

1) Determine if there are any TMDL adopted within project limits
2) Determine if there are any 303d listed water bodies within project limits
3) Determine whether constituents on 303dlist are Department's TDCs
4) Evaluate feasibility of incorporation by ensuring siting criteria is met
5) Run WQV/F calculations
6) Look at checklist T-1 Part 1
7) Run Infiltration Tool
8) Complete checklist T-1 part 1-10 thereby completing design criteria evaluation of all Approved Treatment BMPs
9) Document in SWDR

Table III.1.6.1 Approved Treatment BMPs

Biofiltration Systems	Infiltration Devices
Detention Devices	Traction Sand Traps
Dry Weather Flow Diversion	Gross Solid Removal Devices (GSRDs)
Media Filters	Multi Chamber Treatment Train
Wet Basins	

Source: PPDG Manual, Table 2-5, July 2010

A preliminary review of the project area has been completed and potential locations and types of treatment BMPs have been assessed for feasibility (based on criteria outlined in the PPDG and discussed above along with other factors such as climate, water volume, soil conditions, physical limitations, other environmental considerations, etc.). As the proposed project proceeds further into the design phase, the locations of these treatment BMPs would be further evaluated to determine feasibility in relation to right-of-way limitations, environmental constraints and hydraulic capacity. In addition, in areas where treatment BMPs cannot be incorporated due to above mentioned reasons, vegetation will be maximized and every effort will be made to ensure the successful establishment of landscaping and erosion control throughout the project limits. The project will also consider any future treatment BMPs that might be approved by Caltrans from the ongoing research and monitoring program.

Description, design criteria and siting consideration of approved treatment BMPs is presented below. The SWDR will document decisions made by the PE to determine feasibility and implementation of treatment BMPs to deal with TDCs and other parameters as required by the Permit and outlined in the PPDG.

III.1.6.1 BIOFILTRATION STRIPS AND SWALES

Biofiltration Strips are vegetated land areas, over which stormwater flows as sheet flow.
Biofiltration Swales are vegetated channels, typically configured as trapezoidal or v-shaped channels that receive and convey stormwater flows while meeting water quality criteria and other flow criteria.
Pollutants are removed by filtration through the vegetation, sedimentation, adsorption to soil particles, and infiltration through the soil. Strips and swales are effective at trapping litter, Total Suspended Solids (soil particles), and particulate metals. In most cases, flow attenuation is also provided, thus biofiltration swales and strips can also be considered a LID technique.
Caltrans Biofiltration Swale Design Guidance and Caltrans Biofiltration Strips Design Guidance for complete guidance on design criteria, site evaluation, and preliminary and final design.

<u>Description</u>

Biofiltration Strips are sloped vegetated land areas located adjacent to impervious areas, over which storm water runoff flows as sheet flow. Pollutants are removed by filtration through the vegetation, uptake by plant biomass, sedimentation, adsorption to soil particles, and infiltration through the soil. Biofiltration Swales are vegetated, typically trapezoidal channels, which receive and convey storm water flows while meeting water quality criteria and other flow criteria. Pollutants are removed by filtration through the vegetation, uptake by plant biomass, sedimentation, adsorption to soil particles, and infiltration through the soil.
When properly implemented, biofiltration strips and swales are aesthetically pleasing. Due to the presence of its vegetation, the public views these devices as a “landscaped roadside” this would make placement more acceptable than other Treatment BMPs using concrete vaults.

<u>Appropriate Applications and Siting Criteria</u>

Biofiltration Strips and Swales should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities will not cause scour. A minimum vegetative cover of approximately 70% is required for treatment to occur.
Biofiltration Strips and swales are one of several BMPs for treatment of stormwater runoff

from project areas that are anticipated to produce pollutants of concern (e.g., roadways, parking lots, maintenance facilities, etc.).

III.1.6.2 INFILTRATION DEVICES

An Infiltration Device is designed to remove pollutants from surface discharges by capturing the Water Quality Volume (WQV) and infiltrating it directly to the soil rather than discharging it to surface waters. Infiltration devices may be configured as basins or trenches.

The following sections give a brief overview of infiltration devices and a summary of design criteria.

Description

Infiltration Basins are a volume-based Treatment BMP that temporarily store runoff in bermed or excavated areas for later infiltration over a limited period. During a storm, runoff enters the Infiltration Basin during which time the water level in the basin rises. During the rainfall, and for some time after it ends, the runoff infiltrates into the soil through the invert area, which is sized depending upon the design volume of runoff to be treated, the permeability of the soil below the invert, and the time period selected for infiltration (between 24 to 96 hours, but typical projects use 40 to 48 hours). Overflow events (when the runoff during rainfall events rises above the WQV elevation) are released, typically through a spillway through the confining berm, or through an overflow riser.

Infiltration Basins should be considered wherever site conditions allow and the design WQV exceeds 0.1 acre-feet.

An Infiltration Trench utilizes relatively shallow excavations backfilled with gravel or other high porosity materials to create subsurface storage for runoff that will over a design period infiltrate into the surrounding soils. Infiltration Trenches are often elongated, allowing them to be used in constricted areas, but there is no shape restriction.

The WQV should be directed to the Infiltration Trench by gravity flow in an open channel or as sheet flow and the captured volume should flow downward within the trench by the action of gravity and without vertical piping for distribution to lower depths of the trench.

Since infiltration trenches can be sited in circuitous alignments and sometimes implemented within a disconnected and distributed pattern, the BMP can also be considered a LID technique.

Infiltration Devices are considered the most effective Treatment BMP against most pollutants. Due to the effectiveness of treatment, Infiltration Devices are always a first choice to be considered when selecting a Treatment BMP for a Caltrans project.

Appropriate Applications and Siting Criteria

Infiltration Devices should be considered wherever site conditions allow. Appropriate sites for Infiltration Devices should have:

a) Sufficient soil permeability;
b) A sufficiently low water table;
c) The influent would not present a threat to local groundwater quality; and
d) Sufficient elevation to allow gravity drainage of the device when needed for maintenance purposes (Infiltration Basin only).

III.1.6.3 DETENTION DEVICES

A Detention Device is a permanent treatment BMP designed to reduce the sediment and particulate loading in runoff from the water quality design storm (Water Quality Volume [WQV]). While the WQV is temporarily detained in the device sediment and particulates settle out under the quiescent conditions prior to the runoff being discharged. A Detention Device is typically configured as a basin.

Detention Basins can remove litter, settable solids, total suspended solids, particulate metals, and absorbed pollutants such as heavy metals, oil, and grease by capturing, temporarily detaining, and gradually releasing storm water runoff.

The following sections give a brief overview of detention devices and a summary of design criteria. The PE shall refer to Caltrans Detention Basins Design Guidance for complete guidance on design criteria, site evaluation, and preliminary and final design.

Description

Detention Basins operate by intercepting runoff and detaining it long enough for the sediment and particulates to settle out under quiescent conditions prior to the runoff being discharged. Detention Basins are typically designed to completely drain after a storm event, and are normally dry between rain events. Detention Basins are designed for water quality purposes but they must also operate safely and effectively as part of the overall highway drainage system. Detention Basins must safely pass the peak drainage facility design event in accordance with the HDM.

In addition, Detention Basins should be able to operate by gravity flow while limiting clogging of the water quality outlet and providing a proper overflow spillway or overflow riser for larger runoff volumes. The basins should only require occasional maintenance and cleaning.

Entering flows should be distributed uniformly at low velocity to prevent re-suspension of settled materials and to encourage quiescent conditions. Low flow channels are often used to ensure conveyance to the outlet and to limit erosion during low flows. Basin shape and/or configuration should result in as natural an appearance as possible.

Appropriate Applications and Siting Criteria

Detention Devices and other approved Treatment BMPs should be considered for implementation wherever Infiltration Devices are not feasible. For Detention Devices, the WQV should be at least 0.1 acre-foot and site conditions must meet criteria.

Sufficient hydraulic head should be available so that water stored in the device does not cause an objectionable backwater condition in the upstream storm drain system. The seasonally high groundwater should be at least 10 ft below the invert of the Basin unless a liner is used.

III.1.6.4 DRY WEATHER FLOW DIVERSION

Dry Weather Flow Diversion (DWFD) devices provide permanent treatment by directing nonstormwater flow through a pipe or channel to a local municipal sanitary sewer system during the dry season or dry weather. This flow must be generated by Caltrans activities or facilities.

Description

Typically, dry weather flow diversions consist of a berm or wall constructed across the dry weather flow drainage channel so the dry weather flows are diverted to a pipe or channel leading to the sanitary sewer. A gate, weir, or valve should be installed to stop the diversion during the wet season or during storms during the wet season. Accordingly, the conveyance to the sanitary

sewer should be sized for the dry weather flows only. Wet weather flow is diverted back to the stormwater conveyance system.
If possible, a screen or trash rack should be installed at the diversion to reduce the likelihood of clogging the diversion pipe or channel. Maintenance vehicle access should be provided, especially if a screen is installed.
Appropriate Applications and Siting Criteria
DWFD should only be considered when all of the following conditions apply:
• Dry weather flow is persistent, and contains pollutants;
• An opportunity for connecting to a sanitary sewer is reasonably close and would not involve extraordinary plumbing, features or construction practices to implement;
• The POTW is willing to accept the flow during the dry season or dry weather.

III.1.6.5 MEDIA FILTERS

A Media Filter Treatment BMP device primarily removes TSS pollutants (sediments and metals) from runoff by sedimentation and filtering, and also is effective for dissolved metals, litter and potentially some nutrients (depending upon type of Media Filter selected).
Description
There are two types of approved Media Filter devices: The Austin Sand Filter and the Delaware Sand Filter; each is configured using two chambers. An Austin Sand Filter is usually open and at grade and has no permanent water pool; a Delaware Sand Filter is always configured with closed chambers and below grade and has a permanent pool of water. An Austin Sand Filter may be configured with earthen or concrete sides and invert; a Delaware Sand Filter is always made using concrete sides and invert.
In both types of Media Filters, stormwater is directed into the first chamber where the larger sediments and particulates settle out, and the partially treated effluent is metered into the second chamber to be filtered through a media. In the Austin Sand Filter, the first chamber may be sized for the entire WQV ('full sedimentation') or as a 'partial sedimentation' chamber, holding only about 20% of the WQV; the Delaware Sand Filter holds the entire WQV in the initial chamber, and is designed to pass the WQV from the second chamber.
The treated effluent (filtered water) is captured by perforated underdrains for release downstream. There is a drop in elevation of 3 ft to 6 ft between the invert of the inlet pipe and the invert of the device outflow pipe depending on device type, size or configuration.
The filter media typically consists of sand, which is effective for removal of coarse and fine sediments and particulate metals. Other materials, such as topsoil or organic materials may be added to the sand to increase the treatment capacity for some pollutants (for example,
dissolved metals) but these additives often increase the nitrogen and phosphorus
concentration levels in the effluent. When media filters are used to encourage infiltration or subsurface storage and mimic natural hydrology within small applications, then the media filters may be considered a LID technique.
Appropriate Applications and Siting Criteria
The minimum WQV for Media Filters is $\geq$ 4,356 ft3 (0.1 acre-ft [a-f])
Sites proposed for Media Filters must have sufficient hydraulic head to operate by gravity; generally between 3 to 6 ft of elevation drop is needed between the inflow to the initial chamber and effluent outflow from the second chamber.

Media Filters will perform better if the tributary area has a relatively high percentage of impervious area, and low sediment loading.
Standard details for a vector-proof Delaware Sand Filter have been developed when vector control is an issue.
For earthen-type Media Filters, at least 10 ft separation from seasonally high groundwater should be provided. For vault-type Media Filters, the level of the concrete base of the vault must be above seasonally high groundwater unless by special design.

III.1.6.6 WET BASIN

Wet Basins are detention systems comprised of a permanent pool of water, a temporary storage volume above the permanent pool, and a shoreline zone planted with aquatic vegetation. Wet Basins are designed to remove pollutants from surface discharges by temporarily capturing and detaining the Water Quality Volume (WQV) in order to allow settling and biological uptake to occur. Wet Basins are recommended for the following pollutants: Total Suspended Solids (TSS); nutrients; particulate metals; pathogens; litter; and Biological Oxygen Demand (BOD).

Description

A Wet Basin has temporary storage capacity above the permanent pool for the Water Quality Volume. The WQV enters the Wet Basin and commingles with the permanent pool, during which time the water level in the basin rises to inundate the surrounding vegetation during a WQ event. The commingled water is slowly discharged through a water quality riser until the water level returns to the level of the permanent pool.
The level of the permanent pool must be maintained year-round to support the plant community in the Wet Basin; this water level is maintained by connecting the Wet Basin to a stream channel, by seepage from springs, or by water from some other source.

Appropriate Applications and Siting Criteria

The site under consideration for a Wet Basin should, if possible, be located where the visual aesthetics of the permanent pool is considered a benefit (such as a roadside rest area or vista point). The proposed site must have a source of water to provide base flow sufficient to maintain a year-round plant community to account for losses due to infiltration and evapo-transpiration. The soil immediately below the invert must be relatively impermeable to limit loss of water by infiltration (NRCS Hydrologic Soils Group [HSG] soils C and D) unless a liner is used. Separation between seasonally high groundwater and basin invert should be > 10 ft; use liner if separation is between 1.0 ft and 10 ft unless approved by the local RWQCB due to presence of low permeability soils [Hydrologic Soil Groups C or D]).
Conditions that do not allow for siting are: sites having contaminated soils or groundwater plumes; objectionable backwater conditions in the storm drain system being induced; placement on or near unstable slopes, or slopes steeper than 15 percent.
Note also that if the impounded volume exceeds 15 a-f then the Wet Basin may classify as a jurisdictional dam and be subject to other requirements; consult with District Hydraulics if the volume below the spillway exceeds this threshold.

Specific information about Multi-Chamber Treatment Train, Gross Solids Removal devices and Traction Sand Traps are not included since the project location, TDC or operations do not meet the design criteria.

III.1.7 Water Quality Volume/ Flow

Water Quality Volume (WQV)

Treatment BMPs are designed to treat the lower volume or flow of more frequent (i.e. return period < 1 year) storm events. The volume associated with the frequent events are commonly referred to as the WQV for BMPs designed based on volume, and Water Quality Flow (WQF) for BMPs designed based on flow.

Treatment BMPs are sized to accommodate the WQF or WQV from the contributing drainage area. Flows in excess of these values are diverted around or through the Treatment BMP. Methods for determining the WQV are generally tied to an analysis of rainfall depths generated over 24-hour periods although the WQV may be determined by the drawdown time of certain Treatment BMPs.

The WQV of Treatment BMPs is based on using either of the following methods:

1. Where they are established, sizing criteria from the RWQCB or local agency (whichever is more stringent) will be used; or
2. Where the RWQCB or local agency does not have an established sizing criterion, Caltrans will use the following method:

Water Quality Flow (WQF)

The listed values of rainfall intensity are used in the Rational Formula (Q=CiA) to estimate runoff from areas that would discharge flow to flow-based Treatment BMPs. The resulting runoff rate would be the design WQF to be used at any specific site. The WQF is the primary design criteria used for various types of flow-based Treatment BMPs (e.g. Biofiltration Swales). Caltrans, the SWRCB and the nine RWQCBs worked cooperatively to establish these values. For San Diego, the negotiated rainfall intensity is 0.20"/hr region wide. In addition to designing for the WQF, the PE must also insure that the flow-based Treatment BMPs include a bypass or an overflow device to convey peak discharges from larger design storms consistent with Section 861.3 of the Highway Design Manual.

III.1.8 Infiltration Tool

In order to determine infiltration by vegetated and earthen BMPs, the Department created a workbook containing two separate tools: the Strip and Swale Infiltration Tool (SSIT) and the Basin Infiltration Tool (BIT). The SSIT was created to estimate infiltration for biofiltration strips and swales, infiltration trenches, and other subsurface infiltration practices.

The BIT was created to estimate infiltration for infiltration basins and detention basins. The values generated by these tools are intended to be used in the SWDR, which requires the input of an infiltration estimate for four scenarios:

1) flow across native soil or existing fill,
2) flow across amended soil,
3) infiltration basins, and
4) detention basins.

The output generated will be used by Design to determine whether infiltration is occurring and whether it can be increased by use of compost or other soil amendments.

III.1.9 Existing Treatment BMPs within the I-5 Corridor

Litigation between the Department and the Natural Resource Defense Council (NRDC), Coast Keepers and the United States Environmental Protection Agency (USEPA) resulted in a requirement to develop a Best Management Practice (BMP) Retrofit Pilot Program in District 7 and 11 (BMP Retrofit Pilot Program). Moreover, subsequent to the Statewide Permit adoption (Order 99-06-DWQ), and as described in SWMP section 4.4.1 and PPDG, Caltrans conducts an assessment whenever new construction or reconstruction is taking place, documented in the SWDR. Below is a list of the treatment BMPs that have been constructed within the I-5 corridor as either part of the BMP Retrofit Pilot Program or ongoing construction projects along with some photographs.

Table III.1.9.1 Existing Treatment BMPs within the I-5 North Coast Project*

Watershed	Location Description	BMP type	Total Tributary Area (Treated Acres)
Penasquitos	N Roselle St, 5/805 I-5/SR-56	Biofiltration Swales Detention Basin	7.7
San Dieguito	N of Del Mar Heights Lomas Santa Fe	Biofiltration Swales and Detention Basin Biofiltration Swales	24
Carlsbad	Lomas Santa Fe I-5 at Manchester Avenue I-5/La Costa I-5 & Palomar Airport Rd.	Biofiltration Swales Detention Basin Wet Basin Biofiltration Swale	15

Source: BMP Retrofit program Final Report (CTSW-RT-01-050) and project files (EAs 0301U4, 06510,2358U4)
*Park and Ride treatment numbers not included in table.

I-5/SR-56 Detention Basin after storm event



I-5 at Manchester Ave. Detention Basin after storm event



I-5 @ Lomas Santa Fe Biofiltration Swales after construction





III.1.10 Current Pavement Areas

Table III.1.10.1 below shows existing and proposed pavement acreage by watershed for the I-5 NCC project. These calculations differ from previously provided numbers as a result of more precise cross-section and design information; previous data was based on GIS data.

Table III.1.10.1 Pavement Acreage

Watershed/ Hydrologic Area	Sub watershed/ Major Water Bodies	Location	Existing Impervious Area (Acres)		Proposed Impervious Area (Acres)	
Penasquitos 906	Rose Canyon	La Jolla V. Dr. To Voight St	11.7	193.5	8.7	30.0
	Penasquitos	Voight St To Roselle St	33.1		15.0	
		5/805 To SR 56	115.1		0.0	
		SR 56 – Del mar Height Ave	33.6		6.3	
San Dieguito 905	San Dieguito	Del mar - S. Dieguito River	38.5	90.2	12.7	29.0
		S. Dieguito - V.V. Blvd	14.2		9.4	
		V. V. - Lomas Sanfe Ave	37.5		6.9	
Carlsbad 904	San Elijo Lagoon	Loma. - Manchester Ave	14.5	327.8	20.2	142.3
		Man. - Birmingham Ave	38.3		19.0	
	Cottonwood	Bir. - Encinitas Blvd	28.3		12.7	
		Enc - Leucadia Ave	15.1		6.8	
	Batiquitos	Leu - La Costa Ave	36.6		12.6	
		L.C. - Poinsettia Lane	19.1		8.3	
	Encinas	Poin - Palomar Air. Rd	27.3		10.7	
		Pal - Cannon Rd	32.9		11.3	
	Agua Hedionda Lagoon	Cannon - Tamarack Ave	16.7		7.2	
		Tamarack -Carlsbad V. Dr	28.2		9.0	
	Buena Vista Lagoon	Carlsbad - SR 78	21.9		7.2	
		SR 78 - Cassidy St	21.0		4.4	
	Loma Alta Creek	Cass. - Oceanside Blvd	10.1		5.4	
		O.Blvd. - Mission Ave	17.8		7.5	
San Luis Rey 903	San Luis Rey	Mission - SR 76	16.8	46.0	4.5	12.4
		SR 76 - Harbor Dr	29.2		7.9	
Santa Margarita 902	Santa Margarita (Oceanside Harbor)	Harbor - Vandergrift Blvd	11.7	11.7	0.8	0.8
			Totals	669.2		214.5

III.1.11 Proposed Treatment BMPs

As discussed above, there has been preliminary siting for treatment BMPs based on the current footprint. Based on the proposed areas that will receive treatment, an equivalent of 112 % of the new pavement will receive treatment.

Table III.1.11.1 Treatment Acreage for I-5 NCC Project

Watershed/ Hydrologic Area	Subwatershed/ Major Water Bodies	Location	Existing Treatment Acreage		Proposed Treated Acreage	
Penasquitos 906	Rose Canyon	La Jolla V. Dr. To Voight St	0.0	7.8	9.8	41.7
	Penasquitos	Voight St To Roselle St	0.9		25.1	
		5/805 To SR 56	6.9		6.9	
		SR 56 – Del mar Height Ave	0.0		0.0	
San Dieguito 905	San Dieguito	Del mar - S. Dieguito River	17.7	24.1	23.2	36.4
		S. Dieguito - V.V. Blvd	0.0		4.3	
		V. V. - Lomas Sanfe Ave	6.4		9.0	
Carlsbad 904	San Elijo Lagoon	Loma. - Manchester Ave	2.0	15.0	3.1	137.8
		Man. - Birmingham Ave	4.8		18.1	
	Cottonwood	Bir. - Encinitas Blvd	0.0		25.7	
		Enc - Leucadia Ave	0.0		11.5	
	Batiquitos	Leu - La Costa Ave	4.1		24.9	
		L.C. - Poinsettia Lane	0.0		10.3	
	Encinas	Poin - Palomar Air. Rd	4.1		8.2	
		Pal - Cannon Rd	0.0		9.3	
	Agua Hedionda Lagoon	Cannon - Tamarack Ave	0.0		0.0	
		Tamarack -Carlsbad V. Dr	0.0		0.0	
	Buena Vista Lagoon	Carlsbad - SR 78	0.0		0.0	
		SR 78 - Cassidy St	0.0		11.3	
	Loma Alta Creek	Cass. - Oceanside Blvd	0.0		0.0	
		O.Blvd. - Mission Ave	0.0		15.5	
San Luis Rey 903	San Luis Rey	Mission - SR 76	0.0	0	6.1	19.5
		SR 76 - Harbor Dr	0.0		13.4	
Santa Margarita 902	Oceanside Harbor	Harbor Dr - Vandergrift Blvd	0.0	0	20264.0	5.0
				46.9		240.5

Summary Table of I-5 NCC Impervious Areas being treated

	Existing	Proposed (includes existing)
Impervious	669.2 acres	883.57 acres
Treated Impervious	46.9 acres	240.5 acres
% Treatment	7 %	27 %
Proposed Equivalent Area Treated (proposed treated/added impervious)		**112%**

IV. PROJECT OPERATION AND MAINTENANCE

The Division of Maintenance performs various activities on different facilities throughout the state to ensure safe and usable conditions for the public. Most of the activities are performed by small crews with minimal soil disturbance.

IV.1 Maintenance of Treatment BMPs

The operation and maintenance requirements for each type of treatment BMPs are outlined in Family F-7 and Appendix C of the maintenance staff guide, they are included in the following pages.

Agricultural Viability Analysis for the Manchester Property in Encinitas and the Cannon Road Property in Carlsbad, California for the North Coast Corridor Public Works Plan/ Transportation and Resource Enhancement Program

Prepared for:

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SEPTEMBER 2013

Printed on 30% post-consumer recycled material.

Agricultural Viability Analysis for the Manchester Property in Encinitas and the Cannon Road Property in Carlsbad, California

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1.0 INTRODUCTION TO THE AGRICULTURAL VIABILITY ANALYSIS

The agricultural viability analysis that follows in this document has been prepared to provide a condensed, but reasoned and detailed examination of two particular properties affected by the North Coast Corridor (NCC) Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP), referred to as the Manchester property and the Cannon property. The methodology employed in the analysis utilizes information related to a number of factors including underlying soils information and production costs. Information has been retrieved through research, personal communication, the San Diego County Agricultural Commissioner's Office, the San Diego County Farm Bureau, and the University of California Cooperative Extension. When current data could not be retrieved, assumptions have been made based on agricultural industry standards, best management practices and cultivation of the same and/or similar crops in comparable counties. The factors discussed in this analysis are important and necessary to consider when determining the physical viability of agricultural operations on specific parcels and their impact on the larger agricultural context of a particular area or region.

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2.0 AGRICULTURE IN SAN DIEGO COUNTY – OVERVIEW

San Diego County is the southernmost county in California and is essentially, a desert. There is very little water, comparatively to other counties in the state and the soil qualities, in general, are less suitable to large agricultural tracts and intense cultivation. Only 6% of soils within the County are considered Prime soils according to the U.S. Department of Agriculture, Natural Resources Conservation Services. These factors, coupled with variation in topography and resource constraints, create an environment which demands small farms, high value crops, and innovation. These small farms are generally surrounded by various land uses, including rural and urban land uses. However, these limiting factors and constraints have not fettered the ability of San Diego's agriculture to thrive and maintain its place as the 12th largest agricultural economy in among more than 3,000 counties nationwide[1]. In fact, the proximity of growers to large local markets, coupled with state of the art transportation corridors to transport fresh products to even larger markets and distribution centers, provides farmers with the means to remain competitive in an increasingly global economy.

As mentioned, the County has a vast array of topographies and a wide fluctuation of microclimates that give rise to over 30 different varieties of vegetation communities. Today, agricultural commodities in San Diego include over 200 different types of crops and products[2]. The County has more small farms, less than 10 acres in size, than any other county in the State. In fact, 68% of the 6,687 small farms are nine acres or fewer in size with a median farm size of four acres; 90% of the County's farms are under 49 acres[3]. This small farm size is attributable to: 1) the high cost of land; 2) the comparatively inferior soil types; and 3) the low availability of water; frequent drought conditions, and therefore the high cost of water, which priced at more than $600/acre foot requires farmers to utilize smaller acreages and produce high dollar value per acre crops. San Diego County produces the highest dollar value per acre crop statewide.[4] Agricultural innovation and flexibility are at the heart of the industry. From the 1920's to the present, the agricultural industry in the County has adapted and changed. In 1927, which is the first year that statistics were available, the most valuable products were lemons, canning tomatoes, celery, alfalfa, table grapes and navel oranges[5]. Today, the prevailing crops are vastly different and reflect the pressures experienced by growers and market demand. The types of crops grown throughout the county, such as greenhouse products or small-scale row crops, have been and continue to be compatible with the surround land uses, whether they are urban or rural.

[1] http://sdfarmbureau.org/SD-Ag/Ag-Facts.php
[2] http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/2011_Crop__Report_WEB.pdf
[3] http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/stats_sdagriculture.pdf
[4] http://sdfarmbureau.org/SD-Ag/Ag-Facts.php
[5] http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/stats_sdagriculture.pdf

According to the most recent 2011 Crop Statistics and Annual Report[6] (Crops Report), prepared by the County of San Diego Department of Agriculture, Weights and Measures, the top ten crops in the County are:

- ornamental trees and shrubs;
- indoor flowering and foliage plants;
- colored bedding plants;
- avocados;
- tomatoes;
- eggs;
- lemons;
- cactus and succulents;
- herbaceous perennials; and
- foliage.

Field crops, which are the types of crops grown on the parcels included in this analysis (strawberries and Asian vegetables at the Manchester property, and various row crops at the Cannon property), account for less than 1% of all major crops in the County given the limiting factors discussed previously. As compared to 2010, the total value of field crops in the county has fallen from $5,117,287 to $5,038,735 in 2011, which has an indirect relationship with the increase in field crop acreage from 247,565 acres in 2010 to 248,089 acres in 2011.

[6] http://sdfarmbureau.org/SD-Ag/Ag-Facts.php

3.0 BASELINE INFORMATION

3.1 Soils – Overview

The soils information presented in this analysis is derived from statewide soils maps that have been prepared by both State and Federal government entities. The California Department of Conversation, Division of Land and the United State Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), both conduct regular and on-going assessments of soil types and then prepare detailed soil maps. Once soils are mapped, they are grouped into the following categories that have specific definitions. The categories and definitions are presented below:

- Prime Farmland – In California, California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program (FMMP) maps all statewide farmlands. The FMMP's soils study area is contiguous with modem soil surveys developed by the USDA. The FMMP requires that any land designated as Prime must meet the following criteria, which are related to Land Use and Soils. Under the category of Land Use, the following criterion is applied: 1) the land has been used for irrigated agricultural production at some point during the four years prior to the Important Farmland Map date; Irrigated land use is determined by FMMP staff by analyzing current aerial photos, local comment letters and related GIS data, supplemented with field verification. Under the category of Soils, the following criteria are applied: 1) the soil must meet the physical and chemical criteria for Prime Farmland or Farmland of Statewide Importance as determined by the NRCS. The NRCS compiles lists of which soils in each survey area meet the quality criteria. Factors considered in qualification of a soil by NRCS include: a) water moisture regimes, available water capacity, and developed irrigation water supply; b) soil temperature range; c) acid-alkali balance; d) water table; e) soil sodium content; f) flooding (uncontrollable runoff from natural precipitation); g) erodibility; h) permeability rate; i) rock fragment content; and j) soil rooting depth[7]. As such, farmland with the optimal combination of physical and chemical features to sustain long-term agriculture is described as Prime. The land has been determined to have the soil quality, growing season and moisture supply needed to produce sustained high crop yields[8].
- Farmland of Statewide Importance – As with Prime Farmland, Farmland of Statewide Importance must also meet both the criteria described above with respect to Land Use and Soils and is similar to the Prime Farmland category. The difference is that Farmland of Statewide Importance tolerates greater shortcoming with the soil such as greater slopes or less ability to store moisture, for example[9].

[7] http://www.conservation.ca.gov/dlrp/fmmp/overview/Pages/prime_farmland_fmmp.aspx
[8] http://www.conservation.ca.gov/dlrp/fmmp/mccu/Pages/map_categories.aspx
[9] Ibid.

- Unique Farmland – This category of farmland is categorized as having lesser quality soils, but is still used for the production of leading agricultural crops. This farmland is typically irrigated, but can also include non-irrigated orchards or vineyards found in some climatic zones in the state. These lands must have been used for irrigated agricultural production at some time during the four years prior to the mapping date[10].
- Farmland of Local Importance – Lands that have been determined by local jurisdictional authorities such as county boards of supervisors or local advisory committees to have a specific importance to the local agricultural economy, are considered Farmland of Local Importance[11].

The Farmland Mapping and Monitoring Program (FMMP) has three other categories of land including:

- Grazing Land – Land that is particularly suited to the grazing of livestock given existing vegetation. This particular designation was developed in concert with the California Cattlemen's Association, the University of California Cooperative Extension and a host of other groups with an interest in grazing and livestock[12].
- Urban and Built-up Land – This category refers to land that is occupied by structures with a building density of at least one unit to 1.5 acres or 6 structures to a 10-acre parcel. This category includes land uses such as residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures, and other developed purposes[13].
- Other Land – All other lands that do not fall into the categories above are subsumed into this category. Examples of these lands include low-density rural developments, brush, timber wetland, riparian areas not suitable for livestock grazing, confined livestock poultry or aquaculture facilities, strip mines, borrow pits, and water bodies smaller than 40 acres. In addition, vacant and non-agricultural land surrounded on all sides by urban development and greater than 40 acres is mapped as Other Land[14].

The California Coastal Act also has specific language and standards applicable to agricultural lands. Coastal Act Section 30241states that farmland within the Coastal Zone must meet any of the following in order to be designated as Prime: 1) have a soil classification of Class 1 or II soils as defined by the NRCS; 2) have a Storie Index Rating of 80 through 100; 3) have the ability to support livestock, at least one animal unit per acre as defined by the USDA; or 4) have been

[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Ibid.

planted with fruit or nut bearing trees, vines, bushes or crops that have a nonbearing period of fewer than five years and that will normally return during the commercial bearing period on an annual basis from the production of unprocessed agricultural plant production not less than $200 per acre. In cases where land does not meet the definition of Prime Agriculture per Section 30241, Section 30242 of the Coastal Act applies to other agricultural lands suitable for agricultural use, and limits conversions of such lands to non-agricultural uses unless continued agricultural use is not feasible, or the conversion would preserve prime agricultural land or concentrate development consistent with Section 30250. Any permitted conversion of agricultural land pursuant to Section 30242 must be compatible with continued agricultural use on surrounding lands.

3.1.1 Soils on Identified Parcels in the Study Area

As discussed, this analysis is germane to two distinct properties, the Manchester property and the Cannon Property. Per the FMMP maps, the soils identified on the Manchester site are classified as Class III soils with a Storie Index Ration of 61. The specific soils on the site are Corralitos loamy sand, 2–5% slopes. According to the Natural Resources Conservation Service (NRCS), Class III soils have severe limitations, which reduce the choice of plants or require special conservation practices or both. Hence, these are not strictly Prime soils under the California Department of Conservation or the USDA's definitions, unless they are irrigated. The FMMP has classified the Manchester property as Prime, if irrigated. Under Coastal Act definitions, these soils are not classified as Prime. Corralitos loamy sand is not suitable for livestock grazing; the parcel is currently cultivated in strawberries and Asian vegetables.

The Cannon property is primarily underlain with Class III soils that have a Storie Index Rating of 54 (56.7 acres), and is partly underlain with Class IV soils that have a Storie Index Rating of 15 (14.3 acres). Specifically, the soil types are Marine loamy coarse sand, 2–9% slopes (Class III) and Carlsbad gravelly loamy sand, 15–30% slopes (Class IV). Although not strictly prime soils, the FMMP has classified the Cannon property as Prime, if irrigated. The FMMP has also categorized the property as Farmland of Statewide Importance and Unique Farmland. Under the Coastal Act definitions, these soils do not qualify as Prime, nor are marine loamy coarse sand suitable for livestock grazing. After laying fallow for a few seasons (approximately two years) due to the high cost of water, the property is currently being recultivated to strawberries and potentially other row crops.[15]

[15] Personal communication with the farmer, March 2013

3.2 Geographical and Historical Information

The Manchester Property

The Manchester property consists of 30.5 acres located in the City of Encinitas. The property is bounded by residential uses to the north and east, by Manchester Ave and San Elijo Lagoon to the south and 1-5 to the west. The current agriculture on the parcel is cultivated field crops, strawberries and Asian vegetables, but the parcel has also produced flowering plants in the past.

Historically, agricultural products in Encinitas have been horticultural, including flowers and flowering plants such as poinsettias, which are native to Mexico and Central America. Production of poinsettias as the main agricultural commodity in the City began in the early 1920's and the City was at one time known as the "Flower Capital of the World." Over the past 90 years, these nurseries and greenhouse products have been the agriculture of choice for a number of reasons:

1. the method of production is highly compatible with a variety of differing surrounding land uses;
2. there is little or no use of machinery typical in large-scale farming;
3. there is little usage of pesticides typically applied on large farms or in other intensively cultivated uses; and
4. the lack of dust and odors associated with large-acreage farming.

The nurseries and greenhouse remain the predominant agriculture in the City of Encinitas. Although in comparison to other coastal communities the northern portion of the County retains a decent amount of land in agriculture use, there is also increasing pressure to relocate operations to other regions. The combination of land costs, water costs, and labor costs, are pushing growers and operators out of the country. A good example of this is the once indomitable poinsettia industry, much of which is now located in central and south America, a trend that began in the 1990's and continues today.

The Cannon Property

The Cannon property is located in the City of Carlsbad. The entire property is owned by San Diego Gas and Electric (Sempra Utilities) and is leased out to different growers for cultivation. Presently, there are 106.2 acres of agriculture on the parcel in various row crops. These crops rotate. The parcel is bounded by Agua Hedionda Lagoon to the north, I-5 to the west, Cannon Road to the south, and open space to the east. The parcel has been in active

cultivation, mainly strawberries and other assorted row crops, since the 1920's. Between 2009 and the present, portions of the parcel had been rendered fallow due to the high cost of water and inability to invest in capital improvements. Recently, in March of 2013, the farmer has expressed an ability to potentially re-invest in the portion of the parcel that has lain fallow and restart strawberry cultivation[16].

The historic agriculture in the City of Carlsbad is varied. In the 1880's most agricultural land was in orchards of citrus, avocados and olives. Over the next decades, the agricultural production shifted to assorted row crops, strawberries, and production in greenhouses. The trend of greenhouses remains today. As discussed above, the ability of greenhouses to remain compatible with other non-agriculture uses is high given the low disturbance to other uses, i.e., pesticides, dust, noise.

[16] Personal communication with Farmer, March 2013

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4.0 PRODUCTION OPERATING COSTS

The production operating costs associated with growing strawberries and row crops vary throughout the state. In general, most studies cite costs from between $30,000 and $40,000 in production costs per acre, including harvest costs[17]. Production operating costs include the land preparation and soil bed up, plant establishment, fertilization, irrigation, pest management, and harvest. The second category of expenses includes labor and equipment.

The following information and assumptions included in the analysis are based on typical farm operation and production practices standard in well-managed fields. The overhead and calculations are derived from the Department of Agricultural and Resource Economics, University of California Davis, the UC Cooperative Extension, and specific information on the subject parcels.

4.1 Land Preparation and Bed Up

Land preparation and bed up is a rather consistent and fixed cost in the industry. In order to cultivate successfully, growers conduct a series of operations such as discing and ringrolling. Typically, discing and ringrolling is conducted over the field a series of five times, and then the subsoil is ripped in order to loosen the compacted soils to a depth beyond the cultivation layer to aerate soils, increase filtration rates, and decrease erosion. The fields are then smoothed over with a triplane, beds are shaped, pre-plant fertilizer is incorporated and drip tape is buried in the bed and a plastic mulch layer is applied. Costs associated with this are labor, which entail the renting of a tractor or the grower will contract out for a custom operator[18].

4.2 Plant Establishment

Once beds are made, the entire length of the field is fumigated, and a tracklayer tractor with a blade makes roads and divides the field into smaller blocks, generally 200–300 feet long. Holes are punched in the plastic mulch using a mechanical punch, and the plants are delivered to the beds for planting in the punched holes. Typically, there are 25,000 plants per acre. Costs associated with this include the plants and the labor.

4.3 Fertilization

Slow release fertilizers are typically used in conventional farming, which is how both of the subject parcels are farmed. Slow-release is applied at 500 pounds per acre, and another fertilizer application is broadcast pre-planting. The slow release fertilizer is drilled pre-plant in the bed with a fertilizer drill with a bed shaper. Throughout the season, growers continue to apply various types of liquid fertilizers through the drip line or with foliar spray.

[17] Personal communication with Grower, July 2013
[18] http://sfp.ucdavis.edu/crops/coststudieshtml/

4.4 Irrigation

The growers rent sprinkler pipe for the pre-plant and the establishment of sprinkler irrigations. Prior to planting, the field is irrigated for 12 hours. Typically, two to three laborers, in addition to the tractor driver, lay and pick up the pipe. After planting, sprinkler pipe is laid out and the field is sprinkled two hours per day for 15 days. There are two to four irrigators who manage the sprinkler and drip irrigation system. Rainfall has not been taken into account in irrigation.

4.4.1 Water

Approximately 80% of the water in San Diego County is imported from the Colorado River and through the State Water Project[19]. The remaining ~20% is derived from local groundwater and surface water sources, in addition to recycled water, and water from conservation measures. In large part, however, growers in the County are dependent on non-local sources and they pay some of the highest rates in the State for their water. Compared to the Central Valley and neighboring Imperial County, growers in the County pay 30 times more for their water.[20] Hence, the opportunity cost for growers is significantly higher than in other parts of California. The price of water is a significant factor driving the ability of agriculture to remain both sustainable and competitive and is decisive in determining the amount of acreage grown and the type of crop cultivated.

The Manchester Property

The Manchester property is made up of two APNs served by the San Dieguito Water District, which obtains their potable water from Lake Hodges in the form of local runoff and imports of raw water from the San Diego County Water Authority. All water is treated at a filtration plant (R.E. Badger Filtration Plant) prior to distribution. The current agricultural rate for water supplied by the district is $2.80 per 100 cubic feet or $985 per acre-foot of water, however, agricultural rates are proposed to increase to $3.13 per 100 cubic feet in September 2013, and to $3.40 per 100 cubic feet in July 2014, which is less than a year away[21]. While the cost increase is graduated over time to allow for growers to adapt and adjust, the already comparatively high rates put growers at a disadvantage and adds pressure to the types of crops cultivated.

The most recent documented water usage on the larger parcel (18.683 acres) was recorded in July and August of 2012, and the water usage at that time was 71 units of water, where one unit equals 100 cubic feet or 748 gallons of water. There is no current water usage information on the smaller parcel (16.098) or more recent water usage date on the larger 18-acre property.[22]

[19] http://www.sdcwa.org/frequently-asked-questions-and-key-facts#t7n115
[20] http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/stats_sdagriculture.pdf
[21] http://www.carlsbadca.gov/services/departments/finance/Documents/APPROVED%20WATER%20SEWER%20RATES%20JAN%202013.pdf
[22] Personal communication with the San Dieguito Water District

The Cannon Property

The Cannon property is served by the Carlsbad Municipal Water District, which is a subsidiary district of the City of Carlsbad. The District provides 100% of its water from the Colorado River through the Colorado River Aqueduct and from Northern California through the California Aqueduct, or more commonly known as the State Water Project. The current agricultural rate for water is $3.70 per 100 cubic feet[23]. As the property owner could not be reached for current water usage numbers, this analysis presumes that the water usage on the Cannon property is similar to the water usage on the Manchester property given the similar cultivation. Therefore, projections have been made.

4.5 Pest Management

The pesticide costs included in this analysis have been considered at the full retail price and the pesticide program typical for row crops/vegetables and strawberries. Fumigants are approximately $2,900 per acre. Weed management is generally controlled by hand weeding, and the analysis assumes a rate that totals 76 hours per acre over a period of eight months. This analysis also assumes insects and diseases are also treated through insecticide and fungicide treatments.

4.6 Harvest

The crop cycles for the harvest are July and June for strawberries, and December and January for other row crops and vegetables.[24] The early harvests of crops go directly to fresh markets, and as other growing areas come into production, the growers tend to shift to the frozen markets. During harvest time, growers run 30–40 person crews with a general foreman for crew supervision, and one field checker on smaller acreages to two field checkers on the larger parcels, to check the field for proper picking. There is also one picking card puncher for smaller parcels and two picking card punchers for the larger parcels per crew to count out the boxes by each picker. For fresh market distribution, crops are picked by hand and then placed into one-pound containers, which are located in container trays that hold 8-one pound containers. Picking rates per day range according to picker from three trays per hour early and late in the seasons, and five to eight trays during the peak season. Growers use 2-ton flatbed trucks that hold 116 pallets of 110 fresh market trays per pallet, or 1,760 fresh trays per load or 960 freezer trays per load. Once the fields are harvested, they need to be cleaned through mowing, removing mulch, and discing.

[23] http://www.carlsbadca.gov/services/departments/finance/Documents/APPROVED%20WATER%20SEWER%20RATES%20JAN%202013.pdf

[24] Communication with farmer on one of the parcels on the Cannon property

4.7 Yield

Row crops and strawberries are measured in the trays per acre for the fresh and frozen market. Tray weights are used to convert the yield to weight per acre. Standard consumer trays hold 8-one pound containers, which typically range from 9.5 to 10.5 pounds per tray. This analysis uses 10 pounds per tray for fresh market products and 18 pounds per tray for the freezer market. Once trays are collected, they are delivered to coolers; trays usually weigh 10–20 pounds. Based on research[25], the total per acre yield is 65,000 pounds delivered to the fresh market and 20,800 pounds delivered to the freezer.

4.8 Cooling

Average cooling costs are $0.50 per tray.

4.9 Selling Costs

Selling costs are market dependent, but according to 2011 figures, these have been estimated at $0.66 per tray.

4.10 Labor and Equipment

Presently, the labor costs associated with agriculture are some of the most variable and unstable costs industry wide, and current trends indicate they are also increasing rapidly.

4.10.1 Labor

Labor costs are variable, but range between $13 and $14 per hour for machine operators, to $11 and $12 per hour for general labor.

4.10.2 Equipment Operating Costs

Equipment repair costs were based on the purchase price, annual hours of use, total hours of life, and repair coefficients formulated by the American Society of Agricultural Engineers (ASAE). Fuel and lubrication costs have been determined by the ASAE and are based on the maximum power takeoff, horsepower, and fuel type. Prices for on-farm delivery of diesel and gasoline have been estimated at $3.44 and $3.85 per gallon, respectively.

[25] http://fruitsandnuts.ucdavis.edu/datastore/?ds=391&reportnumber=612&catcol=2806&categorysearch=Strawberry

5.0 ESTIMATED PRODUCTION COSTS PER ACRE

The following summary table on the production costs per acre (Table 1) have been prepared with information derived from the agricultural industry, information provided from the UC Cooperative Extension, and the preparer's estimates. Most information is based on 2011 data.

Table 1
Per Acre Production Costs[26]

Operation – Cash and Labor Costs Per Acre							
Operation	*Time – Hours*	*Labor Cost – in dollars*	*Fuel – in dollars*	*Equipment – Lube and Repair – in dollars*	*Material Cost – in dollars*	*Custom/Rent – in dollars*	*Total Cost*
Disc/Roll	0.50	8	26	9	0	0	44
Subsoil	0.90	15	47	13	0	0	76
Plow	0.27	4	14	5	0	0	23
Level/Smooth	0.50	8	20	5	0	0	33
Fertilize – Custom	0	0	0	0	184	15	199
Land Prep Chisel	0.30	5	16	4	0	0	25
Irrigate – Layout	4.00	308	31	10	107	0	456
Shape beds	0.90	15	47	18	0	0	80
Fertilize/Pre-Plant	0.25	4	4	1	290	0	300
Irrigate – Install drip	0.14	2	2	1	327	0	332
Weed bed tops	0	123	14	4	0	0	140
Lay Mulch	0.41	12	6	2	572	0	592
Cut roads	0.62	123	14	4	0	0	140
Lay laterals and connect drip	18.0	202	0	0	0	0	202
Cultivate furrows	0.69	11	12	3	0	0	26
Weed furrows	0	0	0	0	9	23	32
Irrigate through drip	29	325	0	0	393	0	718
Punch holes	0.69	11	5	1	0	0	18
Transplant	42	471	0	0	2,925	0	3,396
Hand weeding	76	853	0	0	0	0	853

[26] Estimated (based on UC Extension, 2011 Figures)

Table 1
Per Acre Production Costs[26]

Operation – Cash and Labor Costs Per Acre							
Operation	*Time – Hours*	*Labor Cost – in dollars*	*Fuel – in dollars*	*Equipment – Lube and Repair – in dollars*	*Material Cost – in dollars*	*Custom/Rent – in dollars*	*Total Cost*
Worms	0.58	10	6	2	42	0	60
Drip fertilizer	0	0	0	0	79	0	79
Drip fertilizer	0	0	0	0	210	0	210
Disease – Botrytis/mildew	1.17	19	12	4	157	0	192
Insect mite	2.40	27	0	0	120	0	147
Disease – Botrytis/mildew	1.17	19	12	4	265	0	300
Disease - mildew/mites	.58	10	6	2	152	0	169
Disease - mildew	.58	10	6	2	10	0	27
Disease – Botrytis/mildew	.58	10	6	2	157	0	175
Disease Botrytis/Lyngus /Mite	.58	10	6	2	138	0	156
Disease Botrytis/Lyngus /Mite	.58	10	6	2	150	0	168
Harvest	704.22	12,059	33	15	7,514	0	19,621
Field Clean Up	1.94	245	30	10	0	23	308
Cooling	0	0	0	0	0	2,210	2,210
Selling Costs	0	0	0	0	0	2,917	2,917
Fruit/Vegetable Commission/ Association Assessment Fees	0	0	0	0	98	0	96
Interest on Operating Costs @ 5.75%	0	0	0	0	0	0	634
Total operating costs/acre	**889.57**	**$14,808**	**$368**	**$121**	**$13,924**	**$6,411**	**$36,264**

6.0 ESTIMATED REVENUE RETURNS

The Table 2 below provides an estimate or the revenue returns for the parcels and operations analyzed.

Table 2
Costs and Returns Per Acre[27]

Gross Returns	Quantity/Acre	Unit	Price or Cost/Unit – in dollars	Value or Cost/Acre – in dollars
Fresh (10 pound tray)	4,4200	tray	$8.25	$36,465
Freezer (19 pound tray)	1,156	tray	$5.40	$6,242
Total Gross Returns	5,576	tray		$42,707
Operating Costs				
Insecticide – aggregated				$475
Fungicide – aggregated				$596
Bio- Control - aggregated				$120
Herbicide – aggregated				$35
Fertilizer- aggregated				$763
Custom Fertilizer/Drip				$6,411
Material - aggregated				$8,413
Water	28	acin (acre inch)	17.86	500
Plants	25,000	thousand	117	$29,000
Assessment				
Fresh (10 pound tray)	4,420	tray	0.02	77
Freezer (14 pound tray)	1,156	tray	0.02	20
Labor				
Equipment Operator	26.63	hours	13.84	369
Field Labor	1,286.87	hours	11.22	14,439
Machinery				
Fuel - Gas	10.48	gallon	3.85	40
Fuel - Diesel	95.13	gallon	3.44	327
Lube				55
Machinery Repair				66
Interest on Operating Capital				634
Total Operating Costs/Acre				**$36,264**
Net returns above operating costs				**$6,443**

[27] Estimated (based on UC Extension, 2011 Figures)

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7.0 CONCLUSIONS

The analysis above has taken into consideration the following information in the determination that the impacts of the project would not impair the viability of the parcels to remain in active agricultural production.

- soils and farmland classifications;
- historic and current agricultural production and practices in the County;
- per acre production cost estimates; and
- estimated revenue returns.

Soils and Farmland Classifications

As discussed earlier in the analysis, the soils on the subject parcels are primarily Class III soils, and to lesser extent, Class IV soils on the Cannon property, and are therefore not strictly considered Prime soils under the FMMP classifications and categories, unless they are irrigated. In the case of The Coastal Act, these soils are not considered Prime.

Historic and Current Agricultural Practices in San Diego County

Agriculture in the County is conducted on small farms (with a median farm size of four acres; 90% of the County's farms are under 49 acres28) and demands high value crops. The high cost of land and the high cost of water, as well as the lack of superior soil quality and the prevalence of slopes unsuitable to large-scale cultivation, necessitate this growing situation. The agricultural economy in the County is highly dependent on greenhouse crops, which are compatible with surrounding non-agricultural uses, and the row crops grown on the subject parcel account for less than 1% of the overall County agricultural revenue. Agriculture in the County has survived and thrived in large part throughout the last century and a half by innovating and responding to changing market demands and environmental situations.

Agriculture on the subject parcels, which are of acreages over the County average, is existing and persists to this day, however, as briefly mentioned, one of the growers on the Carlsbad parcel was forced to leave fields fallow given the high water costs.

Per Acre Production Cost Estimates

Per acre production, cost estimates for the crops on the subject parcels are $36,264.

[28] http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/stats_sdagriculture.pdf

Per Acre Estimated Revenue Returns

The per acre estimated revenue returns above the operating costs for the subject parcels and crops is $6,443.

Acreage Impact of North Coast Corridor Project on the Agricultural Viability of the Parcels

According to analysis provided in the March 2013 Draft North Coast Corridor PWP/TREP, the impacts to the Manchester and Carlsbad properties are 8.4 acres and 2.3 acres. On the Manchester property, approximately 28% of the current acreage would be impacted by the project, and on the Carlsbad property, approximately 2% of the property would be impacted by the project. Strictly comparing these parcels to the overall County average of parcel size and production viability, the answer of continued agricultural viability is positive. The impacts of the project would not impair the viability of the parcels to remain in active agricultural production.

Based upon the analysis provided in the per acre production cost estimates and the per acre estimated revenue returns, the answer is not quite as clear, but is dependent on the individual grower and efficiency of their respective farm management plans. Determination of profitability of the individual parcels at present would be speculative, however, anecdotal evidence based on the 150 year trend of types and acreage in agriculture in San Diego County as well as recent discussions, assessments and personal communications, indicates that the growers will remain in production given the fact that historical crop production rotates on the sites, and that crop production has changed over time consistent with the prevailing trends. Historical evidence also supports the viability of the parcels and products in their proximity to large markets and articulated transportation networks with access to even larger distribution centers.

I-5/LOSSAN Rail North Coast Transportation Corridor

Transportation White Paper: The Need for a Multimodal NCC Program



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Caltrans
SANDAG

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January 5, 2012 **Final Draft**

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1.0 PURPOSE AND SUMMARY

This white paper demonstrates the need for a multi-modal approach to address existing and projected transportation and related coastal access deficiencies in the I-5/LOSSAN North Coast Corridor (NCC) over the next 40 years. It presents a vision for the corridor in 2050, outlining the numerous enhancements planned for both transportation and coastal resources, and demonstrating that the transportation vision is consistent with the public access and recreation policies of the Coastal Act. However, this paper does not address the interim phasing of individual projects to achieve the 40-year vision, which will be presented separately.

Over the past four decades, the NCC has grown dramatically. By 2006, nearly half a million people lived in the corridor and that number is expected to grow by 23% by 2030. There will be approximately 400,000 jobs in the corridor by 2030.[1] In addition, the NCC contains some of the most heavily used beaches in California and offers a wide range of coastline activities that are enjoyed by the public year-round. As a result of residential, commute, recreational, and commercial use, traffic congestion and impediments to access in the NCC are significant and growing problems for residents, visitors, and businesses alike.

SANDAG and Caltrans have prepared a draft Transportation and Resource Enhancement Program and Highway Public Works Plan (TREP/PWP) that presents a vision for the corridor that addresses the mobility and coastal access needs of those who live, work, play and do business in the NCC through an integrated, multi-modal approach. The vision balances these mobility needs with protection and enhancement of coastal resources, and it does so within the context of a larger planning framework that attempts to maximize the returns on transportation investments across the entire San Diego region.

To accommodate the growth in population and travel demand that will occur in the corridor, mobility improvements planned for the NCC rely on projects that move people—not just cars. Planned projects include rail and bus facilities and service enhancements to increase the capacity of transit, as well as expansion of the I-5 highway to incorporate Managed Lanes for carpools, vanpools and transit. Bike and pedestrian improvements are also planned to provide alternative, non-vehicular modes of transportation in the corridor, which will also provide new coastal recreation opportunities and eliminate or improve existing public access barriers to the corridor's significant coastal resource areas. The result is a balanced mix of investments that recognize the importance of transit to future growth, while acknowledging the many constraints that hinder its viability in the NCC.

By focusing on a high-occupancy, multi-modal program in the corridor, this essential transportation lifeline in the region will continue to serve the disparate needs of the area's travelers well into the future, ensuring ongoing access to, through and within the corridor. The incorporation of bike and pedestrian facilities and coastal resource enhancements creates a truly coordinated approach for improving mobility and access in the NCC, while preserving coastal resources to the greatest extent possible.

[1] TREP/PWP Chapter 3

2.0 CURRENT AND FUTURE TRAVEL DEMAND IN THE NORTH COAST CORRIDOR

2.1 Existing Transportation Facilities and Services

People travel for a variety of reasons and their trips have an even greater variety of start points (origins) and end points (destinations). How travelers make their trips depends on the range of transportation facilities and options. The NCC offers travelers an array of multi-modal options:

Rail

The LOSSAN rail corridor extends from San Diego on the south to San Luis Obispo on the north. It runs through six counties (San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego), connecting the major metropolitan areas of Southern California, and serving some of the most populous areas of the state. The LOSSAN corridor is the second busiest intercity rail corridor in the nation. Amtrak's Pacific Surfliner service; Metrolink and COASTER commuter rail services; and Burlington Northern Santa Fe (BNSF) freight services all operate along the LOSSAN rail tracks in the NCC. The east/west SPRINTER light rail service connects with the LOSSAN corridor at the Oceanside Transit Center.

COASTER service between downtown San Diego and Oceanside is operated in both directions every 30 to 45 minutes during peak periods and less frequently during the off-peak, for a total of 22 one-way trips per day. Stations within the NCC are located at Oceanside Transit Center, Carlsbad Village, Carlsbad Poinsettia, Encinitas, Solana Beach, and Sorrento Valley. Amtrak Pacific Surfliner service between downtown San Diego and San Luis Obispo is operated with approximately 12 trips per day in each direction, with stops in Oceanside and Solana Beach in the NCC. Metrolink service connects the Oceanside Transit Center to locations in Orange, Los Angeles, and San Bernardino counties with 16 trips on weekdays. Four to eight BNSF freight trains use the corridor each day (See Appendix A: NCC Bus and Rail Service Maps).

Bus

Local bus service is provided by the North County Transit District (NCTD) in the northern and central areas of the NCC (branded "Breeze"), and by the San Diego Metropolitan Transit System (MTS) in the southern portion of the NCC. Existing all-day bus service in the corridor is local in nature, with the NCTD Route 101 providing service along the length of the North Coast Corridor via Coast Highway and NCTD Route 309 linking Oceanside to Encinitas via El Camino Real. As many as fifteen other local bus routes and intercity buses provide feeder service to COASTER and Amtrak stations within the corridor (See Appendix A: NCC Bus and Rail Service Maps).

Freeway

I-5 is the principal north-south auto and truck transportation corridor in the western US, extending from the US/Mexico international border to the US/Canada international border. It has been named by the U.S. Department of Transportation as one of six "Corridors of the Future" based on its essential role in interstate and international commerce.[2] In Southern California, I-5 connects San Diego County with

[2] U.S. Department of Transportation Press Release, September 10, 2007. http://www.fhwa.dot.gov/pressroom/dot0795.htm

Orange County, the Los Angeles metropolitan area, and Mexico. In the NCC, I-5 currently consists of four general purpose lanes in each direction and is used for interregional, regional and local trip making.

Local Roads

Regional arterials and state highways provide access to and within the corridor. Coast Highway and El Camino Real, the two main north-south arterials, supplement some of the local circulation provided by I-5. In addition to these north-south arterials, there are three east-west state highways that intersect I-5 and provide access to the corridor: SR-76; SR-78; and SR-56. Numerous east-west arterials also provide access to and from I-5 to the residential areas, places of employment, retail, and other destinations in the corridor. Many of these arterials, especially those parallel to I-5, have gaps due to environmental and topographic constraints resulting in a discontinuous local street network within the corridor. Capacity expansion, extensions and gap closures are generally infeasible as a result of these constraints and existing development.

2.2 Users of the NCC Transportation Facilities

The NCC is used by a wide variety of travelers, with a range of needs that require an array of transportation solutions. A traveler's trip purpose, trip length, and origin and destination influence and often dictate the choice of travel mode. Because trip characteristics vary so widely, a multi-modal corridor provides travelers with the ability to choose the mode that best meets their travel and access needs for each trip.

Table 1 identifies the key types of travelers who use the NCC and the primary types of trips they make. The classification of trip types depends upon the distance traveled as well as the locations of each trip's origins and destinations relative to the NCC. Taking consideration of where the "ends" of the trip fall, Table 1 and Table 2 utilize the following definitions for travel that utilizes NCC facilities:

- **Internal Trip:** Both ends of trip in NCC (regardless of distance)
    - *Example: An Oceanside resident taking a day trip to Carlsbad State Beach*
- **Regional Trip:** One or both ends of trip outside NCC but within San Diego region
    - *Example: A commuter traveling from her Encinitas home to Downtown San Diego; a Fallbrook resident using I-5 to visit relatives in Coronado*
- **Interregional Trip:** One end of trip within San Diego region, other end outside San Diego region
    - *Example: A family from Los Angeles visiting Legoland; a Mission Valley resident attending a business meeting in Orange County*
- **Interregional–Through Trip:** Both ends of trip outside San Diego region
    - *Example: Freight movement from Mexico to Los Angeles*

Table 1: Typical Characteristics of NCC Travelers and Trips

	Residents	Commuters	Visitors	Businesses	Interregional & Through Travelers
General Trip Purpose	• Shop • School • Errands • Recreation	• Work	• Recreation • Tourism	• Goods Movement	• Multiple
General Trip Length					
Short (< 5 miles)	■	■			
Medium (5-30 miles)	■	■	■	■	
Long (> 30 miles)		■	■	■	■
Trip Type					
Internal	■			■	
Regional	■	■	■	■	
Interregional	■	■	■	■	■
Interregional–Through			■	■	■

Table 2 provides a breakdown of the existing and projected travel patterns of I-5 travelers in the NCC. As travel grows in the corridor, all types of trips are expected to increase in absolute terms, indicating a definite need for the NCC transportation system to accommodate new demand. In relative terms, the projections show an increasing proportion of regional and interregional trips using I-5, and a concurrent decrease in the proportion of internal trips. This reflects the growing importance of I-5 to non-local travelers; as the region grows, the corridor will serve as an increasingly vital link in the regional and interregional transportation system. In addition, the increasing prevalence of longer-distance travelers also indicates a strong opportunity for the success of Managed Lanes, which serve these longer trips best by separating them from the slower, "on-and-off" patterns of local and internal traffic.

Table 2: I-5 North Coast Corridor Weekday Travel Pattern Trends, 2010-2050

	2010	2035	2040	2050
Internal	38.3%	30.1%	30.7%	28.9%
Regional	41.1%	46.8%	47.0%	47.8%
Interregional	19.4%	21.2%	21.1%	22.0%
Interregional–Through	1.2%	1.2%	1.2%	1.3%

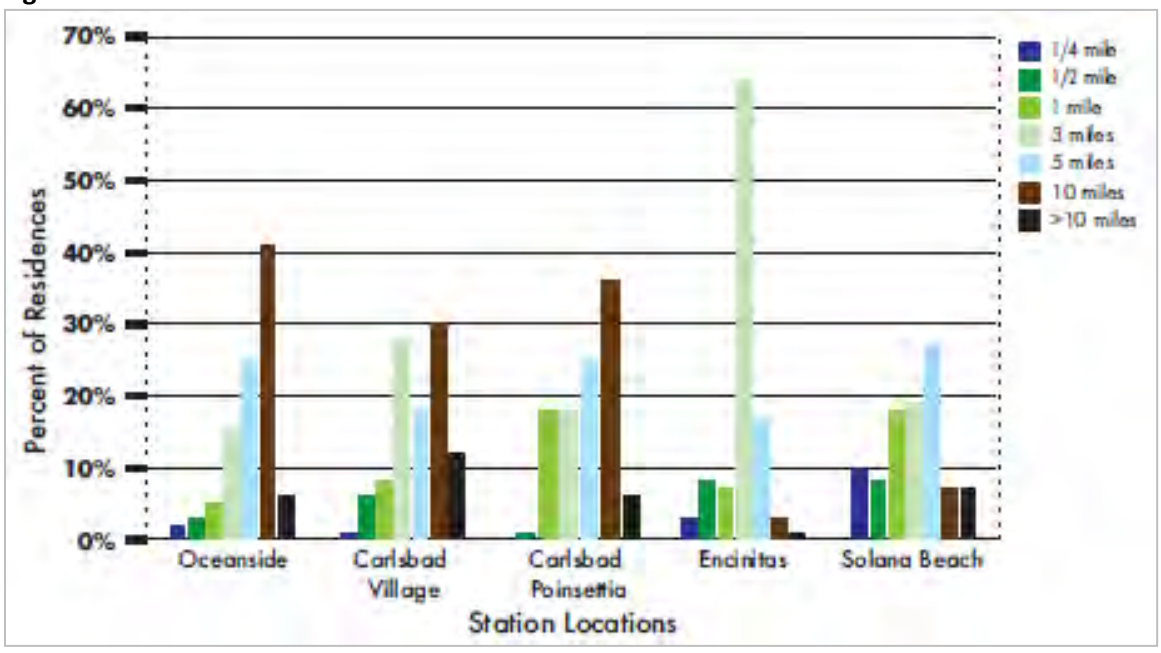
Source: SANDAG/Caltrans Series 12 Model. *Note: Not all columns add perfectly to 100% due to rounding.*

Residents

Local residents in the NCC make a variety of essential and discretionary trips to shop, run errands, go to school, and enjoy their communities' recreational opportunities. Many of their trips are short in distance and often include family members or other companions. Like most trips in the corridor, these are dominated overwhelmingly by the automobile; only 2-3 percent of all trips in the NCC are currently made by bus or rail transit.[3] While local automobile trips would ideally be made on the local street network, geographic constraints significantly limit arterial routes in much of the area, meaning that many local trips often use the highway. Indeed, nearly 40 percent of the trips on I-5 have both their origin and destination within the NCC.[4]

Local trip use of I-5 contributes to highway congestion and subjects both local and regional travelers to substantial delays. The planned expansion of rail service in the corridor will provide benefits to commuters and longer-distance travelers, but will be unlikely to attract many new local trips since, as shown in Figure 1, more than half the residents in the corridor live farther than five miles from rail stations (and many live closer to I-5 than the rail corridor). In addition, rail service on the LOSSAN corridor is geared to the long-distance commute and interregional market, with widely spaced stations (4-5 miles apart) for faster travel to a few key employment and community destinations. Local bus service may be appropriate for some local trips, but the short length of these trips often means that driving has substantial time and access advantages over fixed-route buses—so most travelers will still choose the automobile for their local purposes.

Figure 1: Distance of Residences from COASTER Stations



Source: I-5 North Coast Corridor System Management Plan (CSMP), Chapter 3, July 2010

[3] Draft 2050 Regional Transportation Plan, Technical Appendix 7, p. 7-19.
[4] TREP/PWP Chapter 2B, pg 2-24

Commuters

Commuters generally travel during peak periods and frequently leave the NCC to access employment sites throughout the region. Commute trips within the corridor tend to be southbound in the morning and northbound in the evening, reflecting the employment draw to the central and southern parts of the region. As shown in Table 3, just 3% of NCC commuters use rail and bus transit services for their work trips. A much larger percentage car/vanpool (10%) and drive alone (76%).

Table 3: Commute Trip (Home to Work) Mode Share

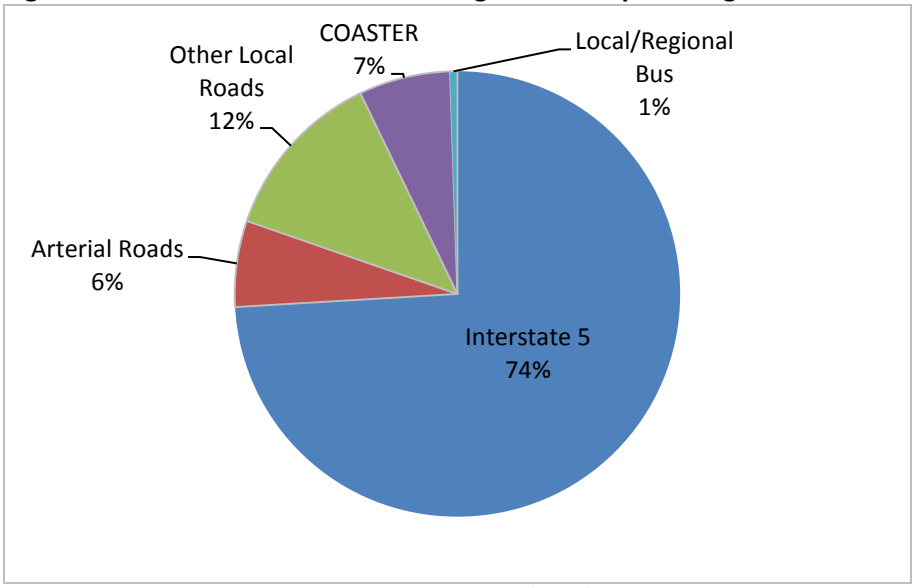
Area	Drive Alone	Carpool/ Vanpool	Public Transit	Other Modes	Worked at Home
North Coast Corridor	76%	10%	3%	2%	7%
California	72%	15%	5%	5%	4%
United States	76%	12%	5%	4%	3%

Source: I-5 North Coast Corridor System Management Plan (CSMP), Chapter 4, July 2010

Key factors that lead to the high auto (and carpool) commute trip mode shares are the dispersed nature of trip origins (homes) and destinations (jobs) both inside and outside of the corridor. On the origin end of the trip, the established low-density land use pattern in the NCC fails to generate the population concentrations necessary to create a sea-change shift in transit mode share in the corridor. On the destination end of the commute trip, the regional distribution of jobs makes automobile travel more efficient for all but a few areas of concentrated employment (i.e., Sorrento Valley, downtown San Diego, Kearny Mesa and University City). As discussed in Section 6.1, few single employment centers in the San Diego region are large enough or concentrated enough to support transit connections to all parts of the region, particularly those parts with low population densities such as the NCC.

Another way to evaluate commute trip mode share is to count the person-trips on each mode as they cross an identified line during the peak periods. This allows for an analysis of mode share during commute times for trips with similar general travel paths (i.e., north-south). Los Peñasquitos Lagoon offers such an opportunity as I-5, LOSSAN rail and Coast Highway (the major north-south arterial) all cross the lagoon in close proximity. Figure 2 illustrates the transportation mode used as travelers cross Los Peñasquitos Lagoon during the AM peak period. While not all travelers at this time are commuters, a significantly large percentage are. This data indicate that the COASTER rail service carries approximately 7% of all person-trips at this location in the corridor during the morning peak period. Almost three-fourths of the person-trips at this location are on I-5. The higher transit mode share for this narrowly defined (peak period, north-south) trip, as compared to all commute trips in the corridor (shown in Table 3), reflects the fact that predictable work trips to the few large employment centers are generally the easiest to capture via transit. Planned enhancements to the NCC rail corridor are anticipated to increase the transit mode share for these peak period work trips. However, the majority of commuters have other widely dispersed origins and destinations, and will continue to depend on the highway and arterial network for their work trips.

Figure 2: AM Peak Mode Share Crossing Los Peñasquitos Lagoon



Source: I-5 North Coast Corridor System Management Plan (CSMP), Chapter 4, July 2010

Visitors

Visitors and locals enjoy the NCC for its approximately 30 miles of beaches, quaint coastal communities, parks, open spaces, coastal resorts, and entertainment venues. Beaches in the NCC attract over half the region's beach visits, or over two million people a year.[5] Attendance figures also show that 1.7 million people visited Legoland, 1.4 million attended the San Diego County Fair, and over 662,000 people visited the Del Mar racetrack during 2010.[6] These Visitor and recreational travelers often have unique needs that are not easily served with transit. For example, a family of four spending a Saturday on the beach would likely load a vehicle with boogie boards, umbrellas and coolers full of food and drinks, which are difficult to transport on public transit. In addition, many recreational users travel from locations east of the corridor that are not directly served by north-south NCC transit services, particularly on weekends. As a result, recreational users are much more likely to make their trips via automobile. While these types of trips do not generally lend themselves to travel by transit, recreational users are more likely to be HOVs, with as many as 50 percent of weekend traffic on some sections of I-5 being HOVs.[7]

Businesses

International, inter-regional and regional businesses transport billions of dollars of goods annually using the intermodal freight transportation network in San Diego County. While there is freight service on the LOSSAN rail corridor, trucks carry more than 90 percent of the region's freight volume.[8] Aside from locally based shipping, which is mostly by truck, the majority of goods that arrive in San Diego bound for other regions are also transferred to trucks before being shipped to their inland destinations. This stems primarily from the economics of goods movement; businesses typically choose trucks to move freight

[5] San Diego Convention and Visitors Bureau, 2006 Visitors Profile Study (Table 3-6 in Draft TREP/PWP)
[6] Compiled from press releases by Legoland, San Diego County Fair, and Del Mar Thoroughbred Club
[7] TREP/PWP Chapter 2, pg. 2-25
[8] Draft 2050 RTP, page 6-36

through the region because it avoids the additional train-truck transfer that would be necessary before goods reach their final destinations, which are predominately within 100 miles. It is expected that this heavy reliance on trucks for goods movement will continue.

As the primary link to the Los Angeles area, I-5 carries about one-third of all the freight in the San Diego region, with an estimated value of up to $88 billion in 2007 and an Annual Average Daily Truck Traffic of about 7,200. In addition, in 2007 approximately 900,000 trucks entered the United States from Mexico through the San Diego region's three land ports of entry, and these international truck volumes are projected to increase to 4.5 million by 2050. In contrast, in 2007 about 9,000 loaded rail cars made this same crossing representing over $900 million in goods. By 2050, these figures are anticipated to 20,000 loaded cars and a value of $2 billion.[9] With many of these goods destined for distribution throughout the nation, I-5's role in goods movement alone makes it a vital economic lifeline—and its importance will continue to grow as the international traffic increases.

Interregional and Through Travelers

Interregional and through travelers use NCC facilities at some point in the course of their travels, but generally do so as part of longer-distance trips to or from points outside the NCC. The region is bounded by several major commercial and tourism destinations—including Los Angeles, Orange County, Riverside County, and Tijuana, Mexico—that attract many types of users. While some of these trips begin or end in the NCC, such as a family from Riverside visiting the beach or an Encinitas resident traveling to Los Angeles for a business meeting, other trips use the transportation facilities to pass through the NCC, such as freight from Mexico heading to the Port of Los Angeles or a family from Chula Vista going to Disneyland. Through trips also include shorter journeys that are entirely within the region and cross into the NCC during the trip, such as a Fallbrook resident using I-5 to reach Downtown San Diego.

During peak hours, over 60 percent of NCC travelers are using NCC facilities for these interregional and through trips.[10] These trips' shares are anticipated to grow by another 10 percent by 2040.[11] As I-5 and the LOSSAN rail corridor provide the only interregional transportation facilities to and through the NCC, they will continue to be essential in facilitating these travel patterns. The addition of Managed Lanes to I-5 will greatly improve the performance of these interregional and through trips, as the new lanes will provide an option for travelers who wish to avoid the congestion caused by local traffic.

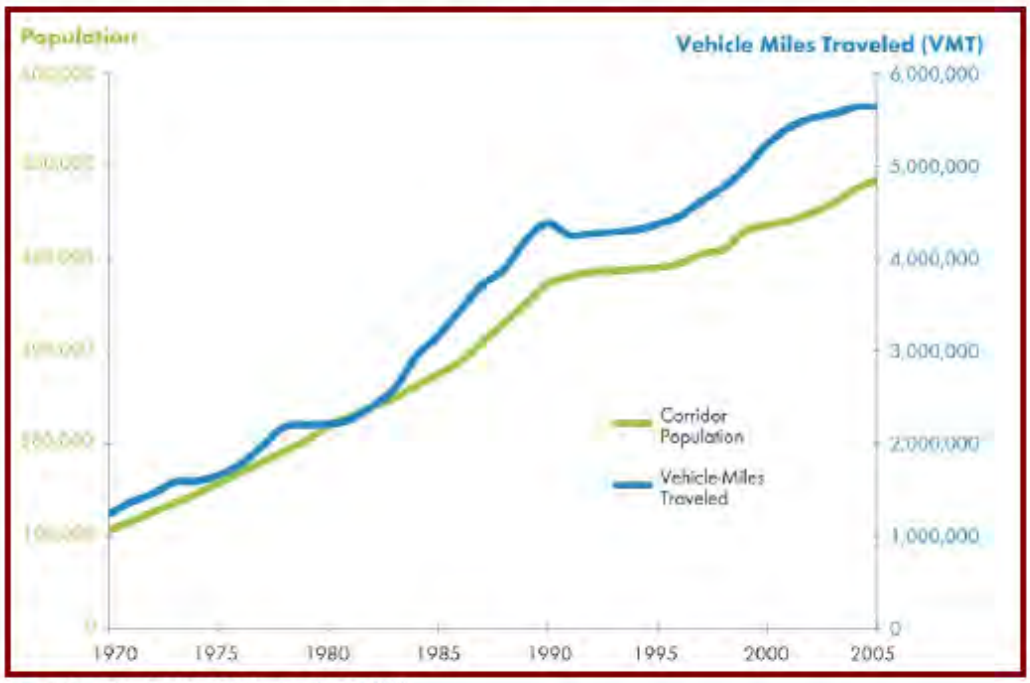
2.3 Travel Demand in the Corridor

The NCC travelers and trip types described above place a demand on the corridor's transportation facilities and services. Historically across the nation, demand for travel has increased at a faster rate than population growth—that is, people are making more and longer trips today than in the past—and the NCC is no exception. Figure 3 shows how growth in vehicle miles traveled (VMT) has significantly outpaced population growth in the NCC. Table 4 shows historic, existing, and projected daily trips on I-5

[9] San Diego and Imperial Valley Gateway Study: Comprehensive Freight Gateway Study. March 2010.
[10] Model data from Caltrans, furnished by Maurice Eaton Sep 29, 2011.
[11] TREP/PWP Chapter 2, pg. 2-24

in selected segments of the corridor.[12] In an effort to slow these increases, SANDAG and the region's local jurisdictions are pursuing innovative "Smart Growth" policies—including the tax-funded Smart Growth Incentive Program—that seek to reduce vehicle-miles traveled (VMT) and greenhouse gas emissions (See Appendix B: Smart Growth Concept Map). However, even with these measures, daily trips on the I-5 segments in Table 4 are still expected to grow by approximately 30% by 2040. In the corridor as a whole (not just on I-5), trips taken on a daily basis by individuals (daily person-trips) are forecast to grow from 2.5 million today to 3.27 million in 2030—an increase of more than 700,000 daily trips, or 30 percent.[13] As population and per-capita travel continue to grow in the NCC, greater demand will be placed on all transportation facilities in the corridor.

Figure 3: North Coast Corridor Population and Travel, 1970-2005



Source: San Diego NCC-CSMP (Chapter 4), July 2010.

Table 4: Interstate 5 Historic and Projected Daily Traffic Volumes

I-5 Segment	1970	2010	2040 (No-Build)	% Change (1970-2010)	% Change (2010-2040)
I-805 to Carmel Mountain Road	48,000	301,500	399,000	528%	32%
Encinitas Blvd to Leucadia Blvd.	43,000	209,500	280,900	387%	34%
Mission Ave. to SR-76	49,000	159,000	203,300	224%	28%

Source: : I-5 North Coast Corridor System Management Plan (CSMP), July 2010 and Staff Updates

[12] TREP/PWP Chapter 3, pg. 3-4
[13] TREP/PWP Chapter 2B, pg. 2-24

3.0 CURRENT AND FUTURE TRANSPORTATION DEFICIENCIES IN THE NCC

The NCC's transportation infrastructure, the majority of which was designed and built decades ago, is becoming increasingly strained as both population and travel demand continue to grow. The deficiencies are spread across all of the corridor's major transportation facilities—not just I-5, but also local roads, bicycle and pedestrian paths, and the rail and bus transit systems.

3.1 Highway and Road Congestion

As population and corresponding travel has grown in the NCC and the region, corridor traffic conditions have deteriorated. Long corridor travel times inhibit mobility and will continue to worsen without improvements. Congestion will further increase travel times, periods of daily congestion will lengthen, and reliability will continue to be an issue for travelers. While this deficiency may be most visible on I-5, its effects are not limited solely to the highway; I-5 congestion also results in increased congestion on the local arterial street networks, as frustrated travelers exit the highway in search of alternate routes. This "cut-through" traffic creates additional problems in the cities along the NCC, further restricting mobility and access to coastal resources.

Table 5 shows corridor median travel times under current and future conditions during peak periods. When I-5 is uncongested, it takes 23 minutes to traverse the 27-mile route from La Jolla Village Drive in San Diego to Harbor Drive in Oceanside. This same northbound trip currently takes 30 minutes during the PM peak period, and is expected to take a congestion-ridden 70 minutes by 2030 without any improvements to the highway.

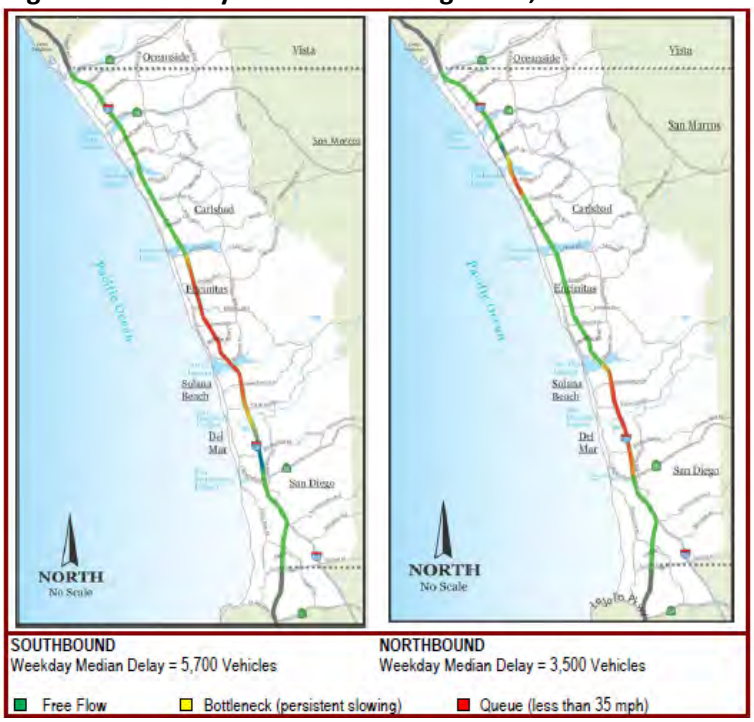
Table 5: Median Weekday Peak Travel Times (minutes)
I-5 from La Jolla Village Drive to Harbor Drive

Time/ Direction	2010	2030 No-Build
A.M. Peak Period		
Northbound	23	37
Southbound	35	54
P.M. Peak Period		
Northbound	30	70
Southbound	32	40

Source: I-5 North Coast Corridor System Management Plan (CSMP), August 2010 and Staff Updates

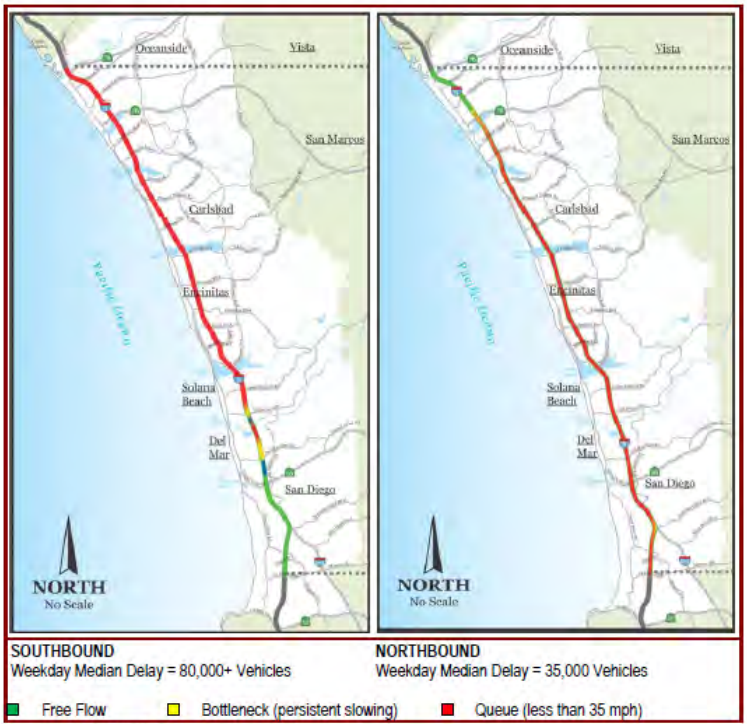
Figure 4 shows the current extent of peak-period congestion in the I-5 corridor. Figure 5 shows the projected extent of peak-period congestion in the NCC in 2030 with no improvements to I-5. Finally, Figure 6 shows that similar or worse conditions are experienced on weekend days, especially during the summer, when recreational travelers are accessing the corridor's coastal resources.

Figure 4: Weekday Peak-Period Congestion, 2008



Source: TREP/PWP Chapter 3, pg. 3-7

Figure 5: Weekday Peak-Period Congestion, Projected 2030 with No-Build Alternative



Source: TREP/PWP Chapter 3, pg. 3-16

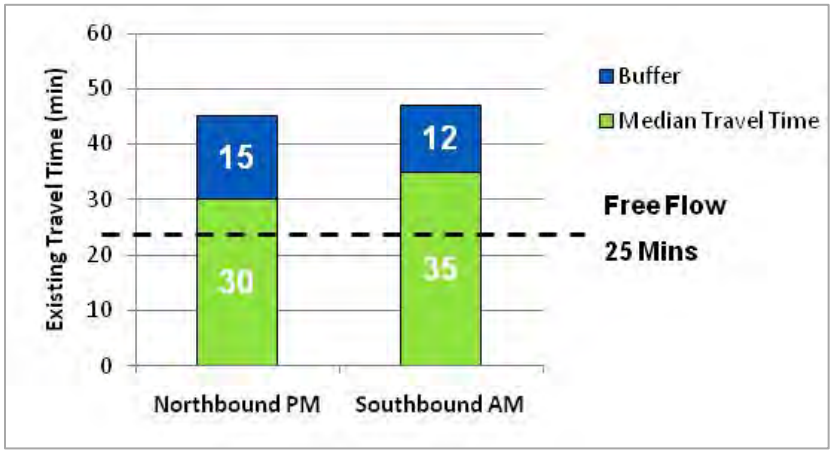
Figure 6: Summer Weekend Northbound Congestion, 2007



Source: I-5 North Coast Corridor System Management Plan (CSMP), Chapter 5, July 2010

Travel reliability is another way to understand how congestion impacts travel patterns. Reliability focuses on the predictability of the public's travel time, and measures the amount of additional time that is needed to guarantee an on-time arrival. Figure 7 presents median travel and buffer times for a person to travel through the I-5 NCC. The bottom green portion of the graphs represents the average weekday (Tuesday through Thursday) travel times, and the top blue portion of the graphs represents the "buffer time"—the extra time that would need to be added to a person's daily commute to ensure an on-time arrival 95% of the time. These buffer times only take into account variations in congestion and do not consider the effects of incidents, weather, and special events (such as the San Diego County Fair and horse races at the Del Mar Fairgrounds).

Figure 7: Median and Buffer Travel Times, 2010



Source: Caltrans Staff, December 2011.

Both increased travel times and reductions in reliability due to congestion in the freeway general-purpose lanes inhibit travel by HOV and BRT when these modes travel on the congested freeway with all the other vehicles. With congested freeways, these modes become significantly less desirable and, especially with BRT, infeasible.

As a result of increased travel times and reduced reliability, the majority of commuters will continue to experience work trip delays, truck freight movements will be further impacted, and access to coastal resources, activity centers, and facilities for local residents and visitors will become increasingly difficult. In addition, regular congestion on I-5 contributes to increased emissions and reduced air quality in the coastal areas, which will only worsen as congestion increases. These conditions have significant impacts on the region's economic viability, environmental health, and quality of life as travelers and businesses suffer from time lost on the freeway.

3.2 Bicycle and Pedestrian Deficiencies

While there are bicycle and pedestrian routes along the coast, east-west access is more limited. The Coastal Rail Trail provides coastal access the length of the NCC primarily on a bicycle facility. The trail has been developed to different levels, with some segments providing bike lanes on streets while other segments provide completely separate rights-of-way. Access to the trail occurs along primary and secondary bicycle routes, which run from inland areas to the coast. These inland east-west routes are limited and contain gaps due to topographical, transportation facility, and environmental barriers. Additionally, many routes cross overpasses and rail crossings where facilities narrow and the quality degrades. Local roads cross I-5 in the east-west direction 37 times in the corridor, and many of these crossings feature non-standard bicycle and pedestrian facilities. As a result, it is difficult to make local trips using these bicycle and pedestrian routes.

3.3 Transit Deficiencies

Transit services in the NCC are relatively robust for an area of mostly low-density suburban development. However, the NCC still features comparatively low transit ridership, resulting not just from its auto-oriented development patterns and local demographics, but also from the many constraints on the transit system itself.

Land Use Constraints

Transit works best when large numbers of people are traveling from the same point at the same time to the same location (i.e., mass transit). Transit struggles to attract riders in places like the NCC, where population is sparse and trip origins and destinations are highly dispersed—a modern development pattern that is promoted, and best facilitated, by the automobile. Rail transit is generally designed to serve long-distance and commute trips with origins and destinations that are inside the travel shed of the rail stations (i.e., dense population and employment centers). Short local trips generally are not well served by the longer-distance and fixed spacing of rail stations, interregional trip destinations generally

extend beyond the rail station service area, and recreational trips have group travel and baggage needs that make using transit less efficient or convenient.

While the NCC's local bus system covers most arterial roads in the corridor, the area's topographic constraints and circuitous and discontinuous street system make it difficult to route buses close enough to most residences and businesses to provide convenient access. For many trips, bus stops are located just beyond practical walking distance. This access deficiency between the transit and the trip origin or destination is referred to as the "first mile" or "last mile" gap, and is often cited as the reason more people do not ride transit: It can get riders close, but not close enough, for many trips.

Studies have indicated a range of thresholds for transit-supportive residential densities, but one common reference, based on a review of Transit-Oriented Development (TOD) guidelines across the United States, indicates that thresholds of seven dwelling units per acre are necessary to support basic bus service, fifteen dwelling units per acre for premium bus service, and 20-30 dwelling units per acre for rail services.[14] Figure 8 provides examples of these development patterns.

The low-density development pattern in the NCC results in very few concentrated areas of population that could support high-frequency transit service. To create a transit-supportive environment and increase walk access to transit, the land use pattern in the NCC would need to be completely transformed: not only tripling residential densities, but also redeveloping communities with more walkable, grid-like, better-connected local street networks. While targeted areas of Smart Growth have been identified in the corridor, most of its built environment stems from a time when local land-use decisions supported low-density, single-use development. As such, suburban, single-family residential homes make up the majority of housing stock in the NCC, with typical densities under seven dwelling units per acre and only a few pockets of higher densities. Given the built-out nature of the corridor and the local cities' adopted land use plans and Local Coastal Programs, large-scale land use changes are highly unlikely. This pattern therefore is projected to remain through 2050, while densities in other areas of the region will continue to intensify (see Appendix D: 2050 RTP Housing Density Maps).

[14] Ewing, Reid. 1996. *Best Development Practices*. Chicago: Planners Press.

Figure 8: Transit-Supportive Land Use Density Examples



Los Angeles, CA: 2.2 units/acre



Hollister, CA: 4.4 units/acre



Fresno, CA: 8.1 units/acre

Density to support bus service



Hermosa Beach, CA: 14.4 units/acre

Density to support premium bus service



Hayward, CA: 27.7 units/acre

Density to support rail service



Pasadena, CA: 35 units/acre

Density to support rail service

Source: "Visualizing Density," Lincoln Institute of Land Policy, 2007

Employment Constraints

If the jobs of residents in the corridor were all located in downtown San Diego and Sorrento Mesa, a large percentage of commuters might be able to take advantage of rail service. However, this is not the case; in 2008 only 5.2% of all jobs in the region were located in downtown San Diego, and only 5.1% of regional jobs were located in Sorrento Mesa. The share of the region's jobs in both these job centers is expected to decline by 2030, and further by 2050.[15] When commuters leave the NCC, they travel to jobs that are scattered throughout the region, often in auto-dependent locations with an abundance of free parking.

As the trend toward dispersed employment continues through 2050, it is exacerbated by several contributing factors (taken from Appendix C):

- Downtown San Diego is not the largest employment center in the region
- There is no single dominant employment center in the region
- No employment center in the region will increase its regional employment share by more than two percent between 2008 and 2050
- The four largest employment centers in the region (University City, Kearny Mesa, downtown San Diego, and Sorrento Mesa/Mira Mesa) are all projected to lose regional employment share through 2050

Appendix C reveals the degree of regional dispersal of employment projected through 2050. The land use patterns in the vast majority of these employment communities are characterized by low-density and/or business park development with large amounts of free parking and limited pedestrian environments. The absence of large, concentrated, and growing employment centers—and the ongoing trend of employment dispersal—highlight the challenge of providing efficient transit service for commute trips in the NCC area.

Trip Characteristic Constraints

As noted in Section 2, a significant portion of trips in the NCC are internal to the corridor, and many of these trips are often only a few miles in length—to include local errands and rides to work or school. These types of trips are difficult to capture with transit in all but the densest areas, since the access and waiting times for buses generally cannot compete with the automobile for such short distances, particularly in the North Coast Corridor where most residents have a car available to make the trip. In addition, the tendency of travelers to "link" several local trips into a single voyage—such as leaving work, buying groceries, and picking up children from school—greatly multiplies the time advantages of driving over transit. Finally, many of these short local trips involve shopping, errands, or other cargo-intensive purposes that are not well suited for transit. Taken together, these factors result in a local population that generally does not choose the bus over driving.

[15] SANDAG Series 12 Regional Growth Forecast/Urban Area Transit Strategy Policy Paper, September 2010

Rail Capacity Constraints

With four rail operators sharing the LOSSAN corridor, passenger rail services along the corridor, including the NCC segments, are constrained by infrastructure that is significantly undersized for the volumes of traffic it accommodates. Fifty-one percent of the existing rail corridor between San Clemente and downtown San Diego consists of single-track railway. These single-track sections greatly constrain the movement of trains through the corridor as trains must stop and wait at scheduled meets to allow for passing. Not only do these scheduled meets increase trip time for travelers, if one train experiences an unscheduled delay, it ripples throughout the corridor, affecting the schedules and on-time performance of other trains on the tracks. The result is relatively poor and unpredictable on-time performance on the LOSSAN rail corridor, particularly for Amtrak services. Poor and unpredictable on-time performance deters people from choosing rail for trips when it would otherwise be an acceptable option.

The single-track sections also limit the number of trains that can use the tracks at any given time, capping passenger capacity in the corridor. COASTER service operates every 30 to 45 minutes in the peak-period peak direction, while Amtrak operates approximately hourly in the peak-period peak direction. With the addition of Metrolink and periodic BNSF freight service, the number of train trips in the corridor is near capacity under current track conditions. The inability to increase service frequency on passenger rail reduces the attractiveness of rail as a viable transportation alternative in the NCC for many trips that require greater flexibility in travel-time choices. It also constrains the economic growth of freight rail service.

SANDAG has projected that the planned capital improvements and more frequent service on the LOSSAN corridor will increase daily person-carrying capacity from approximately 18,000 per day to as high as 47,000 per day.[16] This would more than double the current capacity of the line and, assuming equal distribution of rail ridership throughout the day, is equivalent to two freeway lanes of traffic.[17] This level of LOSSAN capacity exceeds the current and forecasted 2050 demand on the rail corridor, meaning that everyone who is expected to travel by rail in the NCC will be accommodated with extra capacity to spare. However, due to the unique and varied characteristics of trips and travelers in the corridor (trip purpose, length, origin/destination, etc.), rail service—even with this excess capacity—simply will not be able address all trip needs. Nearly all of these rail-unsuitable trips must therefore be accommodated on the highway and roadway system in the corridor.

Rail Access Constraints

Even if the rail system could capture more trip types in the NCC, these new riders would still need to be able to access the stations. The area's low-density land use patterns mean that relatively few people are within efficient walk, bike and transit distance to COASTER stations, which means that most passengers access LOSSAN rail stations in the NCC by private automobile. During the morning peak period, on average 63% of passengers boarding the COASTER at stations within the NCC drive alone and park at one of the stations. Combined with those who carpooled or were dropped off, 80% of NCC COASTER

[16] SANDAG (Kim Kawada/Dave Schumacher/Danny Veeh); April 2011
[17] 47,000 trips/12 hours a day = 3900 trips/hour. A freeway lane is at capacity at approximately 2000 trips/hour.

commuters arrive at the stations by car.[18] Relatively few passengers walk, bike, or take local transit buses to the stations, even though seventeen local bus routes connect to them. To change this, corridor land uses would need to become much more transit-friendly (concentrated, higher density development, with mixed uses and widespread pedestrian facilities) to achieve a significant shift in the way that users access rail. However, most of the corridor is already built out—and existing land-use policies in the Local Coastal Program (LCP) support the current development patterns.

Assuming the corridor does not undergo a wholesale redevelopment and most users continue to access rail by driving, a significant increase in ridership would require similar increases in the parking capacities at rail stations. Table 6 shows the current COASTER parking supply, reflecting approximately 2,700 parking spaces at NCC stations. On average, however, all of the COASTER station parking lots except Oceanside are at, or exceed, capacity by 8:00 a.m.[19] Further gains in ridership will require construction of new, multi-level parking structures with thousands of parking spaces, rather than the surface parking lots with hundreds of spaces currently seen in the rest of the corridor. This would mean thousands of additional vehicles accessing parking via local streets, with significant implications for coastal communities and access, as well as possible conflicts with LCPs.

Table 6: COASTER Station Parking and Feeder-Bus Service

Station	Rail and Intercity Services	Parking Spaces	Feeder-Bus Access
Oceanside Transit Center	COASTER, Amtrak, SPRINTER, Metrolink, Greyhound	1,200	Routes 101, 302, 303, 313, 318, 395, RTA Route 202*
Carlsbad Village	COASTER	480	Routes 101, 325
Carlsbad Poinsettia	COASTER	250	Routes 101, 444, 445, 446
Encinitas	COASTER	290	Routes 101, 304, 309
Solana Beach	COASTER, Amtrak	290	Routes 101, 308
Sorrento Valley	COASTER	120	Routes 972, 973, 978, 979
Old Town	COASTER, San Diego Trolley	450	Routes 8, 9, 10, 28, 30, 35, 44, 84, 88, 105, 150
Downtown San Diego	COASTER, Amtrak, San Diego Trolley	0	Routes 2, 210, 810, 820, 850, 860, 923, 992

Sources: TREP/PWP Chapter 3, NCTD and MTS

****Operates from Riverside County to the Oceanside Transit Center***

Local/Feeder Bus Constraints

Another way to provide increased access to NCC rail stations could be through enhancement of the existing feeder-bus services. Appendix A shows the existing bus routes that serve NCC COASTER stations. Taken together, these routes cover most of the major arterials and activity centers in the corridor, leaving few viable options for new direct feeder bus routes. However, due to the low-density, suburban development that pervades the NCC, only 51% of households are within one half-mile of a bus stop, compared to 66% of households across the region and 73% in the SANDAG-defined urbanized

[18] SANDAG 2009 Onboard COASTER Station Access Survey.
[19] I-5 North Coast Corridor System Management Plan (CSMP), August 2010, Page 5-38.

area.[20] This demonstrates the considerable difficulty of providing transit service in suburban areas, where residences are spread out and automobile travel has a considerable advantage.

The existing local bus services currently operate at low to moderate frequencies, reflecting the relatively moderate ridership demand typical of low-density areas (compared to the denser central core areas). While improved frequencies would likely attract more riders, any increases in ridership (and accompanying fares) would not offset the increases in costs associated with providing more service. The result is likely to be that operating subsidies would increase at a faster rate than ridership. These increased subsidies would need to come from somewhere, and given the limited public operating funding available to transit agencies, the likely place would be through elimination of services elsewhere in the region. Because funding is scarce, regional decision-makers must make prudent decisions on where and how to provide transit service that balances access with cost-effective returns on investment to ensure that the transit system is sustainable over time. Local bus service is planned on a short-term basis in order to remain flexible to changes in funding and ridership, and while improvements in local bus transit service are anticipated in the NCC over the next forty years, there will always be limits on the feasibility of investment.

In evaluating the benefits of enhancing bus service in the NCC, it is also important to consider the likelihood that users will actually use the enhanced services to make their trips. Even if the region invested extremely heavily in buses to provide high-frequency coverage in every area of the corridor, the decision on whether to use transit ultimately is up to the individual traveler. By definition, a feeder bus requires the passenger to transfer between bus and rail during their trip, adding more time and an extra logistical layer to the transit experience relative to driving. A comprehensive survey of regional residents in 2000 confirmed the long-held belief among transportation experts that this "transfer penalty" is a significant barrier to transit use, especially among those who already have access to cars.[21] Therefore it is unlikely that enhanced bus service, even if implemented to the maximum extent, will supplant the automobile as the mode of choice for the majority of NCC travelers.

BRT and Rapid Bus Constraints

The NCC currently does not have any BRT or Rapid Bus service. Implementation of both of these types of transit improvements are planned in the corridor over the next forty years. But like local bus service, extensive investment in BRT and/or Rapid Bus is constrained by the challenging topography and circuitous street network, low land use densities with few areas of concentrated populations, and limited funding. Successful BRT is wholly dependent on implementation of the I-5 Managed Lanes since, by definition, BRT operates on a congestion-free "guideway" connecting concentrated areas of population and employment. The reverse-commute BRT planned for the I-5 Managed Lanes targets the peak-period commute trip between the high-density Mid City residential area in central San Diego and the Palomar Airport Road business park in the NCC. There are few other opportunities in the NCC to link dense population and employment centers. A BRT route between Oceanside and University City in San Diego (utilizing the I-5 Managed Lanes) that was evaluated during development of the 2050 RTP failed to

[20] SANDAG (Tom King); November 2011.
[21] Metropolitan Transit Development Board (MTDB) TransitWorks Strategic Plan Report, January 2001.

generate enough projected ridership from NCC residents to withstand the regional screening process for allocation of scarce resources.

Rapid Bus services operate along major arterials and can take advantage of signal and intersection priority treatments to speed up service. The 2050 RTP includes a Rapid Bus project for Coast Highway through the NCC. While some local bus routes can evolve into Rapid Bus services over time, to justify the capital and operating investment necessary to convert to a Rapid Bus, these routes require consistent activity and population concentrations along their routes, something that many major arterials in the NCC lack.

Funding Constraints

As discussed in Section 4, SANDAG needs to focus a large proportion of its transit investment in areas where transit services are most likely to succeed: the region's higher-density, mixed-use, pedestrian-friendly communities. However, while the NCC lacks many of the transit-supportive characteristics of some of the region's central core communities, the 2050 RTP still includes significant investment in LOSSAN rail, BRT, Rapid Bus, and local bus service in the corridor—a level of investment that, compared to the more urban core areas of the region, is somewhat disproportionate to its relatively lower ridership returns. Through the RTP, SANDAG has opted for a balanced system that provides transit access throughout the urban area, while simultaneously achieving regional and state goals. Tipping this balance to allocate additional regional transit resources to the NCC above what is identified in the RTP would come at the expense of regional transit ridership and other objectives.

In addition, providing a one-time capital investment in transit infrastructure is only part of the solution for improving transit in a region or corridor: Transit also requires continuous operating funding to keep services going. Like every other city and region in the United States (and most of the world), transit operations are subsidized heavily by local, regional, and national governments. In the San Diego region, passenger fares cover less than half the cost of providing service (and much less for the COASTER), meaning that public subsidies pay for the majority of transit operations.[22] This operating funding is scarce and diminishing, which greatly limits the region's ability to increase transit services; such scarcity requires difficult decisions to be made on how to allocate the region's resources, both to maximize returns on investment and to ensure fiscal sustainability. Through its RTP, SANDAG has adopted a prudent balance between expanding transit access and maintaining an efficient transit system that can be sustained in the future.

3.4 Implications of Deficiencies and Constraints

Deficiencies and constraints in the North Coast Corridor transportation network inhibit coastal access and economic growth by increasing travel times, decreasing reliability, and limiting travel choices. One likely result is that frustrated travelers may choose not to make discretionary trips to coastal resources.

[22] National Transit Database. MTS and NCTD Profiles. http://www.ntdprogram.gov/ntdprogram/data.htm

While the vast majority of trips in the NCC will continue to be by auto through 2030 and beyond, transit will also continue to play a vital and growing role in the corridor's transportation network. Indeed, SANDAG's 2050 RTP includes major improvements to rail and bus transit facilities and services in the NCC to address some of the existing deficiencies and make transit more competitive with the automobile. The RTP's planned investments in cost-effective transit improvements, high occupancy highway improvements, and expansion of bicycle and pedestrian facilities in the NCC will address growing travel demand and improve access and mobility along San Diego's North Coast by focusing on moving people, not cars. This multi-modal transportation vision will ensure that ongoing access to coastal resources in the NCC will be preserved and enhanced.

4.0 THE REGIONAL CONTEXT FOR THE NCC

The travel, access and quality of life deficiencies in the NCC are addressed by many mobility solutions in SANDAG's 2050 Regional Transportation Plan (RTP). The NCC, however, is only part of San Diego's coastal zone area and the San Diego region as a whole—a region that has a diverse array of transportation needs as well as many regulatory and fiscal constraints. This section outlines the numerous considerations that inform the regional decsionmaking process for allocation of finite transportation resources.

4.1 RTP Goals and Objectives

The overarching policies that guide decisions in the region are published in the 2050 RTP, and are summarized in Table 7.

Table 7: Goals of the 2050 Regional Transportation Plan

Goal	Definition
Mobility	The transportation system should provide the general public and those who move goods with convenient travel options. The system also should operate in a way that maximizes productivity. It should reduce the time it takes to travel and the costs associated with travel.
Reliability	The transportation system should be reliable. Travelers should expect relatively consistent travel times, from day to day, for the same trip and mode of transportation.
System Preservation and Safety	The transportation system should be well maintained, to protect the public's investments in transportation. It also is critical to ensure a safe regional transportation system.
Social Equity	The transportation system should be designed to provide an equitable level of transportation services to all segments of the population.
Healthy Environment	The transportation system should promote environmental sustainability, and foster efficient development patterns that optimize travel, housing, and employment choices. The system should encourage growth away from rural areas and closer to existing and planned development.
Prosperous Economy	The transportation system should play a significant role in raising the region's standard of living.

Source: Draft 2050 Regional Transportation Plan, Table 2.1

The RTP associates each broad goal with specific policy objectives to help focus the decisionmaking process. To support the goal of a Prosperous Economy, one such policy objective is to "maximize the economic benefits of transportation investments."[23] With financial constraints limiting the number of transportation projects possible, this objective requires planners to select the projects that will yield the greatest benefit to the region as a whole; such balancing entails a careful evaluation of the region's varied needs, along with a rational assessment of which projects are most likely to attract users.

[23] Draft 2050 Regional Transportation Plan, Table 2.1

4.2 Regional Growth

The population of the San Diego region is projected to grow significantly in the coming decades, which will spur related growth in housing, employment, and travel demand. Between 2008 and 2050, the region is expected to add 1.2 million residents—a 40% increase. Those new residents will drive demand for 388,000 new housing units (a 34% increase) and the creation of 501,000 new jobs (a 33% increase).[24] To accommodate this influx, SANDAG and the local governments have implemented a "Smart Growth" land-use strategy that seeks to increase population density, reduce vehicle miles traveled, and curb greenhouse gas emissions (See Section 4.5 below and Appendix B: Smart Growth Concept Map).

Travel demand, meanwhile, is growing at an even faster rate than population. As discussed in Section 2.3, this trend indicates that people today are making more trips—and covering longer distances—than in the past. This regional trend holds true in the NCC as well. By 2040, the number of daily trips in the NCC is expected to increase by approximately 30% (see Table 4).[25] This growth greatly outpaces the projected growth in population (20%), and it means that the strain on the transportation system will compound quickly without significant improvements.

4.3 Greenhouse Gas Reduction Targets

The state of California has set ambitious goals for greenhouse gas (GHG) reduction across its 18 metropolitan regions. In 2008 the California Air Resources Board set targets for the San Diego region that call for a 7% per-capita reduction in GHG emissions by 2020, and a 13% reduction by 2035.[26] Since a significant portion of GHG emissions come from transportation sources, these targets heavily influenced the composition of transportation projects and the design of the transportation network in the RTP.

To achieve the mandated GHG reductions, the region cannot continue growing with the same transportation and land-use patterns that dominated its past. SANDAG has determined that meeting the goals will require significant changes in travel behavior at the regional level, to include both a reduction in vehicle miles traveled (VMT) as well as an increase the share of trips taken on public transit. As financial constraints limit the number of transportation projects possible, the RTP therefore attempts to direct transportation investment to the areas where the greatest changes are possible.

4.4 Transit Mode Share Targets

Achieving SANDAG's GHG and VMT reduction goals will require an increase in the region's transit mode share, which is defined as the proportion of total trips taken on public transportation. The RTP specifies that the performance measure for transit mode share will be weekday, peak-period commutes between home and work, as this is the type of trip for which behavior shifts to transit are the most likely.

[24] 2050 Regional Transportation Plan, Chapter 3.
[25] TREP/PWP Chapter 2B, pg. 2-24
[26] The CARB-mandated GHG reduction targets apply only to cars and light trucks during weekday travel, using 2005 as the base year. While reductions are desired for all vehicle classes, only this single class is included in the performance measure.

The current transit mode share (again measured only by peak-period commute trips) is 2-3% for the region as a whole, and just over 5% in the SANDAG-defined urban area. Two of the region's densest areas boast significantly higher numbers: Downtown San Diego has a 24% transit mode share, while the largely residential central core area (which includes Mid-City neighborhoods as well as parts of eastern San Diego) is just below 12%. All other parts of the region have transit mode shares well below 10%. For comparison, Table 8 lists the transit commute mode shares for selected U.S. cities; despite a handful of transit-heavy places, 17 of the nation's 30 largest cities have mode shares of 5% or less.[27]

The RTP sets an ambitious goal of achieving a transit peak-period commute mode share of 10-15% in the urban area by 2050 (a 400% increase from current levels). Though it may be difficult to reach, this growth in transit mode share will be crucial to meeting GHG reduction targets. To achieve the urban area transit mode share goals, SANDAG divided the urban area into districts and established district-level mode share goals based largely on the viability of transit in each area. Transit investments were then allocated according to these goals, with the greatest investment going to areas where transit is most likely to succeed. Downtown San Diego and the central core, where density and land use patterns are most conducive to transit, are charged with raising their transit mode shares to 30+% and 20-25%, respectively. The goal for the NCC is 10-15%, which is ambitious given the area's limitations to transit effectiveness (discussed in Section 6), and would be a major improvement from the current share of 2-3%. Overall, decisions made at the regional level to implement regional goals and address state GHG reduction targets have resulted in a planned allocation of transit resources and projects throughout the region that focuses investment in the densest urban areas.

Table 8: Transit Commute Mode Shares in Selected U.S. Cities

City	Commute Mode Share
New York City	55%
Washington, DC	37%
San Francisco	32%
Chicago	26%
Seattle	19%
Portland, OR	12%
Los Angeles	11%
Goal for San Diego Urban Area and NCC	***10-15%***
Denver	8%
Houston	5%
Phoenix	4%
San Diego[28]	4%
San Antonio	3%

Source: U.S. Census American Community Survey, 2005-2009 5-Year Estimates

[27] U.S. Census American Community Survey, 2009.

[28] For consistency in Table 8, this figure only includes the city of San Diego. As noted above, SANDAG data breaks this down further, revealing a 2-3% transit mode share for the entire San Diego region, and a 5% transit mode share for the SANDAG-defined urban area.

4.5 Land Use

The San Diego region, including the NCC, has historically low-density land use patterns commonly associated with suburban sprawl. This spread-out style of development, while highly conducive to automobile travel, severely limits the potential viability of public transit. Transit is most effective and efficient in areas that contain a mix of high-density residential, commercial and employment development, concentrated populations, and urban design that promotes and encourages walking (most transit riders are pedestrians for some segment of their trips).

In recent years, SANDAG has shifted toward "Smart Growth" policies that encourage these transit-friendly development patterns. By promoting more trips by foot, bike, and transit, and correspondingly less reliance on the automobile, Smart Growth policy is expected to help make transit a more competitive travel mode. In 2008 the SANDAG Board of Directors adopted the Smart Growth Concept Map (Appendix B), which seeks to implement the goals established in the Regional Comprehensive Plan by identifying specific communities for Smart Growth development and coordinated transit investment. The map identifies 196 existing and future transit-supportive and Smart Growth opportunity areas in the region, and is used by the board to prioritize transportation investments in the RTP and determine eligibility for funds from the Smart Growth Incentive Program. The NCC contains over 15 of these Smart Growth opportunity areas, the majority of which are located in community cores near COASTER and SPRINTER transit stations.

Local jurisdictions and SANDAG are working together to introduce Smart Growth development clusters into the NCC to accommodate future growth with higher-density, mixed-use development. However, the majority of the region's Smart Growth is planned to occur in places that have existing transit-supportive land use patterns—primarily the central core area. Because most of the NCC features a low-density, suburban land use pattern, it is not where the region is focusing the bulk of its Smart Growth efforts and corresponding higher-intensity transit.

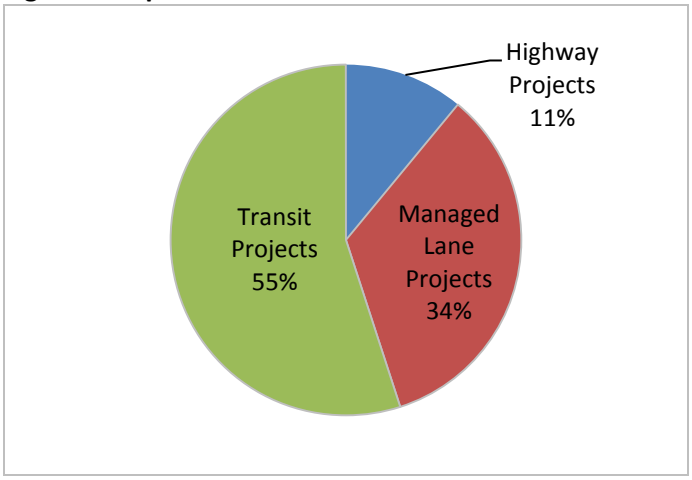
4.6 Funding

The 2050 RTP allocates over $112 billion to transportation in the next forty years, measured in 2010 dollars.[29] Of this sum, 50% is dedicated to transit-related uses, to include capital, operations, and maintenance. Another 41% is allocated to roads and highways. The remainder is earmarked for active transportation projects (bicycle and pedestrian), smart growth incentives, and other initiatives. Subtracting operations, maintenance, and administrative costs, a total of $26.6 billion is allocated for transit capital projects, $16.0 billion for the construction of Managed Lanes and other HOV facilities, and $5.4 billion for general-purpose highway projects.[30] These proportions are depicted in Figure 9. Because Managed Lanes support transit service and discourage single-occupancy travel, they represent a more efficient use of capital funds than general-purpose highway expansions; overall, 89% of the RTP's capital budget is allocated to transit or transit-supportive highway projects.

[29] SANDAG 2050 Regional Transportation Plan, Table 5-3
[30] SANDAG Staff (Heather Adamson), October 2011.

Despite the seemingly large size of these expenditures, the RTP actually represents an abridged list of the region's desired transportation projects. By law, the RTP must conform to a revenue-constrained scenario that makes reasonable assumptions about funding availability in the coming decades. In the planning process, however, SANDAG first devises a revenue-unconstrained scenario: essentially a "wish list" of projects the region would accomplish if given unlimited resources. This unconstrained list is then pared to fit available funding according to the ranked priorities of the projects.

Figure 9: Capital Investments in 2050 RTP



Source: SANDAG Staff, October 2011

To keep fares low enough to attract ridership, most of the world's transit systems require public subsidies to operate. The proportion of costs covered by fare revenue—known as the "farebox recovery ratio"—is currently 35% in the San Diego region, which is consistent with national trends. The remainder of transit funds comes from various public sources, ranging from federal grants to the local TransNet sales tax.

The amount of transit subsidy varies among the region's areas and types of transit service. In the densest areas of San Diego, bus and trolley routes enjoy high ridership and relatively low subsidies: In 2009, MTS buses required $1.43 in subsidy for each passenger boarding, while MTS trolleys' subsidy per passenger boarding was just $0.68.[31] By contrast, local bus routes operated by NCTD—the main transit operator in the NCC—required a subsidy of $4.09 for each passenger boarding, reflecting the challenges of providing efficient transit service in large, low-density suburban areas. Subsidy per passenger on the COASTER was $6.32 in 2009, reflecting the higher cost of operating and maintaining commuter rail service compared to bus service in the corridor.

Transit services that require large public subsidies present a cost/benefit dilemma for regional decision-makers. While there is a social benefit to providing transit access to everyone in the region, fiscal constraints mean that investing in areas with inherently low ridership effectively excludes investment in more cost-effective services in other areas. SANDAG has crafted a careful balance in the RTP that allocates transit throughout the urban area, ensures a fiscally sustainable transit system, and achieves regional transportation goals and state GHG mandates.

[31] SANDAG Coordinated Plan (2010-2014), Technical Appendix C, Pages C-3 – C-12.

5.0 A MULTI-MODAL VISION FOR THE NORTH COAST CORRIDOR

Today and into the future, the NCC is host to a wide variety of travelers, including local residents, commuters, visitors and freight haulers. The number of these travelers has increased historically and is expected to continue to increase due to regional population growth and the continued importance of this corridor in the regional and interregional movement of people and goods. Expanding transit service in the NCC is part of the solution to accommodate travel growth and maintain mobility in and through the corridor. However, transit alone will not be sufficient to meet the diverse needs of the travelers in the corridor. Only a balanced, integrated set of improvements to the transportation system can adequately address the diverse and growing travel demand in the NCC.

5.1 Corridor Objectives

The TREP/PWP identifies both transportation and coastal access goals for the NCC, which are summarized in Table 9 and Table 10. While transportation and coastal access goals are often viewed as representing incongruent purposes, the TREP/PWP integrates these goals so as to not only balance the various transportation needs of the corridor, but to enhance multi-modal access throughout the corridor and thereby maintain and enhance, wherever feasible, access to the coast and upland recreation areas.

Table 9: Transportation Objectives for the North Coast Corridor

Goal	Definition
Congestion Reduction	The NCC's transportation facilities should be free of congestion to the greatest extent possible. This means not only accommodating the transportation needs of today's residents, but also planning for the transportation needs of future residents, whose population is projected to grow by more than 20% in the next two decades.
Environmental Protection and Enhancement	The NCC's human and natural environments should be protected, and enhanced wherever possible, to promote sustainability and quality of life for all residents and visitors.
Transportation Flexibility	In addition to providing benefits in the near term, the NCC's transportation system should be able to adapt to future changes in demand, transit ridership, technology, land use, and other influential factors.
Value Maximization	The NCC's transportation investments should maximize value, providing the greatest possible mobility benefits per dollar spent, for both the NCC and the entire region.
Coastal Access	The NCC's transportation system should provide improved access to coastal areas for all residents and visitors.
Integration into Larger System	The NCC's transportation system should be maintained and enhanced as an important link in the regional, state, and national transportation system.
Movement of People Rather than Vehicles	The NCC's transportation system should prioritize the movement of people, rather than simply vehicles, in order to maximize efficiency and reduce per capita pollution, energy consumption, and vehicle-miles traveled.

Table 10: Coastal Access Objectives for the North Coast Corridor

Goal	Definition
Congestion Reduction	Access to coastal areas should not be hampered by congestion in the transportation system, a problem that has already been cited as a major impediment by the Coastal Commission in its Public Access Action Plan.
Maintenance and Expansion of Transit Service	Public transit service should be a reliable and efficient option for all residents and visitors to access the coastal resources of the NCC. Where practical, transit services should be expanded in response to continued growth in population and demand.
Provisions for Non-Automobile Circulation	Coastal areas should have ample facilities that allow for movement via non-automobile means, to include transit and shuttle services, bicycle access lanes, and pedestrian facilities.
Adequate Parking	Coastal areas should have adequate parking facilities to serve the majority of residents and visitors who travel by car. Where parking is not feasible, substitute means such as public transit or shuttle services should be available to access the coast.
Ability for Future High-Intensity Transit	The NCC should maintain the potential for future expansions of transit service as growth continues, to include higher-intensity modes such as rail, rapid bus, and bus rapid transit (BRT).
Enhancement of Recreational Facilities	To prevent the recreational needs of the growing population from overloading coastal recreation areas, the NCC's parks, beaches, trails, and other recreational facilities should be preserved and enhanced, where feasible, in order to provide recreational opportunities for coastal residents and visitors.

A key theme underlying most of the coastal objectives is ensuring coastal access, a goal that is directly supported many of the transportation objectives. The current levels of congestion on both I-5 and the local street network hinder coastal access on a regular basis, and without capacity improvements this condition will only worsen as the population grows. (Congestion in the NCC also increases emissions and reduces air quality in the coastal areas, an outcome contrary to coastal objectives.) COASTER rail services are similarly limited, with heavy train traffic along single-tracked segments slowing the service and limiting its frequency, thereby limiting use of rail service as an alternative means of travelling to and through the corridor. Finally, the non-motorized links to coastal access and recreational areas, mostly bicycle and pedestrian trails, are also in need of improvement due to various gaps and safety deficiencies. Implementation of the TREP/PWP will address each of these accessibility issues by bringing a multi-modal network of improvements to the NCC.

The proposed transportation projects also contain ample funding for the restoration, enhancement, and mitigation of coastal resources that would otherwise be unavailable. The Resource Enhancement Program will bring these tangible improvements to the coastal zone as an integrated component of transportation infrastructure improvements and at an accelerated pace, enhancing both the natural environment and its accessibility to users. Thus, the forty-year vision and program of projects included in the TREP/PWP will help to further coastal policy goals and objectives.

5.2 Six-Point Alternative Mode Strategy

The I-5 Managed Lanes project is only one piece of the transportation puzzle to address growing travel demand, achieve regional mobility and quality of life goals, and enhance coastal access in the NCC. SANDAG and Caltrans have identified a Six-Point Alternative Mode Strategy for the NCC to ensure that there is an efficient, effective and sustainable multi-modal transportation system to provide access and mobility for all travelers and trips—and to ensure that both coastal and transportation goals are achieved. The six elements of this strategy are:

1. Interregional Rail Improvements

The primary interregional rail service in the NCC is Amtrak's Pacific Surfliner, in addition to one connection at Oceanside with the Los Angeles-based Metrolink commuter rail system. Coordination efforts are underway to increase interregional rail access by allowing both Metrolink and the COASTER to travel farther across county lines. This will provide new travel options for interregional travelers to access coastal communities.

In the shorter term, the transportation agencies are also working on better connection coordination between the arriving and departing COASTER and Metrolink trains at Oceanside. This not only includes efforts to better align the timing between the two services, but also cross-ticketing and marketing programs between COASTER, Metrolink, and Amtrak that will allow interregional travelers to purchase one fare to cover multiple services. Once enacted, these enhancements will allow for smoother transitions between the NCC rail services, resulting in better interregional travel times and more options for travelers.

2. Improvements to COASTER Rail Service, Stations, and Parking

Enhancements will allow for 54 COASTER trips daily (up from 22 in 2011), as well as providing additional capacity for intercity and freight rail services. Infrastructure improvements planned for the LOSSAN corridor include a mix of double-tracking, other track capacity enhancements, rail bridge replacement, pedestrian crossings, vehicle crossing improvements, parking expansion, new platform locations, and other station enhancements. Generally, track projects directly improve capacity and therefore improve reliability, reduce travel times and provide the opportunity for increased service levels. In addition to increased frequencies, COASTER trains will also have reduced travel times due to the improved infrastructure (as shown in Table 11). Other improvements may increase access to rail or improve the passenger experience, which may lead to increased ridership.

More than half of the entire San Diego coastal rail corridor is single-tracked, which creates choke points when trains traveling in opposite directions meet. These conflicts create most of the delay in the corridor and corridor-wide double-tracking is necessary to sufficiently increase capacity and service. The LOSSAN rail program in the NCC would include double-tracking projects ranging in length from 0.6 to 2.9 miles. Other track improvements similarly increase capacity and decrease conflicts, which improves reliability and decreases travel times. Station and parking improvements at corridor stations will also increase passenger capacity, enhance quality of service, and improve access to coastal rail.

3. New Rapid Bus and BRT Services

The 2050 RTP includes a new all-day Rapid Bus route along Coast Highway from Oceanside to University City. Rapid Bus service provides higher speed, limited-stop service through the use of roadway priority treatments such as traffic signal priority, intersection queue jumps, and dedicated transit lanes. The planned service will operate at ten-minute frequencies all day, providing a higher-quality local transit option to complement the existing network of local bus routes in the corridor.[32] This will increase regional mobility and access to coastal areas for residents and visitors alike.

In addition, the RTP includes a new "reverse commute" bus rapid transit (BRT) service on I-5 that serves the peak-period commute trip between the high-density Mid City residential area in central San Diego and the Palomar Airport Road business park in the NCC. Like the planned improvements to LOSSAN rail service, this new BRT line will help to relieve congestion and reserve capacity on I-5 for other users, including visitors and recreational travelers who are not easily served by transit. However, as with the express bus services currently operating on I-15, implementation of BRT on I-5 is wholly dependent upon the construction of Managed Lanes.

4. Improvements to Local Bus Service

While the TREP/PWP does not directly include local bus service, the 2050 RTP includes an increased commitment of operating funds for local buses, both within the NCC and across the region. While many transit dollars are earmarked for the region's higher-density communities, NCTD will receive a generous share of operating funds to sustain and enhance its services in the NCC. Access to the COASTER remains a priority for both NCTD and MTS, and travelers can expect various enhancements to the seventeen local bus routes that serve the NCC's six COASTER stations. (See Appendix A for a graphical depiction of the existing COASTER-oriented services, including ridership and frequencies.) Future enhancements could include higher frequencies, extended operating hours, and other improvements. The RTP also includes specific funding to increase service frequencies to fifteen minutes or better in key bus corridors, but at this stage it has not been determined how NCC routes may benefit from this augmentation.

5. Community Enhancement Projects for Bicycle and Pedestrian Trails

The 2050 RTP contains $2.6 billion for an Active Transportation Program that seeks to improve bicycle and pedestrian facilities across the region, including the NCC. Caltrans and SANDAG have worked with the corridor cities to identify enhancement opportunities that would benefit from simultaneous construction with I-5, and improve how the I-5 project interfaces with adjacent communities. These enhancements would make connections in the existing bicycle and pedestrian network, improve trails, and enhance other new and existing facilities. Improvements include trail connections, streetscape enhancements, trailheads, bicycle and pedestrian bridges, overpasses, underpasses, lagoon trails, and recreational staging areas.

Additionally, local roads cross I-5 at 37 locations within the corridor. Many of these crossings do not have standard bicycle and pedestrian facilities and therefore do not facilitate non-motorized modes crossing the freeway. As overcrossings are rebuilt and undercrossings are widened to accommodate

[32] 2050 RTP, Table 6.2

additional lanes on I-5, pedestrian and bicycle facilities will be upgraded. By addressing existing barriers to east-west pedestrian and bicycle travel, these enhanced crossings will improve access to community facilities, LOSSAN rail stations, and coastal resources.

6. I-5 Managed Lanes for Carpools, Vanpools, and Transit

To increase the capacity of I-5 in a way that moves people—not simply vehicles—more efficiently and effectively, SANDAG and Caltrans plan to construct two new Managed Lanes in each direction in the NCC. These new lanes would be reserved for three types of vehicles: high-occupancy vehicles (HOVs—carpools and vanpools), transit vehicles, and toll-paying single-occupancy vehicles (SOVs). The HOVs and transit vehicles have priority in the lanes, meaning that SOVs would only be allowed to enter when there is excess capacity. The SOV access fee, posted at lane entrances and paid electronically via transponder, would vary based on real-time traffic conditions; as the Managed Lanes approach a congested state, the fee would increase to discourage SOVs from entry. With real-time monitoring of traffic conditions and these variable pricing methods, the Managed Lanes will be able to preserve free-flow speeds and reliable travel times, even as the rest of the highway becomes congested, providing unconstrained access to the coast and through the corridor for many travelers. A similar system has already been implemented successfully on San Diego's I-15 corridor.

During peak travel times, even if each HOV only contains two people, one Managed Lane will be able to carry roughly 70 percent more people than one general-purpose lane.[33] This confers a clear benefit over traditional highway designs by providing major capacity enhancements with a relatively minor footprint. While the region is hoping to realize a significant increase in the NCC's transit mode share, even in the most optimistic projections we know that the majority of future travel demand will still be placed on the highways. SANDAG's Managed Lanes strategy will go the farthest in helping the region accommodate the future demand on I-5 by getting the most person-carrying capacity out of highway expansion.

In addition, far from being an expansion that just suits the needs of drivers, the addition of Managed Lanes also serves as an essential enabler of public transportation. By giving priority to buses and other HOVs, Managed Lanes make attractive public transit possible; because this new infrastructure will support reliable, congestion-free trips, I-5 will be able to accommodate transit services in the future as demands increase.

SANDAG promotes HOV travel through its iCommute program. The program assists commuters by providing free carpool and ride-matching services, a subsidized vanpool program, transit solutions, regional support for bicycling, the Guaranteed Ride Home program for students, and the SchoolPool carpooling program for parents. iCommute also provides free assistance to local businesses, helping them develop and implement customized employee commuter benefit programs that lower costs, increase productivity, and help the environment.

Table 11 shows corridor median travel times under current and future conditions during peak periods. When I-5 is uncongested, it takes 23 minutes to traverse the 27-mile route from La Jolla Village Drive in

[33] Managed Lane capacity is generally 1700 vehicles/hour * 2 people/vehicle = 3400 people/hour. General-purpose lane capacity is generally 2000 vehicles/hour * 1 person/vehicle = 2000 people/hour. 3400/2000 = 170%.

San Diego to Harbor Drive in Oceanside. This same northbound trip currently takes 30 minutes during the PM peak period, and is expected to take a congestion-ridden 70 minutes by 2030 without any improvements to the highway. Even with the planned improvements, travel time in 2030 is projected to be 45 minutes in the general-purpose lanes, indicating that the improvements will not even keep up with projected growth in demand (but will be vastly better than the No-Build condition). In the new Managed Lanes, however, PM peak travel would be nearly congestion-free, requiring just 28 minutes. In addition, planned enhancements to the LOSSAN rail corridor will allow the COASTER to make the same trip in 32 minutes in 2030, an improvement of five minutes over the No-Build scenario.

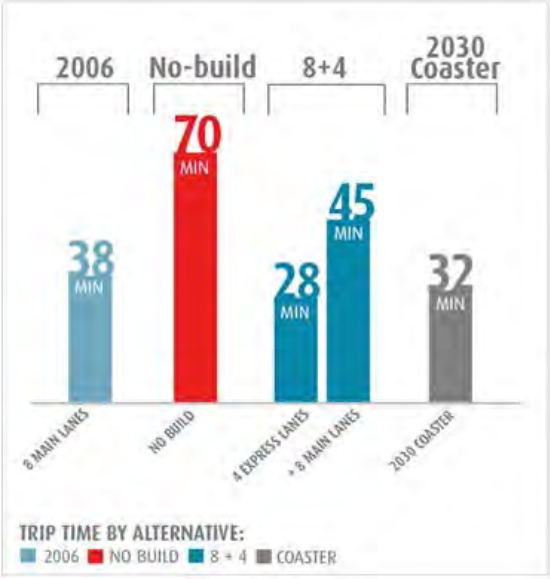
Table 11: Median Weekday Peak Travel Times (minutes), I-5 and COASTER from La Jolla Village Drive to Harbor Drive

	Interstate 5				COASTER		
Time/ Direction	2010	2030 No-Build	2030 General Purpose Lanes	2030 Managed Lanes	2008	2030 No-Build	2030 Improved
A.M. Peak Period							
Northbound	23	37	26	24	34	37	32
Southbound	35	54	36	24-26	34	38	30
P.M. Peak Period							
Northbound	30	70	45	28	34	37	32
Southbound	32	40	30	24-25	34	38	30

Source: I-5 North Coast Corridor System Management Plan (CSMP), August 2010 and Staff Updates

Figure 10 is a graphical depiction of the travel times during the PM peak period in the northbound direction. (The planned improvements to I-5 are expressed in the figure as the "8+4" scenario.)

Figure 10: Typical Weekday PM Travel Times from La Jolla Village Drive to Harbor Drive



Source: I-5 North Coast Corridor System Management Plan (CSMP), August 2010 and Staff Updates

Table 12 depicts the types of travelers who will benefit from the planned transportation improvements, separated by each transportation facility in the NCC.

Table 12: Travelers Benefitting from Planned Transportation Improvements

	COASTER	Inter-regional Rail	I-5 Managed Lanes	I-5 General Purpose Lanes	Coast Highway Rapid Bus	Local Bus	Bike & Pedestrian
Residents							
Short (< 5 miles)				■	■	■	■
Medium (5-30 miles)	■		■	■	■	■	■
Commuters							
Short (< 5 miles)				■	■	■	■
Medium (5-30 miles)	■		■	■	■	■	■
Long (> 30 miles)	■	■	■	■			▒
Visitors							
Medium (5-30 miles)	■	■	■	■	▒	▒	▒
Long (> 30 miles)	■	■	■	■	▒	▒	▒
Businesses							
Short (< 5 miles)			■	■			
Medium (5-30 miles)		■	■	■			
Interregional & Through Travelers							
Medium (5-30 miles)		■	■	■			
Long (> 30 miles)		■	■	■			

■ *Primary trip mode* ▒ *Secondary trip mode*

5.3 Other Strategies to Minimize Highway Expansion

SANDAG and Caltrans understand that the region cannot completely build its way out of congestion, and they have therefore adopted several strategies to focus on managing demand. Population and travel demand will continue to grow in the NCC with or without highway or transit improvements, and SANDAG's goal is to accommodate the growth in the most efficient way possible, minimizing costs as well as environmental impacts.

I-5 was constructed in the 1960s and 1970s. In the past forty years, travel demand in the NCC has increased significantly, but capacity improvements on I-5 have been limited and the footprint of the freeway has changed very little. Improvements to I-5 in the NCC have included the interchange with the I-805 merge, the addition of HOV lanes in the southern portion of the corridor, and operational improvements such as variable message signs and ramp meters.[34] In the absence of major highway expansion in the corridor over the past forty years, the region has focused on a variety of strategies that work together to manage the growth in demand and address the multiple needs of travelers. Without these ongoing strategies, as many as sixteen total lanes of freeway—double the existing I-5 footprint—would be required to meet future forecasted travel demand.[35] Instead, the past and future approach includes the following major components:

Transportation Demand Management (TDM)

TDM strategies have been and will continue to be a critical element for reducing travel demand in the corridor by encouraging use of bus, carpooling, and other alternative modes. TDM strategies take advantage of and help build a customer base for alternative modes by removing obstacles and providing information and incentives to travelers to make it easy to shift from single-occupant driving, reduce trips, or reduce travel at the most congested times. In addition to the ridematching services, vanpool subsidies, and other incentives offered through SANDAG's iCommute program, TDM strategies may include financial assistance from employers for taking transit, allowing alternative work schedules (i.e., "flex time"), and providing opportunities for teleworking from home.

Transportation Systems Management (TSM) and Operational Improvements

TSM is a strategy to increase highway capacity without major capital investment, by enacting various operational improvements that increase system efficiency. These include construction of new auxiliary lanes on the outside of the freeway that will connect on- and off-ramps and allow for acceleration, deceleration, and merging—often the causes of traffic bottlenecks and congestion. Other improvements include Intelligent Transportation System (ITS) features, such as real-time information for drivers that allows them to make informed decisions on travel routes, and corridor-wide ramp metering to help regulate the flow of traffic. Various corridor interchange improvements help eliminate or minimize bottlenecks in the transportation system. Additional detection, monitoring, and communications infrastructure will allow for incident response and active management of the highway.

[34] CSMP, Chapter 2, pg. 2-5, 2-6
[35] Caltrans staff estimate

6.0 TRANSPORTATION OBJECTIVES: MOBILITY, EFFICIENCY, & PRESERVATION

Broadly speaking, the transportation objectives identified in Section 5 are aimed at increasing regional mobility in ways that respect both the environmental and fiscal implications of transportation projects. The Six-Point Alternative Mode Strategy for the NCC is an embodiment of those objectives, with each element of the strategy contributing to the maintenance of an effective and balanced transportation system in the NCC.

Congestion Reduction

As discussed in Section 3, the NCC's transportation facilities today are plagued by congestion. From the peak-period backups along I-5 to the single-track delays on the LOSSAN rail corridor, the NCC represents a bottleneck not just for the San Diego region, but also for the state and national transportation systems. Regular periods of congestion directly result in lost time—and lost money and access—for residents, commuters, and visitors. Bottlenecks on the highway and rail corridors also impede the efficient movement of goods in and through the region, including the economically vital connections to Mexico and the Port of San Diego, resulting in longer shipping times, higher product costs, and economic losses for the entire society. On I-5, these bottlenecks also spill into the local road network in the form of "cut-through" traffic, which congests local communities. Finally, congestion diminishes air quality throughout the corridor as vehicles are forced to operate at inefficient speeds in stop-and-start settings.

With population growing and travel demand increasing even more rapidly, the future promises even greater levels of congestion in the NCC unless capacity improvements are made. The Six-Point Alternative Mode Strategy discussed in Section 5 outlines a wide range of multi-modal improvements planned throughout the corridor to address the growing travel demand. The addition of Managed Lanes to I-5 is one element of this solution, which will expand the highway's capacity for high-occupancy and transit vehicles. But the solution also includes LOSSAN double-tracking, COASTER service improvements, new Rapid Bus and BRT services, enhanced local bus service, and better facilities for bicycles and pedestrians. Each improvement is aimed at increasing capacity in some way and, taken together, they represent a balanced approach to addressing the mobility and access problem. The fulfillment of the PWP's multi-modal transportation vision will go a long way toward increasing corridor capacity, decreasing congestion, and providing faster, more reliable travel choices for the residents, visitors and businesses who use the NCC's transportation system to access homes, jobs, shopping, recreational venues, and coastal resources.

Environmental Protection and Enhancement

While the LOSSAN rail improvements and the addition of Managed Lanes to I-5 will expand the transportation footprint within the coastal zone, SANDAG has selected the smallest-footprint highway alternative (8+4 with buffer) among the highway expansion options considered for the corridor. Further, the concurrent Resource Enhancement Program, which is tied to implementation of the corridor transportation projects, ensures that significant contributions are made to the enhancement and protection of the NCC's environmental resources. The package of improvements planned for the NCC includes not just highway, rail, bicycle, and pedestrian enhancements, but also wetland restoration and creation, lagoon bridge lengthening, and the improvement of coastal trails and habitat areas. By

taking advantage of funding that would otherwise be unavailable, the Resource Enhancement Program ensures that the NCC's natural environment will benefit from the planned transportation improvements.

The PWP's multi-modal vision will also reap environmental benefits through improved air quality, which will result from increased high-occupancy vehicle (HOV) travel as well as fewer vehicles operating in the inefficient, stop-and-start patterns of congestion. SANDAG is mandated by state law to reduce per capita greenhouse gas emissions by 2035, and the agency plans to achieve this through increases in both HOV travel and transit ridership. The PWP's investments in Managed Lanes, LOSSAN rail improvements, and transit service enhancements directly contribute to these objectives, and are key components of SANDAG's overall strategy to meet the legal mandate.

Transportation Flexibility

While population growth in the NCC is expected over the next 40 years, other unforeseen changes may also occur that alter the mobility needs of the corridor's residents and visitors. Whether it is variations in travel patterns, modifications to land use policy, or advancements in technology, the transportation system should be equipped to respond to these changes as they happen. Caltrans and SANDAG understand that the current high level of demand for automobile travel may not persist forever—particularly as regional congestion and fuel costs increase—and this is why they have chosen a program of multi-modal improvements for the NCC.

The Managed Lanes on I-5, for example, will not just allow more efficient automobile travel in the corridor, but will also serve as an essential enabler of future transit services, by providing a congestion-free path for express buses or Bus Rapid Transit (BRT). The ability to manage these new highway lanes to meet changing travel behavior and demand—by varying tolls, changing vehicle occupancy requirements, or even creating a truck route during certain times of day—guarantees that there will always be free-flow access to coastal resources and communities. The RTP already includes plans for a reverse-commute BRT that will utilize I-5, traveling from San Diego's Mid-City neighborhoods north to the employment centers near Palomar Airport Road in Carlsbad. While the I-5 peak-period BRT (traveling south in the morning and north in the afternoon) did not perform well enough in model projections to be included in the current RTP, the existence of Managed Lanes will allow this service to be added in the future when demands dictate. Similarly, the planned LOSSAN rail enhancements will allow for much greater capacity on the rail corridor than is needed today, ensuring that the rail infrastructure will be able to accommodate growth in coastal rail access demands for many decades into the future.

Value Maximization

The competing demands for the region's limited transportation funds require SANDAG to select projects using a rigorous evaluation of goals, priorities, and projections during the regional planning process. As discussed in Section 4, the 2050 Regional Transportation Plan seeks to maximize the efficiency and effectiveness of transportation investments, and its prioritization of projects reflects this goal. While a basic level of funding is provided to all areas, the RTP's major investments are focused in places where they are most likely to succeed; in the denser urban areas of the region this often means a greater

emphasis on transit services, while in the outlying, more suburban areas this might mean a higher proportion of new highway projects or improved local arterials.

The PWP includes a combination of transportation investments that improve the transportation system's efficiency by favoring implementation of high-capacity transit and highway facilities over expansion for single-occupancy autos. And because these facilities will offer fast and reliable travel choices for a variety of travelers to, through, and within the NCC, they are projected to attract sufficient use to maximize the value of the investments. While a transportation "wish list" for the NCC—one that is unconstrained by fiscal or legislative requirements—might contain even larger investments in transit, as discussed in Section 3, the corridor's demographic, employment, land use, geography, and travel pattern characteristics limit the viability of more significant investments in transit. The PWP projects will greatly improve corridor mobility and access while balancing both the corridor and regional need to maximize the benefits per dollar spent.

Coastal Access

The NCC's transportation system is the gateway to the corridor's rich coastal resources, which are enjoyed by millions of residents and visitors each year. Current levels of congestion, which persist on weekends as well as weekdays, directly impede public access to these coastal areas and the neighboring communities. By providing increased mobility in the NCC, the improvements identified in the PWP—not just highway and rail enhancements, but also increased bicycle and pedestrian connections—will provide better, faster and more reliable access to the coast, improving local quality of life and simultaneously fulfilling the Coastal Act mandate to preserve coastal access. The issues surrounding coastal access and the provisions of the Coastal Act are discussed in greater detail in Section 7.

Integration into Larger System

The NCC is not an isolated corridor, but rather one piece in a much larger network of regional, state, and national transportation facilities. As a federally designated "Corridor of the Future," I-5 is an economically significant resource that plays an important role in the movement of people and goods. Similarly, LOSSAN is the nation's second-busiest passenger rail corridor as well as a significant freight facility. Considering the roles that these NCC facilities play in the national economy, it is clear that local congestion is not simply a local problem; such deficiencies create impacts that are felt well beyond the San Diego region.

It is therefore critical to ensure that the NCC's transportation infrastructure is maintained as an effective link in the national transportation system. The facilities must minimize congestion, remain in good repair, and take advantage of technological and operational advancements to increase efficiency. The PWP accomplishes these goals by providing NCC facilities with their first major overhaul in decades, expanding the capacity of both I-5 and LOSSAN to accommodate new demand. In addition, the PWP calls for a wide range of repairs and enhancements—including grade separations, signal improvements, direct access ramps, and auxiliary lanes—that will increase throughput efficiency and help preserve the facilities for the long term. This will allow the NCC to maintain its crucial role as an important link in the larger transportation network and ensure that degradation of NCC transportation facilities does not become the weak link in regional and interregional access to the coast.

Movement of People Rather than Vehicles

The efficiency of a transportation system can be measured by the mobility benefits it provides in relation to its costs. Because each vehicle on a highway contributes to congestion, maximum efficiency is achieved when every vehicle is carrying the greatest amount of people or goods possible. While this is not a realistic scenario for all travelers—circumstances often require travel in single-occupancy vehicles—high-occupancy travel is still something that can be encouraged with incentives. Managed Lanes are one such incentive, as they offer travelers a choice: Either travel alone and risk delays, or carpool and bypass congestion. It is in this way that Managed Lanes prioritize the movement of people over the movement of vehicles, thus achieving both better mobility, and higher capacity, per dollar spent. As noted in Section 5, even if each HOV only contains two people, one Managed Lane is able to carry roughly 70 percent more people than one general-purpose lane during peak conditions.[36] This confers a clear benefit to the region by achieving greater mobility outcomes per dollar spent than a traditional, general-purpose highway expansion. Transit investments bring similar benefits by encouraging travelers to ride in high-occupancy trains or buses when it fits their travel needs. By focusing investments in the NCC on high-occupancy transit and Managed Lane facilities, the PWP projects will enable more efficient coastal access for many more people well into the future than would otherwise be possible under current conditions.

Prioritizing the movement of people over vehicles also contributes to environmental goals, since high-occupancy travel produces fewer greenhouse gas (GHG) emissions per capita than single-occupancy trips. SANDAG is required by state law to meet GHG reduction targets, and the addition of Managed Lanes to regional highways is a key component of the agency's strategy to achieve this. Similarly, the planned enhancements to the LOSSAN rail corridor will reap both mobility and environmental benefits, by providing a better level of service that will encourage some travelers to ride the COASTER instead of driving alone. Efficient movement of people in the coastal corridor will help enhance air quality along the coast and positively contribute to regional GHG reductions.

[36] Managed Lane capacity is generally 1700 vehicles/hour * 2 people/vehicle = 3400 people/hour. General-purpose lane capacity is generally 2000 vehicles/hour * 1 person/vehicle = 2000 people/hour. 3400/2000 = 170%.

7.0 COASTAL ACT POLICIES: PUBLIC ACCESS, RECREATION & TRANSPORTATION

The coastal access and recreation policies of the Coastal Act mandate that maximum public access and recreational opportunities in the Coastal Zone be provided for all people, consistent with the need to protect public safety, private property and natural resources. These policies further require public facilities to be provided throughout an area so as to mitigate impacts of overcrowding or overuse by the public of any single area, that low-cost visitor serving and recreational facilities be protected, encouraged, and where feasible, provided, and that upland areas necessary to support coastal recreational uses be reserved for such uses, where feasible.

7.1 Traffic Congestion Reduction

The Coastal Commission Public Access Action Plan recognizes roadway congestion as one of the greatest impediments to public access in coastal areas and specifically notes that, among other things, traffic congestion and poor traffic circulation are significant problems where residents and visitors compete to use the same transportation system. As discussed in Section 2.0, travel demand and traffic congestion in the NCC is driven not only by residents and visitors, but by a wide variety of travelers with a range of needs that require an array of transportation solutions. However, when considering the unique needs and travel patterns of visitors and recreational travelers in the corridor which, as discussed in Section 2.2, are not easily served with transit, the region's past and continuing efforts to reduce traffic congestion and maintain acceptable transportation services on I-5 and local transportation arterials are critical elements to protecting public access to recreational opportunities along the San Diego County coastline.

As the primary means for the public to reach shoreline access points and upland recreational destinations in the NCC, I-5 serves as the gateway to the entire San Diego coastal area and provides a unique scenic, recreational traveling experience. As travel demand in the I-5 highway corridor continues to increase, so does the existing coastal access impediment of traffic congestion. Congestion on I-5 also results in increased congestion on local arterial street networks, when frustrated travelers exit the congested highway in search of alternate routes, further restricting mobility and impeding access to coastal resources along local transportation corridors.

The TREP/PWP recognizes that constructing new transportation corridors or new general-purpose lanes to meet travel demand would not solve the highway capacity deficiency without affecting adjacent communities, lagoons and habitat areas. To address the highway capacity deficiency in the corridor in a way that would provide the most benefit to coastal access and natural resources while meeting regional travel demand, TREP/PWP facility improvements are planned to accommodate more travelers (i.e., more people), more efficiently, and with minimal facility expansion (footprint) when compared to other transportation alternatives.

To increase capacity and reduce congestion on I-5, proposed TREP/PWP improvements focus on HOV and Managed Lanes, which will provide significantly more person-carrying capacity per lane than a general-purpose lane (carrying roughly 70 percent more people than one general-purpose lane) by

promoting carpool, vanpool, and other transit alternatives to SOVs in the corridor. In addition, as the primary means for the public to reach shoreline access points and upland recreational areas in the NCC, the proposed high occupancy and Managed Lanes will specifically serve visitor and recreational travelers in the NCC, which constitute up to 50 percent of weekend HOV traffic on some sections of I-5.

Toll-paying SOVs would be permitted to access Managed Lanes only when capacity exists, generating revenue to fund corridor transit operations and further reducing overall congestion on the highway for all users at appropriate times. However, the Managed Lanes strategy will preserve free-flow speeds and reliable travel times as the rest of the highway lanes become congested, providing unconstrained access to the coast for priority HOV and transit users. In addition to prioritizing visitor and recreational methods of travel on I-5, reduced traffic congestion on I-5 will alleviate the pressure of local communities to address and accommodate cut-through traffic on Coast Highway and other arterial streets that may otherwise be impacted as travelers search for alternate routes to a congested highway. Maintaining access along the I-5 corridor will also serve to maintain access along the various local coastal transportation corridors in the NCC, ensuring spill-over travel demand from I-5 does not impact local communities or precipitate improvements on local arterials which could impact the NCC's sensitive coastal resources.

Managed Lanes will accommodate future demand on I-5 by getting the most person-carrying capacity out of the least amount of highway footprint expansion, thereby reducing overall congestion on I-5 for all users, protecting and facilitating public access, and minimizing impacts to adjacent communities and sensitive coastal resource. Finally, as discussed further below, I-5 Managed Lanes will make possible new and expanded public transportation opportunities in the NCC by prioritizing and ensuring reliable travel for buses and other HOVs, and I-5 infrastructure improvements will provide new opportunities to enhance pedestrian and bicycle coastal access facilities, all of which will provide alternative means of coastal access in the NCC and further reduce demand on I-5.

7.2 Alternative Transportation Options

The lack of adequate transit service and other alternative transportation modes to access the beach and upland coastal recreation areas is also a recognized impediment to public access. Directly linked to the region's objectives to provide transportation flexibility and ensure the movement of people rather than vehicles are Coastal Act policies which direct protection and enhancement of public access and recreation opportunities by (1) facilitating the provision or extension of transit service, (2) providing non-automobile circulation, (3) providing adequate parking facilities or serving new development with public transportation, and (4) assuring the potential for public transit for high intensity uses.

In addition, the Coastal Act recognizes the benefits of providing transportation choices for all people to not only coastal public access and recreation, but also as a means of reducing vehicle miles traveled, energy consumption and greenhouse gas emissions, and thus curtailing the effects of global climate change. While implementation of Coastal Act policies is limited to addressing development activities affecting coastal resources in the Coastal Zone, climate change is a coastal resource issue driven by land use and transportation activities that extend well beyond the boundaries of the NCC and the region. In

this regard, Coastal Act policies which address reducing vehicle miles traveled and energy consumption through provision of transit in the Coastal Zone are supported by the region's transportation objectives to ensure the NCC's transit-focused transportation system is effectively integrated into the regional, state, and national system, and that transportation investments in the NCC compliment the region's commitment to provide the greatest possible mobility project benefits per investment. Investing available funds in transportation improvements that will support transportation solutions across jurisdictional boundaries, and which will facilitate smart growth practices that maximize mobility at the regional level, is the best means of reducing vehicle miles traveled and energy consumption in the region to help achieve state-mandated GHG reductions, and thus support efforts to address the effects of global climate change on coastal resources.

Rail

As described in Section 3.0, passenger rail services along the LOSSAN rail corridor are currently constrained by infrastructure that is undersized for the volumes of traffic it accommodates. Currently, about half of the 27-mile rail corridor consists of single track, which greatly constrains the movement of trains through the corridor, causing other trains to stack at each end of single track, thus resulting in delays and reducing the attractiveness of rail as a travel mode choice and as an alternative means of access to coastal resources. Since travel time and reliability are among the most important factors in the public's choice of transportation modes, longer and uncertain travel times currently make rail a less-attractive travel option in the NCC.

Rail improvements that increase capacity, reduce travel time, increase reliability, and provide new service area opportunities, are readily recognized as major contributors to protecting and enhancing access to the coast. Overall improvement of rail service is expected to attract more users. While new rail customers will certainly include some visitors and recreationists accessing coastal destinations, Section 2.2 explains the majority of new users are expected to consist of commuters and longer-distance travelers with predictable trips. As these customers are most effectively served by transit in the NCC, planned enhancements to the NCC rail corridor will increase the transit mode share for commuters and longer-distance travelers, thus relieving congestion and reserving capacity on I-5 for other users, including visitors and recreational travelers which are not easily served with transit and rely primarily on I-5 to access the San Diego coastline.

Access to rail stations is another component of ensuring maximum use of rail service to meet the NCC's travel demands. As discussed in Section 3.2, approximately 80% of NCC COASTER commuters arrive at the station by car. Although driving and parking is the primary means of accessing the LOSSAN rail corridor, parking availability is constrained at stations. On average, all of the station parking lots, except Oceanside, are at, or exceed, capacity by 8:00 a.m., thereby inhibiting many potential passengers from using rail corridor services.

Proposed TREP/PWP improvements for the LOSSAN corridor would contribute substantially to enhancing mobility throughout the NCC by increasing and improving rail service, providing new rail service at Del Mar Fairgrounds, and supplementing parking supply at rail stations for new customers. The Del Mar platform—currently planned to operate only seasonally—would provide new access opportunities to the beach, San Dieguito River Park, and Del Mar Racetrack and Fairgrounds, one of the

region's most popular tourist destinations. Planned access improvements to rail stations also include pedestrian and bicycle access. Opportunities to overcome pedestrian and bike access impediments to transit stations and coastal activity centers are the subject of a focused study, and will be presented separately.

BRT, Rapid Bus and Ride-Share

Traffic congestion on I-5 presently discourages many potential bus transit and ride-share options as these modes of travel are subject to the same traffic congestion that SOVs experience on freeway mainlanes. As highway deficiencies associated with increased travel times and reductions in reliability continue to worsen, these alternative modes of transportation become significantly less desirable and, especially with BRT, infeasible.

The addition of Managed Lanes for I-5 will serve as an essential enabler of public transportation. Planned improvements will provide incentives for people to shift from SOV to public transit and ride-sharing where these vehicles would have direct access to the uncongested HOV/ Managed Lanes where reduced travel times and reliability are assured.

The NCC currently does not have BRT or Rapid Bus service. Implementation of these types of transit improvements are planned in the corridor over the next forty years, with successful BRT wholly dependent on implementation of the I-5 Managed Lanes. The BRT planned for the I-5 Managed Lanes targets the peak-period commute trip between the high-density Mid City residential area in central San Diego and the Palomar Airport Road business park in the NCC. As with planned rail service improvements, BRT will serve to relieve congestion and reserve capacity on I-5 for other users, including visitors and recreational travelers which are not easily served with transit. Rapid Bus service is planned for Coast Highway through the NCC. The planned service will provide a higher-quality local transit option to complement the existing network of local bus routes in the corridor, further increasing regional mobility and alternative access to coastal areas for residents and visitors alike.

The region's Transportation Demand Management (TDM) strategies have been and will continue to be another critical element for increasing transit and reducing travel demand in the corridor by encouraging use of bus, carpooling, and other alternative modes. In addition to offering ridematching services, vanpool subsidies, and other incentives offered through SANDAG's iCommute program, TDM strategies may include financial assistance from employers for taking transit, allowing alternative work schedules (i.e., "flex time"), and providing opportunities for teleworking from home. I-5 Managed Lanes is a necessary element to successfully implementing many TDM strategies, particularly those focused on shifting SOV travelers to bus, vanpool and carpooling. When implemented together, Managed Lanes and TDM strategies will work to remove obstacles and provide incentives to travelers to make the shift from single-occupant driving, thereby reducing trips and congestion on I-5.

Future Transit for High-Intensity Uses

Section 6.0 describes the inherent limitations to the effectiveness of transit alone to meet future travel demand in the NCC, which is based less on insufficient transit service and more on the physical arrangement of the corridor's employment, land use, and population patterns. Nonetheless, the region

is aggressively planning to accommodate future population growth while reducing travel demand through provision of transit for the benefit of all who live, work and recreate in the NCC.

To accommodate projected population growth, SANDAG and local governments have implemented a "Smart Growth" land-use strategy that seeks to increase population density in specific areas, reduce vehicle miles traveled, and curb greenhouse gas emissions. "Smart Growth" policies encourage transit-friendly development patterns by concentrating development in areas with sufficient public services and promoting more trips by foot, bike, and transit, with correspondingly less reliance on the automobile. The NCC contains over 15 of these Smart Growth opportunity areas, the majority of which are located in community cores near COASTER and SPRINTER transit stations.

Planned "Smart Growth" areas in the NCC will go a long way toward concentrating populations near rail stations but will be unable to transform the existing, much more far-reaching land use patterns into a broader transit-supportive environment, which would require a tripling of residential densities and redeveloping communities throughout the NCC and Coastal Zone with more walkable, grid-like, better-connected local street networks. However, "Smart Growth" is the most sustainable means of accommodating future growth in the NCC, and the 2050 RTP includes significant investment in LOSSAN rail, BRT, Rapid Bus, and local bus service in the corridor to accommodate this growth near stations and along transit routes with a goal of increasing the transit peak-period commute mode share from 2-3% to 10-15% (over a 400% gain from 2010), an ambitious target given the NCC's inherent limitations to transit effectiveness.

The proposed TREP/PWP includes transportation and transit infrastructure and service improvements intended to specifically serve planned "Smart Growth" areas to help avoid increased traffic congestion, reduced mobility, and a deteriorating quality of life. By planning for higher-density growth in the already developed corridor, implementing improvements to increase ridership on the existing LOSSAN rail corridor, and adding I-5 Managed Lanes that encourage HOVs and transit, the region will encourage concentrated growth patterns in which travel demand can be more readily accommodated.

Parking and Public Transportation

Adequate parking facilities in coastal areas necessary to serve residents, commercial uses and visitors who travel by car is an important variable that influences public access and recreation opportunities in the Coastal Zone. Where parking is not feasible, substitute means of access such as public transportation, pedestrian and biking facilities are necessary to access the coast. The TREP/PWP includes implementation of various public transportation service improvements to protect and enhance public access in the NCC, including rail, BRT and rapid bus.

Providing access to transit, supported by ample parking resources, walking and bike facilities, is an important component of ensuring maximum use of rail service to meet the NCC's various travel demands and coastal access needs. In addition, as the majority of rail stations in the NCC are located just blocks from the beach, constrained parking resources have the potential to result in overflow parking by train passengers onto adjacent streets, which could displace parking resources used by people to access the coast by automobile. However, where adequate parking supply does occur, these parking resources could also be used to support access to nearby beaches and recreation areas.

Proposed TREP/PWP improvements include expanding parking areas at the corridor's transit stations, which would support passenger rail service and reduce the possibility of conflicts between rail passenger and coastal access parking resources on adjacent streets.

Non-Automobile Circulation and Enhancement of Recreational Facilities

The Coastal Act recognizes the necessity and benefit of providing varied transportation choices for all people, including alternative transportation modes that are not reliant on the automobile. These choices include not only transit, but also active transportation modes such as walking and biking. Well planned, non-motorized transportation networks can bridge the gap between origins or destinations and the transit system, addressing the classic "last mile" problem for transit users. In addition, pedestrian and bike facilities create attractive transportation links between land uses that draw travelers out of their automobiles when making short, local trips and when seeking access to coastal resources. Providing pedestrian and bicycle access to the shoreline and upland recreation areas is one of the highest priorities of the Coastal Act.

The Coastal Rail Trail provides coastal access the length of the NCC primarily on a bicycle facility. The California Coastal Trail also provides coastal access the length of the NCC along various shoreline and inland routes. Both of these regionally significant trails are developed to varying levels, with east-west access to the trail corridors occurring along primary and secondary bicycle and pedestrian routes that cross over the I-5 and LOSSAN corridors. The east-west access routes are limited and contain gaps due to topographical, transportation facility, and environmental barriers. Many bicycle and pedestrian routes traverse highway overpasses and rail crossings where facilities narrow and the quality degrades. Local roads cross I-5 in the east-west direction 37 times in the corridor, and most of these are non-standard bicycle and pedestrian crossings. As a result, it is difficult to make local trips and gain access to the shoreline and regionally significant coastal trails using these bicycle and pedestrian routes.

A fundamental element of the TREP/PWP is that it will improve bicycle and pedestrian routes and trails which would enhance the network and provide access to the NCC's transit stations, beaches, lagoons, open spaces, and coastal communities. Existing fragmented access routes and trails of the network would be upgraded and completed, eliminating barriers and gaps to provide safe, non-automobile circulation to and from coastal recreation areas, while creating new recreational opportunities.

Beneficial impacts to coastal access and recreation would result from highway improvements that include reconstructing under- and overpasses to better connect and improve bicycle and pedestrian access routes to the coast. These improvements would address travel-user separations to provide a more comfortable travel environment for pedestrians and bicyclists to further encourage these modes of travel across I-5 between inland and coastal areas, and in certain instances, would provide a connection to regional corridor Class I and Class II bicycle facilities accessed throughout the NCC. These improvements would improve travel choices and substantially enhance recreational opportunities in the corridor by completing linkages between communities, inland and coastal areas, and providing access opportunities to the NCC's regionally significant natural resource and recreation areas. Planned access improvements to rail stations also include the elimination of pedestrian and bicycle access barriers and the inclusion of other facility enhancements.

The NCC's new and enhanced access routes across lagoons would be similarly integrated into highway improvements. These access improvements would serve to meet a primary goal articulated in the state-mandated, Coastal Commission-supported *Completing the California Coastal Trail* report: "Create linkages to other trail systems and to units of the State Park system, and use the Coastal Trail system to increase accessibility to coastal resources from urban population centers."[37] TREP/PWP implementation would provide and connect several threads within the coastal trail system between inland and coastal communities to access the shoreline, lagoons and upland recreation, thus helping to achieve the goals of the *California Coastal Trail*.

Considering the significant alternative transportation options planned for the NCC, the TREP/PWP would maximize public access recreation opportunities throughout the corridor consistent with public safety needs by:

- Improving public transportation infrastructure to support more frequent, attractive, and reliable rail, BRT and rapid bus service, resulting in increased transit ridership and reduced traffic congestion that would otherwise adversely affect the ability of the public to reach the coast along this primary coastal access corridor.

- Improving and integrating transit services with other non-automobile modes of travel within the corridor to increase ridership and reduce traffic congestion that would otherwise adversely affect public coastal access.

- Facilitating and encouraging non-automobile transportation with new and improved multi-modal improvements that would provide access to the coast and recreation areas with alternative modes of transportation (trails, bike paths, and transit). The TREP/PWP projects will add and improve sidewalks and bicycle lanes at highway and rail crossings throughout NCC communities, providing access to coastal amenities including the Coast Highway, the Coastal Rail Trail, and the California Coastal Trail. This will effectively eliminate bicycle and pedestrian barriers, and provide enhanced connections with public transit centers, thereby promoting access to transit.

- Creating and enhancing pedestrian access to other natural resources including lagoons and adjacent upland areas via trail and bicycle improvements throughout the corridor.

[37] California State Coastal Conservancy. http://www.californiacoastaltrail.info/cms/pages/trail/done.html

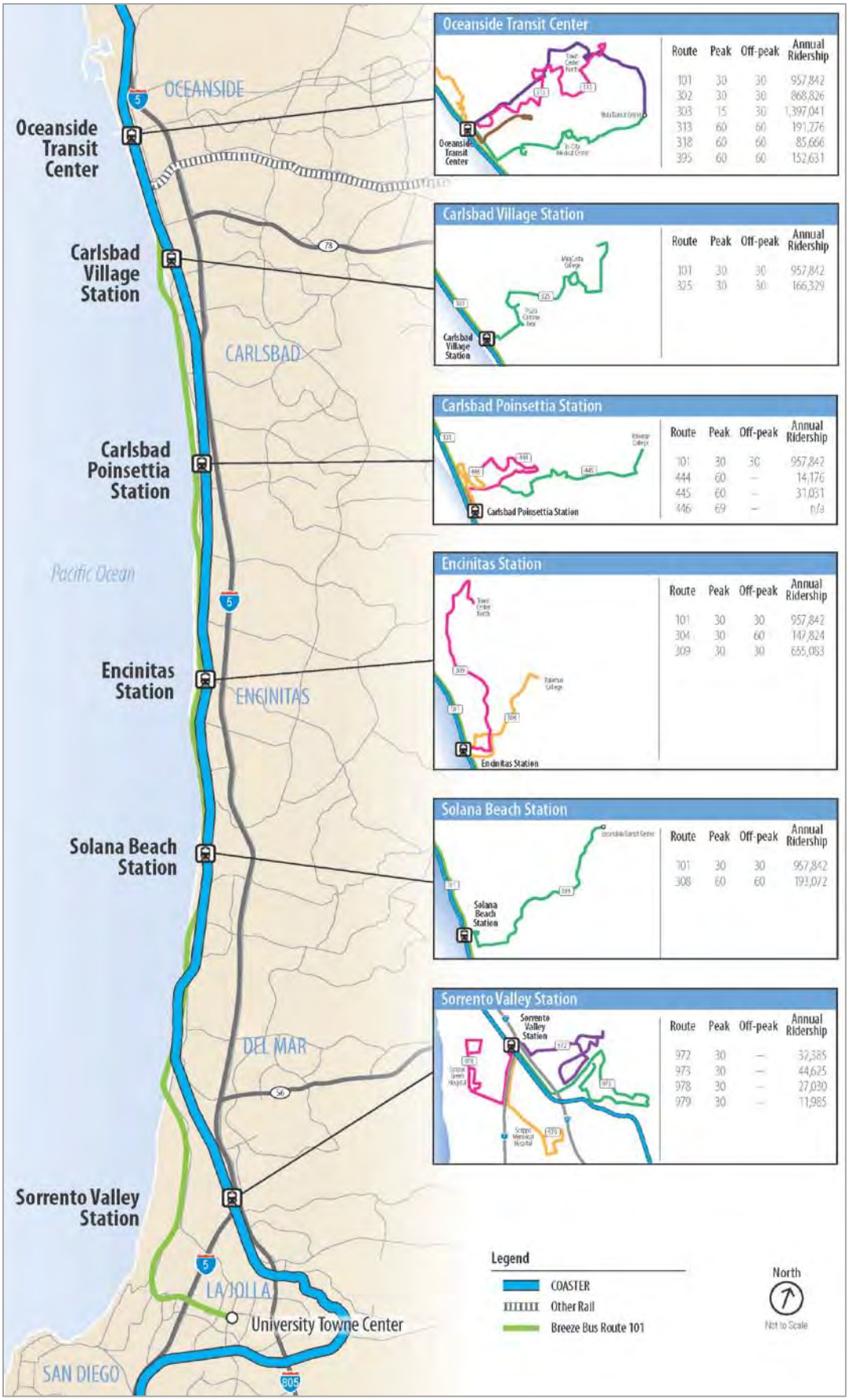
8.0 CONCLUSION

The multi-modal projects planned in the TREP/PWP aim to achieve both transportation and coastal goals in the North Coast Corridor. The NCC will get necessary infrastructure improvements—not just for roads and highways, but also for transit, bicycle, and pedestrian facilities—that will allow it to accommodate substantial future growth. Community enhancement projects will restore and preserve vital coastal areas, taking advantage of funding that would otherwise be unavailable. Most importantly, increased mobility throughout the NCC will increase coastal access for both residents and visitors.

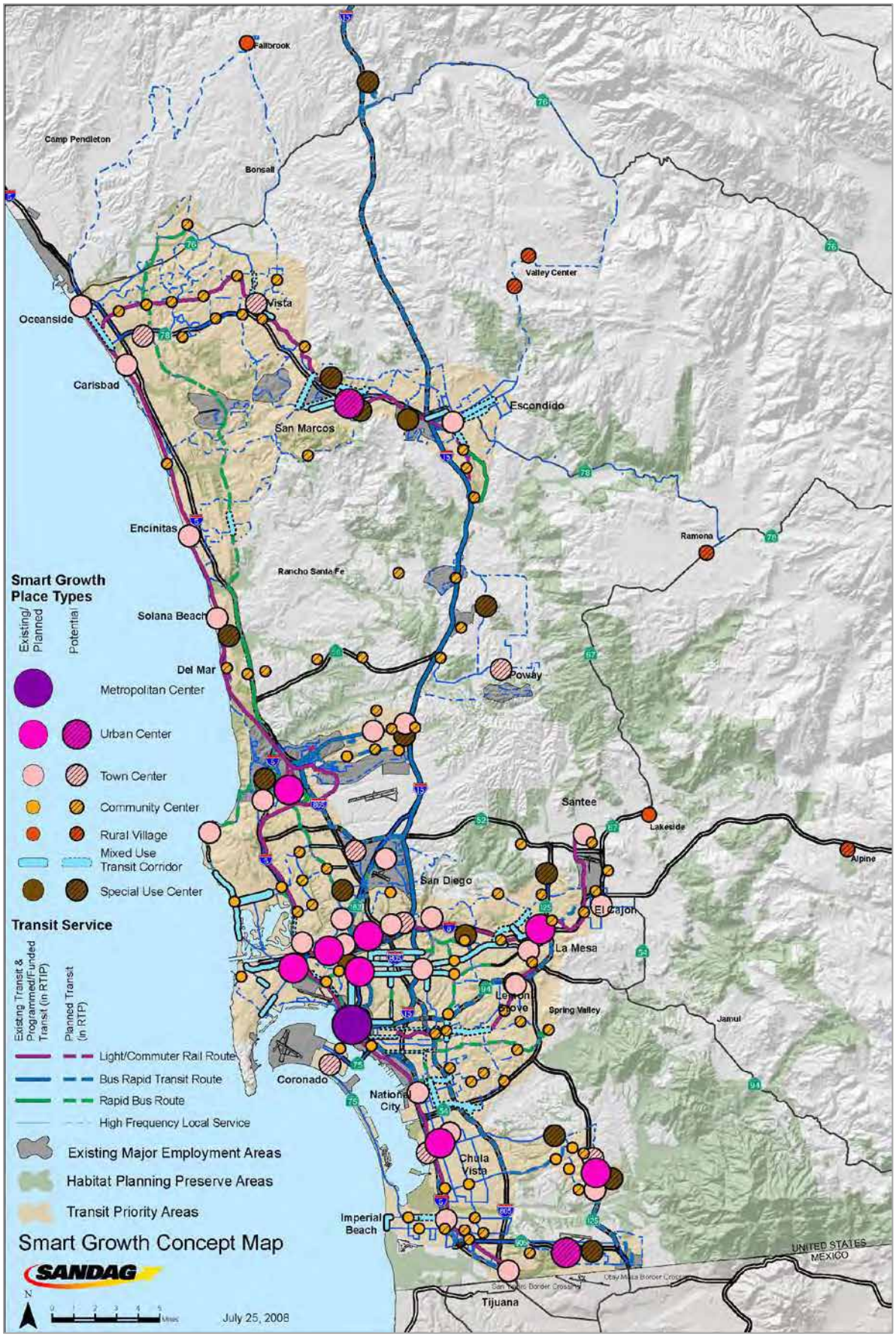
The TREP/PWP is only one part of a larger planning framework for the San Diego region. Balancing the needs of the region against the dual constraints of scarce funding and environmental mandates, SANDAG has devised a Regional Transportation Plan that invests $112 billion in mobility solutions through 2050. The NCC will benefit from LOSSAN rail corridor expansion, and new Rapid Bus and BRT services that will provide significant increases in capacity and travel options for corridor commuters, residents and visitors. The corridor's land use patterns and regional employment concentrations, as well as the wide diversity of travelers, trip purposes, and origins/destinations, require a multi-modal solution.

The addition of Managed Lanes to I-5 is a key element of this multi-modal solution to meet future demand in the NCC. The Managed Lanes represent the smallest expansion option for I-5 considered by SANDAG during the environmental review process, and they achieve the most efficient capacity increase by prioritizing the movement of *people* in the NCC, rather than simply moving *vehicles*. Only this kind of balanced, integrated, multi-modal approach in the North Coast Corridor can provide the range of transportation options necessary to meet the varied travel and mobility needs in the San Diego region.

Appendix A: NCC Bus and Rail Service Map



Appendix B: SANDAG Smart Growth Concept Map



Appendix C: Regional Employment Share by Community and City, 2008 and 2050

Communities with at least one percent of regional employment in 2008 and/or 2050 are included in the table. All other communities not listed have less than one percent of regional employment in 2008 and/or 2050. Most communities are projected to lose employment share by 2050.

	Number of Jobs 2008	Number of Jobs 2050	Change	Percent of Regional Share 2008	Percent of Regional Share 2050	Increase in Regional Share
Communities*						
Otay Mesa	14,360	51,110	36,750	1.0%	2.6%	1.59
Otay	2,828	15,385	12,557	0.2%	0.8%	0.58
Navajo	21,190	29,402	8,212	1.4%	1.5%	0.10
Lakeside	14,205	19,204	4,999	0.9%	1.0%	0.01
Rancho Bernardo	20,786	26,532	5,746	1.4%	1.3%	-0.06
Peninsula	15,126	18,589	3,463	1.0%	0.9%	-0.10
College Area	15,184	17,785	2,601	1.0%	0.9%	-0.10
Torrey Pines	15,801	17,791	1,990	1.1%	0.9%	-0.20
Linda Vista	16,672	18,379	1,707	1.1%	0.9%	-0.20
Midway/Pacific Hwy Corridor	21,416	24,070	2,654	1.4%	1.2%	-0.23
La Jolla	21,196	23,271	2,075	1.4%	1.2%	-0.25
Clairemont Mesa	22,447	24,891	2,444	1.5%	1.2%	-0.25
Uptown	29,361	34,046	4,685	2.0%	1.7%	-0.26
Mission Valley	52,551	64,920	12,369	3.5%	3.2%	-0.26
Pendleton-De Luz	30,959	35,459	4,500	2.1%	1.8%	-0.29
Palomar Airport Road	13,052	19,020	5,968	1.3%	0.9%	-0.32
Downtown San Diego	78,614	95,780	17,166	5.2%	4.8%	-0.46
Mira Mesa	76,172	91,111	14,939	5.1%	4.5%	-0.53
University	90,300	108,547	18,247	6.0%	5.4%	-0.60
Kearny Mesa	87,331	104,303	16,972	5.8%	5.2%	-0.61
Cities**						
Carlsbad	61,999	87,100	25,101	4.1%	4.3%	0.22
Chula Vista	70,230	121,555	51,325	4.7%	6.1%	1.39
Coronado	27,994	33,251	5,257	1.9%	1.7%	-0.20
El Cajon	41,686	58,630	16,944	2.8%	2.9%	0.15
Encinitas	26,985	31,481	4,496	1.8%	1.6%	-0.23
Escondido	61,143	75,004	13,861	4.1%	3.7%	-0.33
La Mesa	27,579	32,018	4,439	1.8%	1.6%	-0.24
National City	28,743	37,668	8,925	1.9%	1.9%	-0.03
Oceanside	43,977	67,410	23,433	2.9%	3.4%	0.44
Poway	31,176	41,005	9,829	2.1%	2.0%	-0.03
San Marcos	37,383	61,585	24,202	2.5%	3.1%	0.58
Santee	15,304	26,554	11,250	1.0%	1.3%	0.31
Vista	41,315	61,293	19,978	2.8%	3.1%	0.31
Subtotal	1,175,065	1,574,149	399,084			
Remainder of Region	326,015	428,889	102,874			
Region TOTAL	**1,501,080**	**2,003,038**	**501,958**			

*City of San Diego and County of San Diego communities with 1.0 percent or more of regional job share in 2008 and/or 2050.

**Cities with 1.0 percent of more of regional job share in 2008 and/or 2050. Some cities include community data.

Source: SANDAG, Series 12 Regional Growth Forecast

Appendix D: 2050 RTP Housing Density Maps

(Separate Attachment from 2050 RTP)

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the San Dieguito Lagoon W19 Restoration Site

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

JULY 2012

Printed on 30% post-consumer recycled material.

Site Location: The mitigation site is located east of Interstate 5 (I-5), south of Via De La Valle and the San Dieguito River, and west of El Camino Real. The parcel is situated in the eastern portion of San Dieguito Lagoon (see Figure 1).

Latitude/Longitude: 32.9722/-117.2357

APNs: 299-040-300 (1.6 acres) and portions of the following parcels:

- 304-020-1300 (6.2 acres)
- 304-020-1600 (62.7 acres)
- 299-040-4100 (18.0 acres)
- 299-040-4700 (4.6 acres)
- 299-040-3700 (6.2 acres)
- 299-040-3600 (7.2 acres)

Ownership: Owners in the approximate 107 acre mitigation area include the San Dieguito River Park Joint Powers Authority (JPA), Southern California Edison (SCE), and the City of San Diego. San Diego Association of Governments (SANDAG) entered into an agreement with the JPA to secure the rights to restore 107 acres of land east of I-5 and to the south of SCE coastal wetlands restoration project. In addition, the California Department of Transportation (Caltrans) has the rights over the restoration of 6 acres of the City of San Diego property at Caltrans discretion through a separate cooperative agreement.

Correspondence with Resource Agencies: A group of stakeholders, including the RWQCB, ACOE, CCC, CDFG, NMFS, and USFWS, was identified and brought together to discuss the feasibility of the W-19 property to support establishment and restoration of tidal and freshwater wetlands. Three stakeholder meetings were held in March and October 2011 and in April 2012. In February 2012, the agencies met to discuss additional design alternatives, which are currently being evaluated by SANDAG and Caltrans. The stakeholder meetings resulted in no major disagreement regarding the feasibility of the site to be used as mitigation; coordination with the stakeholders will be ongoing as hydrologic and sediment transport modeling and design alternatives become devised.

MITIGATION GOAL

The SANDAG and Caltrans propose to mitigate impacts to sensitive wetlands habitats associated with the projects covered under the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by creating and managing high quality tidal wetland and upland habitat on the referenced parcels located on the eastern side of San Dieguito

Lagoon. In addition, the City of San Diego will be mitigating impacts from the El Camino Real Bridge Replacement Project on a portion of the site in exchange for use of 14 acres of their property for salt marsh establishment. The goal of the mitigation project is to create new tidal wetlands and expand the tidal wetlands complex associated with the SCE San Dieguito Lagoon mitigation project, to create adjacent uplands habitat, and to ensure long-term management of the parcels in perpetuity.

This site assessment is largely based on information contained in the San Dieguito Lagoon W19 Restoration Project Feasibility Study (Dokken Engineering, December 2011). Excerpts from the San Dieguito Lagoon W19 Restoration Project Feasibility Study (Feasibility Study) are incorporated throughout this site assessment as noted in the following sections.

The Feasibility Study identifies the primary purpose of the mitigation site as follows:

> The primary purpose of the proposed project is to restore the habitats that historically occurred within this coastal area, taking into consideration the constraints now imposed by existing adjacent land uses. In light of permanent losses of adjacent wetlands and aquatic areas in addition to permanent hydrologic modifications, and urbanization surrounding San Dieguito over the last century, complete restoration of wetland and aquatic functions to historical levels is not possible. However, there is opportunity for the establishment and/or substantial restoration of large portions of the area that historically supported coastal wetlands. In addition, recent public acquisitions of the western river valley's floodplain areas and surrounding uplands provides many opportunities for restoration of native grasslands, coastal sage scrub, and other upland habitats, as well as brackish habitats that support light-footed clapper rail. Finally, the project offers opportunities for public access and interpretation/education including trail links to the Coast to Crest Trail along the southern edge of the project area.

The proposed mitigation project will complement the SCE San Dieguito Wetland Restoration Project and contribute to achieving the overall vision of the restored San Dieguito Lagoon system. The Feasibility Study identifies the San Dieguito Lagoon W19 Restoration Project's ultimate goal as achieving the establishment of at least 50 acres of tidal wetland area to the west of the utility corridor and to the east of I-5 and at least 14 acres of brackish wetland area to the east of the utility corridor and to the west of El Camino Real Road. For purposes of the North Coast Corridor PWP/TREP, the proposed mitigation is intended to create 48.4 acres of wetland habitat and to establish 19.8 acres of high quality upland habitat within the mitigation area, which will provide new and improved ecosystem continuity through connectivity between coastal wetlands and native uplands. Any sections of the proposed link to the Coast to Crest Trail along the southern edge of the project area are not included in the restoration totals of the site.

Table 1
Habitat Mitigation Goals

Habitat Types	Mitigation Type	Mitigation Acreage
Coastal Wetlands	Establishment	48.4 ac.
Uplands	Rehabilitation	19.8 ac.

EXISTING CONDITIONS

Ecological Context

The San Dieguito Lagoon W19 mitigation site is located in the San Dieguito River Valley, within the northern portion of the City of San Diego. The mitigation site is located within the Focused Planning Area of the JPA's San Dieguito River Park, and is located within the City of San Diego Multiple Habitat Planning Area (MHPA). The majority of the mitigation site was previously disturbed by agricultural activities (see Figure 2). Nonetheless, the California Natural Diversity Database (CNDDB) indicates numerous sensitive plant and wildlife species are present in the vicinity of the San Dieguito Lagoon W19 mitigation site (see Figures 3 to 5).

The Feasibility Study notes that although San Dieguito Lagoon has suffered damage as a result of human alteration, the lagoon's existing non-tidal wetlands and flats provide regionally important feeding and resting areas for migratory birds along the Pacific Flyway. The lagoon's tidal open water, mudflat, and salt marsh habitats also support a variety of birds, fishes, and invertebrates. Restoration of the lagoon would substantially improve the biological value of this resource. The Feasibility Study further notes that within the Del Mar USGS 7.5' Quadrangle surrounding the project area, there are 28 species that are either federally or state-listed as threatened or endangered and many other species that are listed as species of concern or California Native Plant Society sensitive species. The federally and state threatened or endangered species include 17 plant species and other wildlife including: western snowy plover (*Charadrius alexandrines nivosus*), California black rail (*Laterallus jamaicensis coturniculus*), Belding's savanna sparrow (*Passerculus sandwichensis beldingi*), coastal California gnatcatcher (*Polioptila californica californica*), light-footed clapper rail (Rallus longirostris levipes), California least tern (*Sternula antillarum browni*), least Bell's vireo (*Vireo bellii pusillus*), and Pacific pocket mouse (*Perognathus longimembris pacificus*) (CNDDB Rarefind 4 Query, 2011). There is no critical habitat in the project area.

Drainage and Hydrology

Jurisdictional waters associated with the San Dieguito Lagoon system occur in the project area. Groundwater occurs at depths between 7.0 and 9.5 feet below the existing grade. Various drainages exist throughout the site including man-made drainages associated with past agricultural land uses.

Soils

The Feasibility Study indicates that soils at the mitigation site consist generally of alluvial deposits consisting of very soft to soft sandy silt, loose to medium dense silty sand, and occasional gravel and pockets of clayey sand. A limited amount of beach quality sand has also been observed within the mitigation area.

Vegetation

The majority of the mitigation site has been previously disturbed by agricultural activities. The Feasibility Study identifies vegetation communities occurring on the site, as illustrated in Figure 2, and describes the communities as follows.

Disturbed habitat: The majority of the site is considered disturbed and occurs in areas impacted by SCE's restoration or in areas of former agricultural activities. A mixture of non-native invasive species as well as native species dominates these areas. Non-native dominants include prickly Russian-thistle (*Salsola tragus*), five-hook bassia (*Bassia hyssopifolia*), tree tobacco (*Nicotiana glauca*) and non-native grasses, e.g., bromes (*Bromus* spp.). Native species include coyote brush (*Baccharis pilularis*), broom baccharis (*Baccharis sarothroides*), and scattered mule-fat (*Baccharis salicifolia*).

Disturbed coyote brush scrub: This habitat occurs in drainage ditches on the former tomato fields that comprise the former Boudreau property. The dominant species is coyote brush with broom baccharis, prickly Russian thistle and five-hook bassia.

Disturbed high salt marsh/mule fat scrub: This habitat has developed in low lying areas that were disturbed by the SCE project. These areas are low enough to pond water during winter. They support a mixture of native wetland species as well as invasive non-native species. Dominant native species include Pacific pickleweed (*Sarcocornia pacifica*), bush seepweed (*Suaeda nigra*), alkali heath (*Frankenia salina*) and mule-fat. Non-natives include five-hook bassia, and prickly Russian thistle.

Arrow weed scrub: Arrow weed scrub consists of monotypic arrow weed (*Pluchea sericea*).

Brackish marsh: Brackish marsh occurs in the north/south trending man-made channel associated with former agricultural activities. It is typified by elements of both salt marsh and freshwater marsh. Dominant species include Pacific pickleweed, California bulrush (*Schoenoplectus californicus*) and Olney's bulrush (*Schoenoplectus americanus*).

Disturbed brackish marsh: Disturbed brackish marsh is similar to undisturbed brackish marsh except that it supports more weedy species. Dominant weedy species observed included curly dock (*Rumex crispus*) and annual beard grass (*Polypogon monspeliensis*).

Salt marsh: Undisturbed salt marsh occurs in two areas within the project footprint; both in association with the San Dieguito River. Salt marsh habitat on-site is dominated by Pacific pickleweed.

Disturbed salt panne: Disturbed salt panne is primarily unvegetated but shows evidence of vehicles having recently accessed the site for the SCE project. Those vehicles have left tracks and ruts that impound water resulting in invasion by non-native grasses, such as bromes.

Disturbed mule-fat scrub: Undisturbed mule-fat scrub is typically composed of scattered Mulefat with little understory. Disturbed mule-fat scrub differs from undisturbed mule-fat scrub by supporting a high percentage of invasive weedy species, including, five-hook bassia, tree tobacco and prickly Russian thistle.

Disturbed seasonal high salt marsh: Seasonal high salt marsh differs from salt marsh by its hydraulic regime. Salt marsh as defined here, is connected hydraulically to the river and is inundated by tides, at least intermittently if not daily. Seasonal high salt marsh is isolated from tidal flows and represents as relic conditions from before this area of the lagoon was disturbed. Seasonal high salt marsh relies on rainfall for its persistence. Disturbed seasonal high salt marsh supports a high percentage of non-native invasive species including non-native grasses (e.g., bromes) and crystalline iceplant (*Mesembryanthemum crystallinum*).

Wildlife

The Feasibility Study identifies wildlife species occurring on the site including song sparrow (*Melospiza melodia*), common yellowthroat (*Geothlypis trichas*), American crow (*Corvus brachyrhynchus*), Anna's hummingbird (*Calypte anna*), goldfinch (*Carduelis* spp.), kingbird (*Tyrannus* sp.), and black phoebe (*Sayornis nigricans*).

Prior and Current Land Use

The majority of the mitigation site has been previously disturbed by agricultural activities. The site now primarily consists of open space, and is zoned as open space within the City of San Diego's General Plan. The SCE San Dieguito Wetland Restoration Project, involving a comprehensive restoration project for approximately 150 acres of land in the western end of the San Dieguito River Valley, is located just north and west of the proposed mitigation site. Land uses surrounding the site largely include Open Space Reserves and Preserves followed by water. Open Space Reserves and Preserves consist of areas to be retained in their natural state and protected from future encroachment, disturbance, or degradation (City of San Diego, 2007). Water areas consist of the San Dieguito Lagoon, bays and the San Dieguito River.

Constraints/Existing Utilities/Infrastructure/Easements

Preparation of the Feasibility Study included review of right of way maps, as-built records, and design drawings from recently completed construction projects to determine the existence of utilities within the project vicinity (see Figure 6). Preliminary investigation indicated that the following utility companies have facilities within the project vicinity:

- AT&T
- Cox Communications
- Kinder Morgan
- NEXTG Networks
- SDG&E Electric
- SDG&E Gas
- City of Del Mar

The Feasibility Study notes that a 150-foot wide San Diego Gas and Electric (SDG&E) utility corridor separates the proposed tidal wetland area from the proposed brackish wetland area. Within the project area there is also an existing SDG&E electrical overhead line which runs north-south over the project area. A 10-inch abandoned steel pipe located within a 10-foot City of Del Mar easement was encountered and removed during the construction of the SCE

Restoration Project. Approximately 2,600 feet of the 10-inch abandoned steel pipe is located within the mitigation site and will require removal for the San Dieguito Lagoon W19 Restoration Project. An extensive investigation into the utilities on the site will occur through the NOID process.

Any sections of the proposed link to the Coast to Crest Trail along the southern edge of the project area are not included in the restoration totals of the site. The proposed trail will be clearly defined and mapped, and the trail acreages not counted toward mitigation. Additional limitations involving the trail use, including hours of use, fencing and signage, will be detailed in the Conceptual Mitigation Plan for the San Dieguito Lagoon W19 Restoration Site, through the NOID process and/or Coastal Development Permit.

Site access is via existing dirt roads that connect to El Camino Real on the south.

MITIGATION PROGRAM

The San Dieguito Lagoon W19 mitigation site presents an opportunity to create tidal and brackish wetland and native upland habitats which will complement the SCE San Dieguito Wetland Restoration Project and contribute to achieving the overall vision of the restored San Dieguito Lagoon system. Depending on the restoration option selected and implemented for the site, restoration activities would involve modification to the site's existing hydrology, topography and vegetation communities to varying degrees; however, all options involve establishing a tidal wetland area west of the SDG&E utility corridor and a brackish wetland area east of the SDG&E utility corridor. In addition, creating native upland vegetation communities would support and maximize sensitive biological resources onsite, and create a seamless connection to restored wetland areas and adjacent open space lands.

Schedule

The Feasibility Study provides a concept for the mitigation design, and a schedule for further development of the design, permitting and implementation (Table 2). Design and planning are ongoing with the development of more detailed alternatives analysis and an Environmental Assessment/Environmental Impact Report (EA/EIR) that will further develop these concepts. The ACOE is the federal lead agency and JPA is the CEQA lead agency. All resource agencies have been involved in these discussions and will continue to be involved as alternatives are developed. Detailed design will be provided through the Notice of Intent to Develop (NOID) approval process during the first phase of implementation of the North Coast Corridor PWP/TREP. As discussed in Section 6.5.3 of the PWP/TREP, the results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed

development, including consultations with federal and state resource agencies (e.g., Army Corps, USFWS, CDFG, RWQCB, etc.), as well as all supporting documentation are required to be submitted along with the NOID project report. Accordingly, all design and related project reporting would be submitted to the permitting agencies for consultation as part of the NOID review and approval process.

Table 2
Mitigation Project Schedule

Project Phase	Anticipated Start-Completion Date
Preliminary Design Engineering	12/11-12/13
CEQA/NEPA & PWP/TREP Preparation/Approval	12/11-12/13
Final Design/Project Report & Permitting (NOID/CDP/Federal Consistency & Agency Permits)	12/13-12/14
Implementation/Construction	01/15-01/17

Mitigation Goal and Purpose

The goal of the mitigation project for the PWP/TREP is to create approximately 48.4 net acres of tidal wetland area, with rehabilitation of about 19.8 net acres of native upland habitat also occurring. The Feasibility Study describes the various habitat establishment benefits as follows:

> The created wetland habitats, in particular salt marsh, are highly productive and efficient in transferring the energy produced by primary producers to higher trophic levels. Coastal wetlands, in particular salt marshes, are among the most productive systems in the world. The reason for this high productivity is that there are two major groups of primary producers (i.e., organisms that produce energy from sunlight) at the base of the flood chain – algae (including phytoplankton and macro-algae) and vascular plants. The food chain in salt marshes is shortened which makes primary productivity available directly to other trophic levels. For example, the California horned snail (*Cerethidia californica*) feed, directly on macro-algae and, in turn are preyed upon by higher order consumers, such as the endangered light footed clapper rail (*Rallus longirostris levipes*). In this example, the food chain is a three-step process and is very efficient at transferring energy from one trophic level to the next. (Nordby Biological Consultants et al, 2008).
>
> The interface between tidal channel and salt marsh interface increase energy transfer by making algae and detritus available to invertebrates and small fishes. Tidal channels with an edge to length ratio of 50% or greater have been positively correlated with fish standing crop (Adamus et al 1980). The irregular plant/water interface also provides structure and

protection for juvenile fishes, thereby serving a nursery ground for many fish species. The habitats that comprise a coastal wetland provide habitat and refuge for a number of taxa. These habitats intergrade and, as a result, their habitat functions overlap to some degree. (Nordby Biological Consultants et al, 2008).

The project would also create subtidal, mudflat, and transitional habitats. The values of these habitats include:

Subtidal: Habitat for fishes and invertebrates. Important links between fish and picivorous birds (diving and wading) and between higher trophic order fishes (predators such as halibut) and lower trophic order fishes, such as arrow goby.

Mudflat: Mudflats are the feeding grounds for shorebirds. The invertebrate infuana, primarily polychaete worms and molluscs, are available with each receding tide. Fish also feed on mudflats while they are submerged. In terms of trophic relevance, the detritus and algae from the highly productive marsh provides energy to invertebrates, which in turn, transfer energy to birds and higher trophic order fish.

Transition to upland: Transitional habitat is the least known habitat associated with wetlands in southern California, as most of this habitat has been lost to development. Some of the values ascribed to transition include:

- Provide an area of potential habitat transgression given predicted sea level rise due to global climate change;
- Provide important upland refugee for shorebirds and other species during extreme high tides and/or storm events;
- Provide important interface between wetland and upland for foraging bird species and other species, i.e. energy transfer;
- Provides a unique habitat where wetland and upland plant species co-occur; and
- Provide important habitat for pollinators, such as ground-nesting bees.

Hydrology

Tidal salt marsh hydrology will be established through topographic modification of the site that will create tidal connections to the portion of the San Dieguito River channel at the west end of the site and south of the SCE and 22nd District Agricultural Association's least tern nesting island. The goal is to design the site to have similar tidal range as the SCE salt marsh wetland east of I-5 and north of San Dieguito River. In addition, the goal is to have no negative effect on

the SCE mitigation site or downstream sediment transport. Fluvial hydraulics are also being modeled to ensure that there are no downstream floodplain impacts to structures or sediment transport.

Topographic Modification

The project will grade up to approximately one million cubic yards of soil from the abandoned agricultural fields. It is necessary to grade channels to allow water to flow into the created salt marsh habitat and allow for functioning low salt marsh and mud flat with mid to high marsh habitat. Depending on the restoration option selected, berms may be constructed to separate the San Diego River hydrology from the tidal hydrology, similar to the berm implemented by the SCE project.

Soils

Based on soil textural analysis and the lack of sand suitable for beach replenishment, the site appears to have suitable soils that will support salt marsh habitat. In addition, the adjacent SCE wetlands mitigation project was built on similar soil and has demonstrated soil suitability for the intended mitigation project.

Target Plant Communities

The target plant communities include lower, middle and upper salt marsh habitat and transitional and upland habitat. The design and plant palette will be determined during the development of the design for the environmental document.

SITE PROTECTION

The mitigation site is located within the San Dieguito River Valley. The JPA is the agency responsible for creating a natural open space park in the San Dieguito River Valley and is empowered to acquire, plan, design, improve, operate, and maintain the San Dieguito River Park. The mitigation parcels will add additional habitat to the restored San Dieguito Lagoon system and improved ecosystem continuity through connectivity between additional coastal wetlands and native uplands habitat to be maintained, managed, and protected in perpetuity by the JPA.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the biological resources that are established through the mitigation project. The JPA will assume long term management responsibilities in association with other restoration properties within San Dieguito Lagoon (see Figure 7). Funds for long term

management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

ADDITIONAL STUDIES

The preliminary engineering and alternatives development is ongoing and will be documented in the environmental documents.

REQUIRED PERMITS

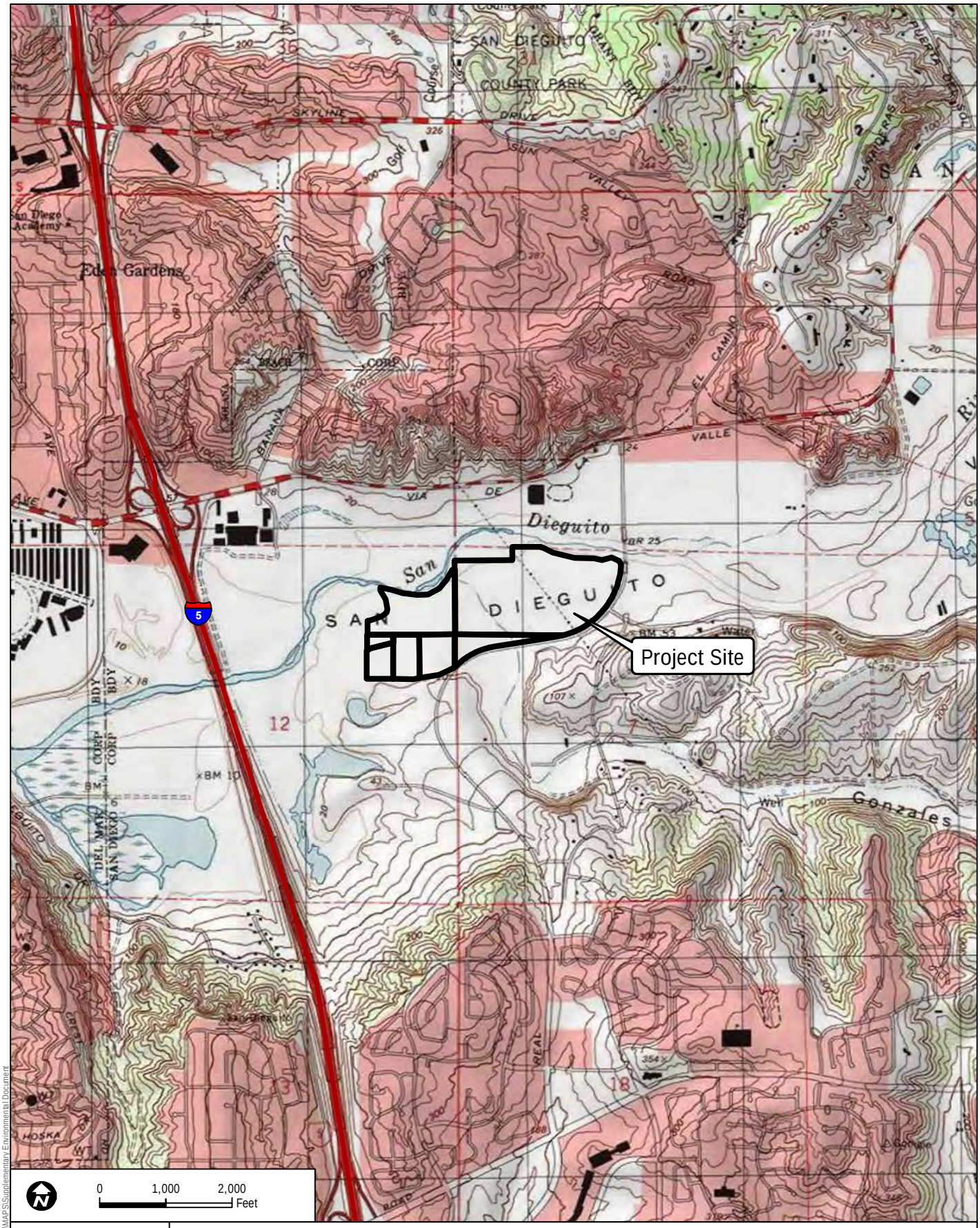
A Coastal Commission approved NOID and/or coastal development permit with accompanying project report will be required for project implementation. In addition, there are existing waters of the U.S. and State present within the project area. All potential options would require dredging and/or filling to convert the jurisdictional areas into marsh and upland habitat. The extent to which the various options will dredge and/or fill depends on several factors including the presence and size of the berms as well as the amount of land converted. Additional waters of the U.S. and State will be created through the project. As such, it is anticipated that the following additional agency permits will be required for implementation of the mitigation project:

- Clean Water Act 404 from ACOE;
- Clean Water Act 401 from RWQCB;
- Clean Water Act 402 from State Water Resources Control Board (SWRCB);
- 1602 Streambed Alteration Agreement with CDFG; and
- Endangered Species Act Section 7 Consultation with USFWS.

REFERENCES

Dokken Engineering, 2011. San Dieguito Lagoon W19 Restoration Project Feasibility Study. December 2011.

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SOURCE: USGS Topo 7.5 min Quards

FIGURE 1

San Dieguito - Vicinity Map

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MAY 2012

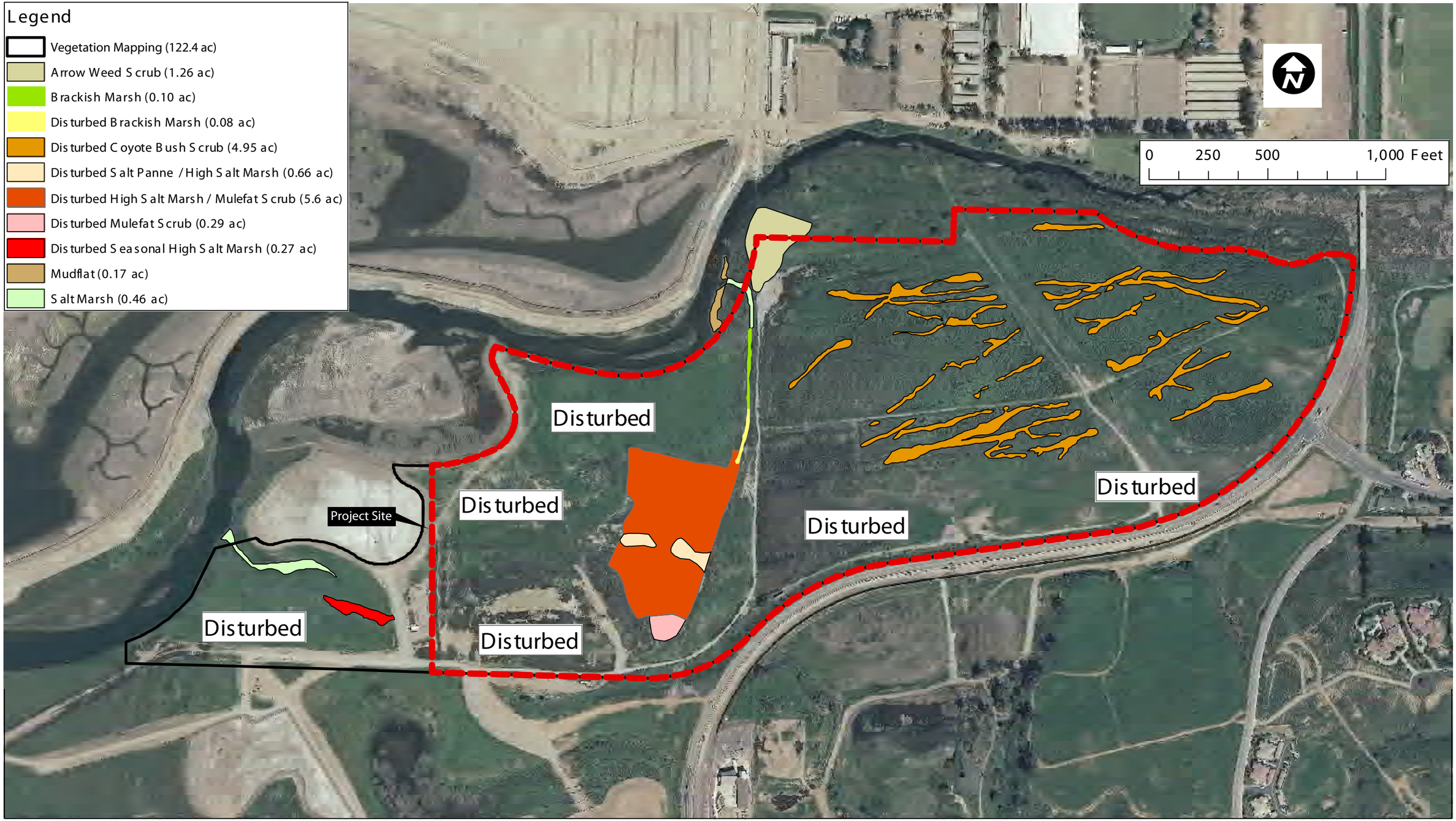
North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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Legend

- Vegetation Mapping (122.4 ac)
- Arrow Weed Scrub (1.26 ac)
- Brackish Marsh (0.10 ac)
- Disturbed Brackish Marsh (0.08 ac)
- Disturbed Coyote Bush Scrub (4.95 ac)
- Disturbed Salt Panne / High Salt Marsh (0.66 ac)
- Disturbed High Salt Marsh / Mulefat Scrub (5.6 ac)
- Disturbed Mulefat Scrub (0.29 ac)
- Disturbed Seasonal High Salt Marsh (0.27 ac)
- Mudflat (0.17 ac)
- Salt Marsh (0.46 ac)



SOURCE: DOKKEN ENGINEERING 2011

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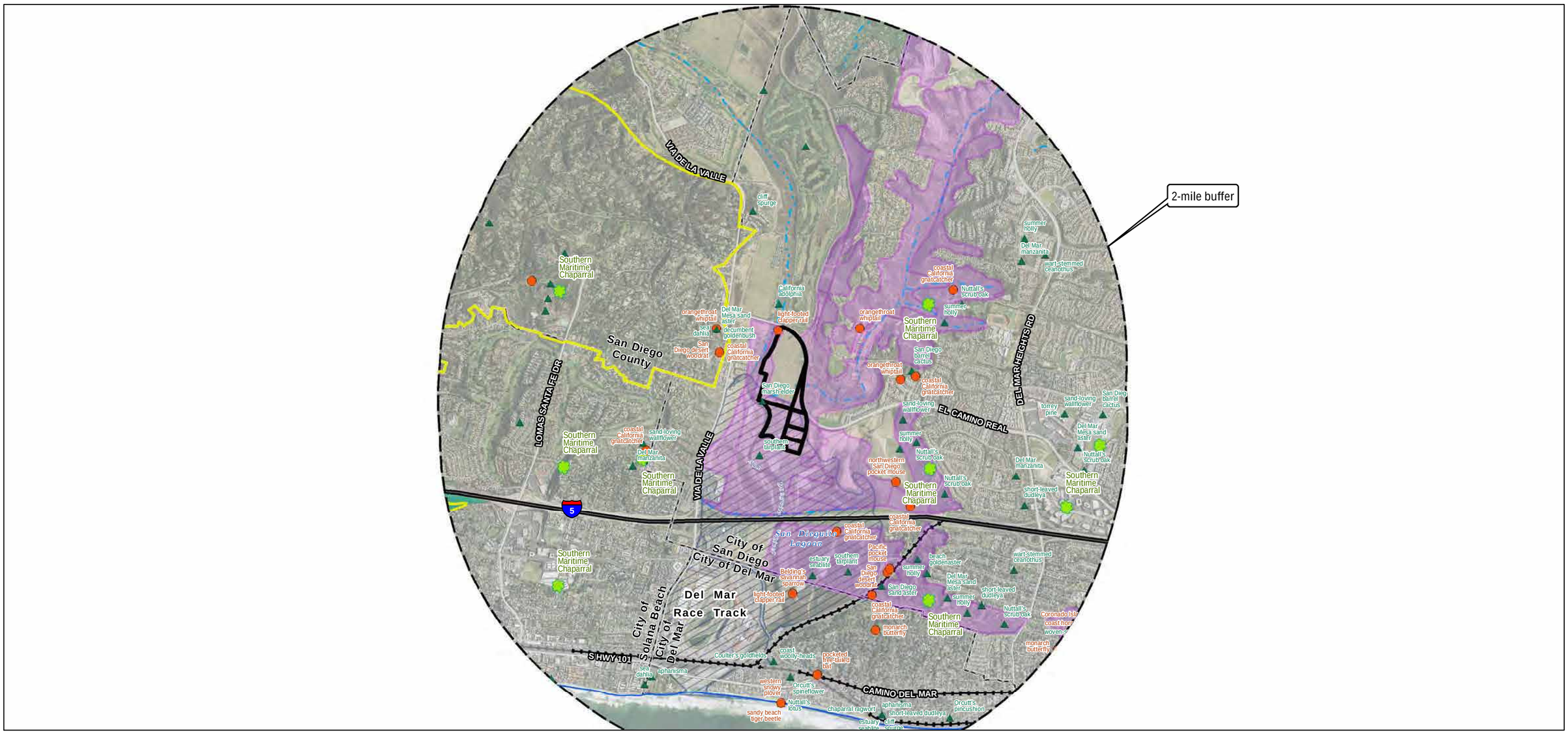
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FIGURE 2

Existing Vegetation

San Dieguito Lagoon Mitigation Parcels–North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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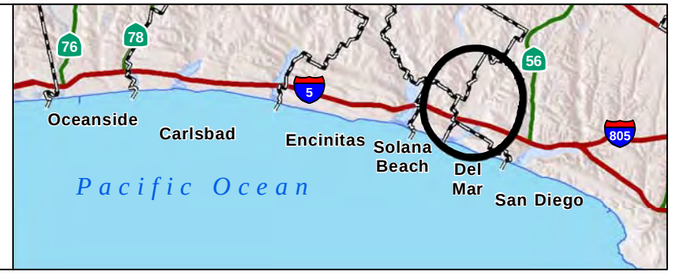


San Dieguito Parcel
I-5 NCC Project Area
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Stream/River

North County MSCP Boundary
San Diego MSPA
Coastal Commission Permit Jurisdiction

CNDDB Points
Plant
Animal
Terrestrial Comm
Aquatic Comm

NORTH
0 1,600 3,200 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, CNDDB, Imagery: DigitalGlobe March 2008

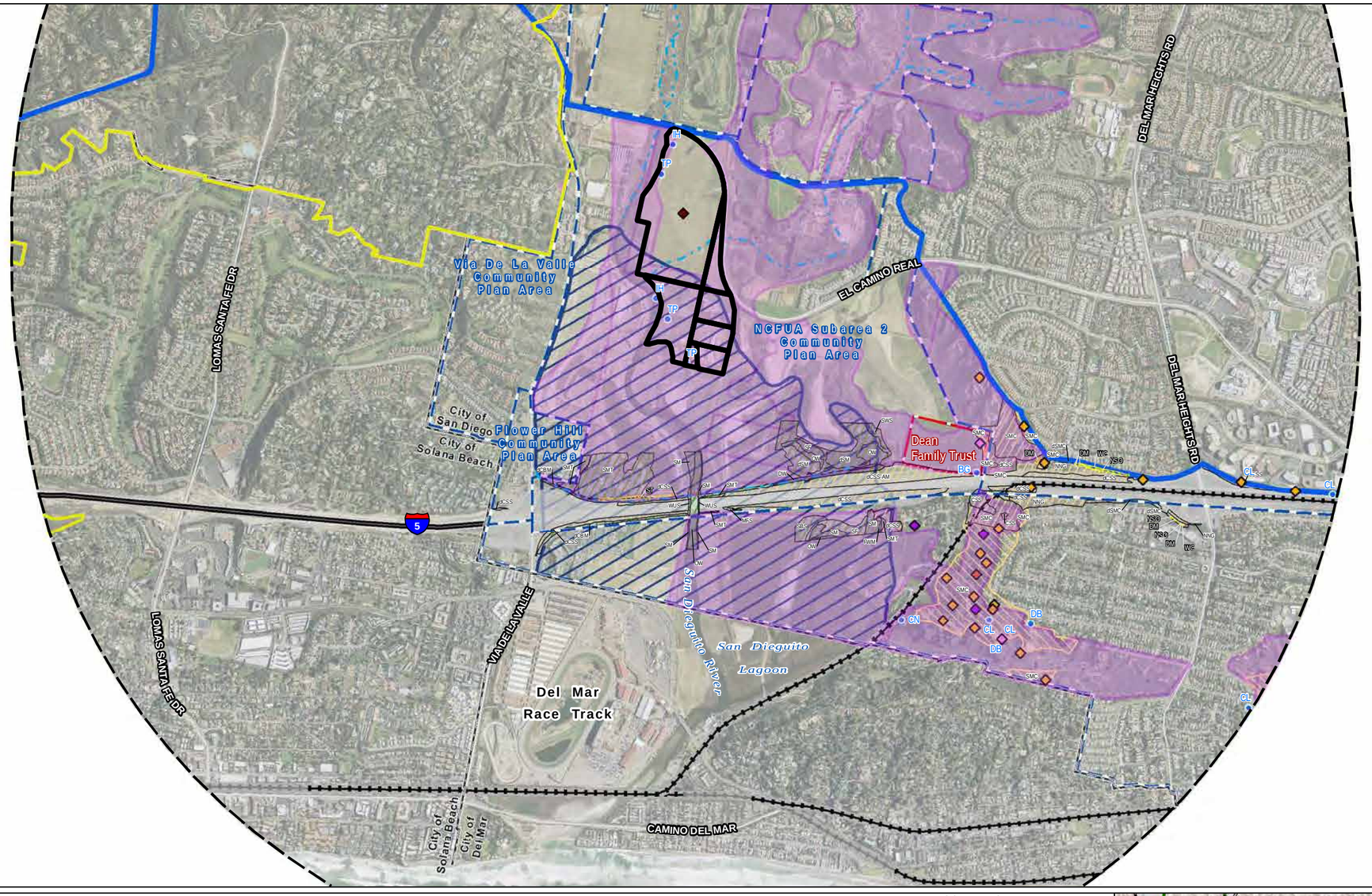
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FIGURE 3

San Dieguito Parcel CNDDB Resources within 2 miles

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



San Dieguito Parcel
San Dieguito Parcel Buffer (2 miles)
I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary

Coastal Zone Boundary
Stream/River
City of San Diego Community Plan Area
Coastal Commission Permit Jurisdiction
Mitigation Site - Secured
San Diego MSPA
North County MSCP Boundary

NORTH

0 500 1,000 1,500 Feet

Special Status Vegetation

Caltrans CNDDB

Upland Vegetation

CSS = Coastal Sage Scrub
dCSS = Coastal Sage Scrub (Disturbed)
dCSS-AM = Coastal Sage Scrub (Disturbed) Already Mitigated
NNG = Non-native Grassland
SMC = Southern Maritime Chaparral
dSMC = Southern Maritime Chaparral (Disturbed)

Special Status Vegetation

Caltrans CNDDB

Wetland Vegetation

dCBM = Coastal Brackish Marsh (Disturbed)
DW = Disturbed Wetland
FWM = Freshwater Marsh
MF = Mule Fat Scrub
OW = Open Water
SBS = Salt Bush Scrub
SF = Salt Flat
SM = Southern Coastal Salt Marsh
dSM = Southern Coastal Salt Marsh (Disturbed)

Special Status Vegetation

Caltrans CNDDB

Wetland Vegetation

SMT = Salt Marsh Transition
SRF = Southern Riparian Forest
SWS = Southern Willow Scrub
dSWS = Southern Willow Scrub (Disturbed)
SWS/FWM = Southern Willow Scrub /Freshwater Marsh
WUS = Waters of the US

Special Status Plants

Caltrans

Other Sources (CNDDB, SanGIS)

Plants

DM = Del Mar manzanita
NSO = Nuttall's scrub oak
ST = Southern tarplant
WC = wart-stemmed ceanothus

California adolphia
Coast barrel cactus
Del Mar Manzanita
Nuttall's scrub oak
Torrey pine
Wart-Stemmed ceanothus

Special Status Plants

Other Sources (CNDDB, SanGIS)

Other Species

BG = Beach goldenaster
CL = Del Mar Mesa sand aster
CN = San Diego sand aster
CO = Orcutt's spineflower
DB = Short-leaved dudleya
DO = Western dichondra
EA = San Diego button-celery
IH = San Diego marsh-elder
LN = Nuttall's lotus
SY = Summer holly
TP = Southern tarplant
WO = Woven-spored lichen



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

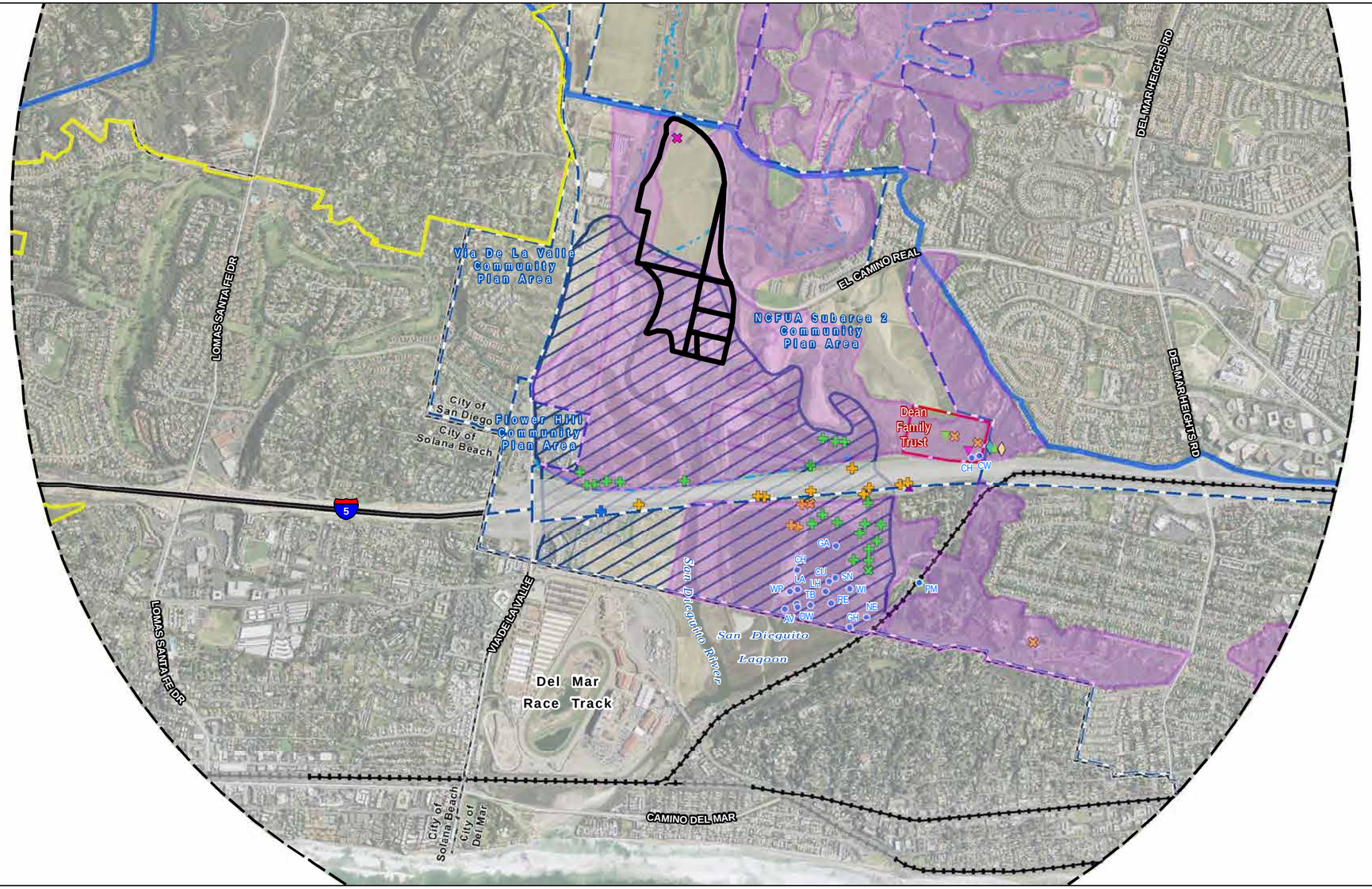
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FIGURE 4

San Dieguito Parcel Special Status Plant Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



San Dieguito Parcel
San Dieguito Parcel Buffer (2 miles)
I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary

Coastal Zone Boundary
Stream/River
City of San Diego Community Plan Area
Coastal Commission Permit Jurisdiction
Mitigation Site - Secured
San Diego MSPA
North County MSCP Boundary

NORTH

0 500 1,000 1,500 Feet

US Fish and Wildlife Service
Western Snowy Plover Critical Habitat

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Belding's savannah sparrow
✚	✖	California gnatcatcher
	✖	California least tern
✚		Least bittern
✚	✖	Light-footed clapper rail

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
▲	▼	NW San Diego pocket mouse
▲	▼	Orange-throated whiptail
▲	▼	Rufous-crowned sparrow
◆		San Diego desert woodrat
◆	◆	San Diego horned lizard

Special Status Plants

Other Sources (CNDDB, SanGIS)

Other Species

AV = American avocet
CH = Cooper's hawk
CS = Coronado sink
CU = Canada goose
CW = Coastal cactus wren
DW = Downy woodpecker
GA = Gadwall
GH = Green Heron
LA = California horned lark
LH = Loggerhead shrike
LI = Mountain lion

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

Other Species

MB = Monarch butterfly
MD = Southern mule deer
NE = Black-crowned night heron
PM = Pacific pocket mouse
RE = Reddish egret
RN = San Diego ringneck snake
SK = Black skimmer
SN = Snow goose
TB = Tricolored blackbird
WI = White-faced ibis
WP = Western snowy plover



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

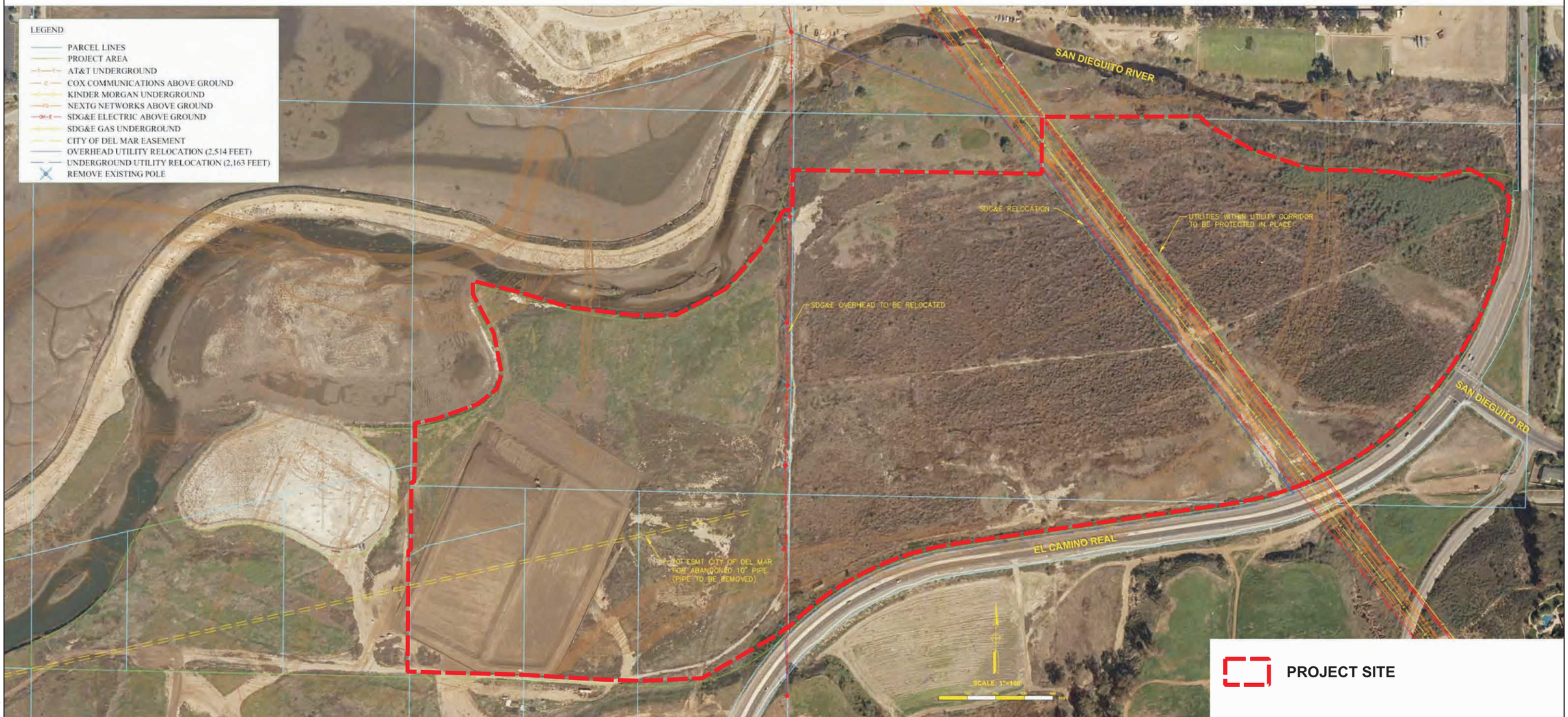
The Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map are for planning and engineering study purposes only. Data are derived from multiple sources. The digital Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map have not been adopted by the Coastal Commission, and do not supersede the official versions certified by the Coastal Commission as may be amended from time to time.
Disclaimer: The State of California makes no representations or warranties regarding the accuracy or completeness of the files or the data from which they were derived. The State shall not be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of these Coastal Zone boundary, jurisdiction and Local Coastal Program files or the data from which they were derived. Because the Coastal Zone boundary, jurisdiction and Local Coastal Program data files are merely representational, they and the data from which they were derived are not binding and may be revised at any time.

DRAFT

FIGURE 5

San Dieguito Parcel Special Status Wildlife Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



DUDEK

6264

MAY 2012

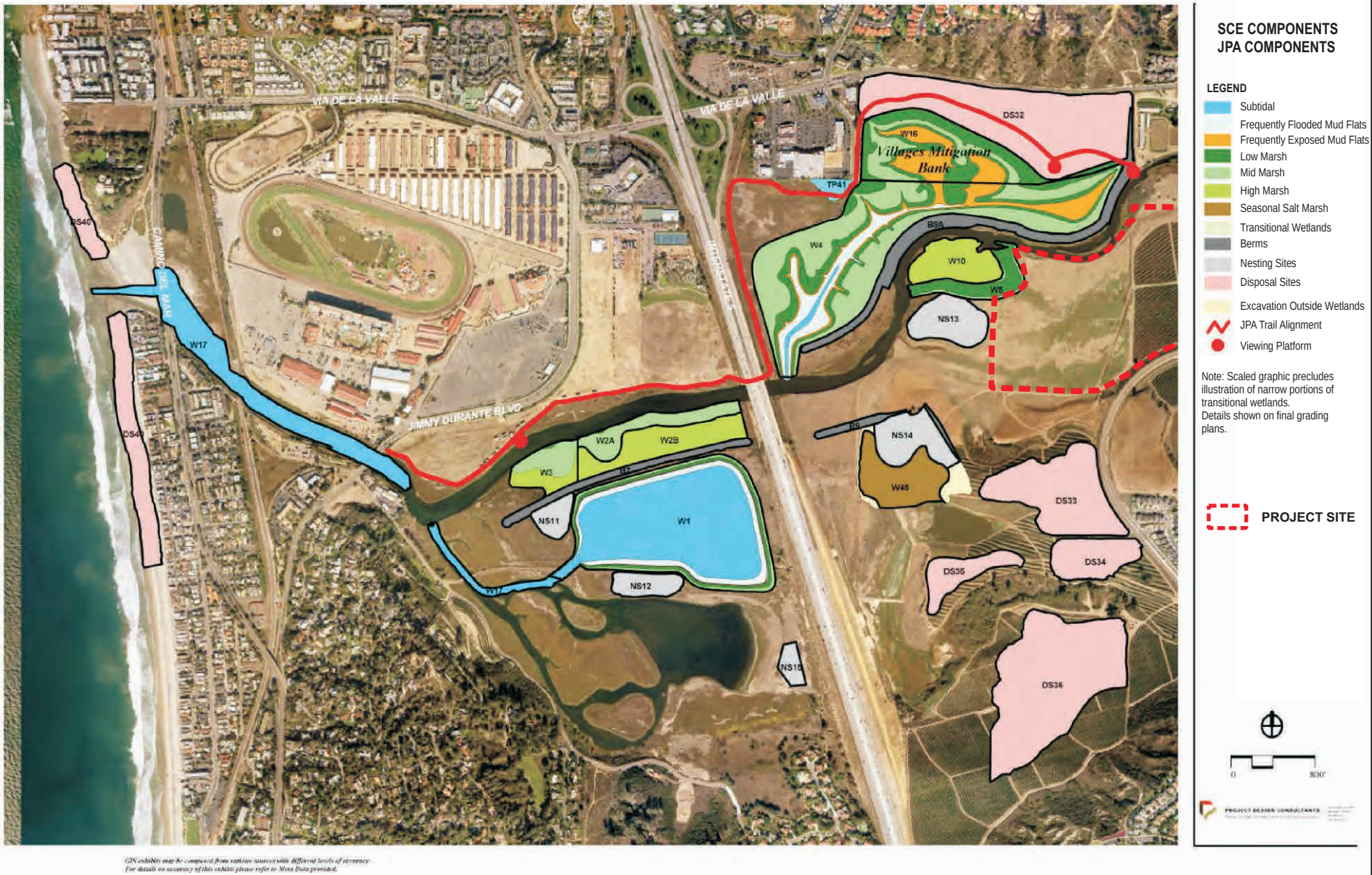
SOURCE: DOKKEN ENGINEERING 2011

FIGURE 6

Constraints - Utility Location

San Dieguito Lagoon Mitigation Parcels–North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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GIS exhibits may be compiled from various sources with different levels of accuracy. For details on accuracy of this exhibit please refer to Meta Data provided.

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SOURCE: DOKKEN ENGINEERING 2011

FIGURE 7

Existing Restoration Areas

San Dieguito Lagoon Mitigation Parcels–North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Hallmark Parcels

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

JULY 2012

Printed on 30% post-consumer recycled material.

Site Location: The Hallmark Properties are located along the margins of the northeastern portion of Agua Hedionda Lagoon. The properties consist of three parcels of land; a western parcel and two adjoining eastern parcels. The western parcel (Hallmark West) is approximately 11.1 acres in size and is located between Park Drive and Agua Hedionda Lagoon. The other two parcels (Hallmark East) are next to one another between the lagoon and the neighborhoods along Via Hinton and Via Marta (Figure 1); these parcels comprise approximately 8.2 acres.

Latitude/Longitude: West Parcel 33.1428/-117.3174, East Parcels 33.1479/-117.3063

APNs: 207-101-34-00, 207-101-33-00, and 208-020-43-00

Ownership: Caltrans currently owns these parcels

Correspondence with Resource Agencies: June 2008, Resource agencies receive request from Caltrans and SANDAG to approve site for acquisition; Letters acknowledging consideration of site for mitigation received from CCC March 2009, CDFG July 2008, USFWS August 2008, and NMFS July 2008.

MITIGATION GOAL

The San Diego Association of Governments (SANDAG) and California Department of Transportation (Caltrans) propose to mitigate impacts to Army Corps jurisdictional and State wetlands, as well as sensitive upland habitats associated with the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by creating salt marsh habitat and restoring and preserving coastal sage scrub habitat on the Hallmark Parcels along the northern shore of Agua Hedionda Lagoon. The goal of the mitigation is to permanently retire development potential of the sites, preserve existing wetland and upland habitat through site protection (easements and fence), enhance existing upland habitat through exotics removal, and to create tidal salt marsh habitat. The proposed mitigation treatments and native vegetation community establishment as indicated in Table 1 will provide the following benefits for:

- California gnatcatcher; by increasing resources within and adjacent to existing occupied gnatcatcher territories;
- *Atriplex pacifica*; by preserving coastal sage scrub (CSS) habitat where it presently occurs and limiting unauthorized site access and the associated disturbance regime;
- Shorebird populations that utilize the Pacific flyway and Agua Hedionda Lagoon salt marsh habitat areas in particular by expanding tidal salt marsh habitat.
- Upland refugia for wildlife in the event of sea level rise.

- Wetlands migration opportunities for salt marsh habitat in the event of sea level rise.

West Parcel

This parcel is immediately adjacent to the ecological reserve owned by the California Department of Fish and Game (CDFG). There is the potential to create additional salt marsh habitat on the disturbed fingers of fill and natural headlands that extend into the tidal lagoon area. In addition, fencing and access control has discouraged bicycles and off road vehicles that have made bike jumps and have driven into the marsh areas. With exotic removal and some planting, the upland areas could also be restored to a more natural condition. Restoration of tidal salt marsh will expand existing tidal wetlands providing important biological resources for shorebirds and aquatic species that are dependent upon the lagoon for spawning and nursery habitat. Upland areas will provide important opportunities for the slow upward migration of tidal saltmarsh vegetation communities as sea level rise gradually occurs.

East Parcel

This parcel is also immediately adjacent to the Agua Hedionda Lagoon Ecological Reserve owned by the CDFG. The eastern end of this parcel is already deed restricted and it is unlikely any work would take place at this end due to access restrictions; however, some exotic control may be completed along the riparian forest at this end of the parcel. Treatment of the slopes below the homes will be consistent with fire protection standards for plant density, vegetation height, and reduced cover using appropriate fire resistant plantings. Deed restricted and fuel/fire zone areas would not be included in the restoration totals of the site. The remainder of the slope parcel will be restored to CSS and the wetlands enhanced through removal of exotics and planting with native species.

Table 1
Habitat Mitigation Goals

Habitat Types	Mitigation Parcel	Mitigation Type	Mitigation Acreage
Coastal Sage Scrub	East/ West	Preservation/Enhancement	1.8
Coastal Sage Scrub	East/ West	Enhancement	6.6
Coastal Sage Scrub	East/West	Establishment	3.5
Riparian Wetland	East	Preservation/Enhancement	0.32
Freshwater Marsh	East/ West	Restoration/Enhancement	0.52
Brackish Marsh	East	Enhancement	0.45
Riparian	East	Establishment	0.17
Tidal Salt Marsh	West	Establishment	4.2
Tidal Salt March	West	Preservation	0.12

EXISTING CONDITIONS

Hallmark West Parcel

Ecological Context

The Hallmark West parcel is situated adjacent to Agua Hedionda Lagoon. The site supports a combination of salt marsh vegetation, coastal sage scrub vegetation, and disturbed areas (see Figures 2 and 4). Mitigation on this site will enhance biological resources within the lagoon ecosystem and provide greater synergistic ecological benefits in association with the larger ecological system such as water quality, wildlife, and habitat continuity on the north lagoon shoreline. The project will establish new tidal salt marsh habitat that provides biological resources and ecological functions used by salt marsh species and shorebirds that utilize the Pacific flyway. Upland mitigation will directly benefit California gnatcatcher and *Atriplex pacifica* through habitat enhancements and preservation as provided by site restoration and enhancement, access restrictions, and long-term management.

Drainage and Hydrology

Overland drainage (sheet flow) generally occurs from the upland area into the adjacent salt marsh vegetation that is associated with Agua Hedionda lagoon. The overland flow has been modified into more concentrated flow patterns due to a lack of vegetation from a derelict revegetation effort on the upland slopes and at an old road cut where soil excavation previously occurred. The concentrated flow has resulted in erosive conditions that are transporting sand to the lagoon.

The lagoon is subject to tidal hydrology (ebb and flow) that effect lagoon shoreline areas below the high tide elevation. These areas typically support salt marsh vegetation.

A storm drainage from the adjacent neighborhood and Park Avenue drains through a culvert into a disturbed wetland at the eastern end of the parcel.

Soils

Upland and soils within the proposed salt marsh creation area are Huerhuero loam associated with marine terraces. Parent material is calcareous alluvium derived from sedimentary rock. The typical soil profile is loam within 0-10 inches below land surface (bls), clay loam/clay from 10-50 inches bls, and stratified sand to sandy loam from 50-60 inches bls (NRCS, soil survey maps). Due to past grading activities, most soils within disturbed habitat areas and the proposed salt marsh mitigation area are sand to sandy loam. Soil within the non-graded and intact habitat areas retain the topsoil characteristics of Huerhuero loam.

Vegetation

The Hallmark West Parcel is composed of coastal sage scrub, salt marsh, salt marsh transition, freshwater marsh, southern willow scrub, disturbed habitat, and bare ground (see Figures 2, 4 and 5). Table 2 presents a summary of existing vegetation communities and land covers present on Hallmark West.

The coastal sage scrub (CSS) habitat is dominated by coastal sage brush (*Artemisia californica*), coyote bush (*Baccharis pilularis*) and goldenbush (*Isocoma menziesii*). Other common species found in the coastal sage scrub on site include prickly pear (*Opuntia littoralis*), lemonadeberry (*Rhus integrifolia*), and laurel sumac (*Malosma laurina*). The disturbed CSS contains up to 35 percent nonnative exotic species including black mustard (*Brassica nigra*), pampas grass (*Cortaderia* sp.), ice plant (*Carpobrotus edulis*), and nonnative grasses. Sparse CSS on slopes facing southwest have extensive rilling of the sandstone and now support less than 40 percent CSS species, with the remainder as bare ground.

Table 2
Existing Vegetation Communities for Hallmark West

Community Name/Land Cover	Map Code[1]	Acreage
Bare Ground	BG	1.98
Coastal Sage Scrub	CSS	1.04
Disturbed Coastal Sage Scrub	CSS-D	4.28
Sparse Coastal Sage Scrub	CSS-S	0.90
Disturbed Habitat	DH	0.64
Freshwater Marsh	FWM	0.18
Salt Bush Scrub	SBS	0.31
Salt Marsh	SM	0.12
Salt Marsh Transitional	SMT	0.96
Disturbed Salt Marsh Transitional	SMT-D	0.64

[1] See Figure 2 for mapped vegetation communities.

CSS is located on a small knoll and slope on the north side of the parcel. Patches of CSS habitat are high quality, relatively intact habitat with minor trails and openings. These patches have high

native cover, low weed cover, and high diversity. California gnatcatchers present on site are utilizing the higher quality habitat patches for nesting and forage. Disturbed CSS (dCSS) is present in areas where soil was dug from the hillside and in fingers of habitat that extend out from the toe of slope toward the lagoon. The sparse CSS areas have low native cover and high representation of bare ground (exposed sandstone). Weed cover is low due to the lack of top soil and highly erosive condition as demonstrated by sediment flowing from the excavated area. Habitat occurring on flat areas is degraded by past public uses that promoted non-native vegetation along numerous redundant trails.

The salt marsh (SM) habitat is present in small fingers that extend back toward the parcel boundaries from the lagoon. The salt marsh habitat is dominated by pickleweed (*Salicornia virginica*), and cord grass (*Spartina foliosa*) with some alkali heath (*Frankenia salina*), saltwort (*Batis maritima*) and saltgrass (*Distichlis spicata*). Only a small amount of this habitat is within the parcel and extends out toward the lagoon.

Between the SM and CSS is salt marsh transition (SMT) community that has components of both the salt marsh and CSS. This transition habitat is dominated by saltgrass, coyote bush, goldenbush, and alkali heath. Other species in this transition habitat include spiny rush (*Juncus acutus*), pickleweed, fennel (*Foeniculum vulgare*), and cholla (*Cylindopuntia prolifera*). Much of the SMT habitat is disturbed with black mustard, slender-leaf ice plant (*Mesembryanthemum nodiflorum*), and nonnative grasses.

There is a small drainage running from Park Drive into the lagoon at the eastern end of the west parcel. This drainage is an incised channel that supports freshwater marsh (FWM). The FWM is dominated by cattails (*Typha* sp.), with saltgrass, myoporum (*Myoporum laetum*), western ragweed (*Ambrosia psilostachya*), tobacco tree (*Nicotiana glauca*), and marsh fleabane (*Pluchea odorata*). Immediately surrounding the freshwater marsh area is coastal brackish marsh dominated by spiny rush with some pickleweed, saltgrass, and alkali heath. In one corner of the marsh there is a small patch of disturbed SWS dominated by sandbar willow (*Salix exigua*), with mulefat (*Baccharis salicifolia*), a few tamarisk (*Tamarix* spp.), and pampas grass.

The remainder of the West parcel is composed primarily of bare ground (BG) and disturbed habitat (DH). Bare ground areas are found on trails, and on fingers of fill that extend out into the area that was formerly wetland. These areas have less than 10 percent cover and most of what does grow on these compacted soils are weedy species. However, *Atriplex pacifica* also occurs within and immediately adjacent to these disturbance areas The disturbed habitat is dominated by black mustard, ice plant, slender-leaf ice plant, and yellow sweet clover (*Melilotus indica*).

Wildlife

Protocol surveys of the parcel identified two pairs of federally threatened coastal California gnatcatchers (*Polioptila californica californica*) on site (see Figures 2 and 6). One of the pairs had at least one fledgling in May 2008. Other bird species that commonly occur on site include California towhee (*Pipilo crissalis*), Bewick's wren (*Thryothorus bewickii*), song sparrow (*Melospiza melodia*), Anna's hummingbird (*Calypte anna*), lesser goldfinch (*Carduelis psaltria*), common yellowthroat (*Geothlypis trichas*), bushtit (*Psaltriparus minimus*), and northern harrier (*Circus cyaneus*). Other wildlife species observed on site include coyote (*Canis latrans*), western fence lizard (*Sceloporus occidentalis*), desert cottontail (*Sylvilagus audubonii*), and California ground squirrel (*Spermophilus beecheyi*). Several shorebirds were observed adjacent to the site including black-necked stilt (*Himantopus mexicanus*), American avocet, willet (*Catoptrophorus semipalmatus*), marbled godwit, and great egret (*Casmerodius albus*).

Two pairs of federally threatened coastal California Gnatcatcher were identified at the west parcel (see Figures 2, 4 and 6). *Atriplex pacifica* was observed on site. *A. pacifica* is a CNPS List 1B.2 species: a rare, threatened, or endangered in California and elsewhere that is fairly endangered in California.

Prior and Current Land Use

The site is highly disturbed from a period of time when the land was planned for development. Prior to 2009, there were illegal trails, dumping, bike jumps, fire pits and other trespassing on site. In 2009, 2,025 feet of fencing was replaced on site with 735 feet of that fence replaced on CDFG land east of the site to limit access and illegal activities onsite. The proposed land use for the site will be for open space and habitat preservation and management.

Existing Utilities/Infrastructure/Easements

There are no known utilities, infrastructure and easements on site that would constrain the mitigation project (Figure 7).

Hallmark East Parcel

Ecological Context

The Hallmark East Parcel lies between some residential housing and riparian habitat associated with Agua Hedionda Creek that is owned and managed by the CDFG (see Figures 3 and 4). The east parcel is 0.8 mile upstream of the Agua Hedionda lagoon. The mitigation site presents an opportunity to establish and enhance brackish marsh into the low lying area of the mitigation

site. Slope restoration and enhancement are proposed that would create a habitat buffer between existing residential land use and fuel modifications zones and the existing riparian habitat.

The existing riparian habitat sliver is the edge of a larger stand of riparian forest associated with Agua Hedionda Creek. The riparian vegetation extends downstream toward the lagoon until saltwater influences cause the vegetation to transition to brackish marsh and tidal salt marsh, mud flats and salt panne.

Drainage and Hydrology

Drainage on site is heavily modified and dictated by adjacent residential development. Drainage from streets and residential lots occurs through sheet flow and concentrated flow from the road edge. A storm drain outfall is present at the bottom of the existing road slope. The drainage settles in a low area on site as evidenced by a patch of disturbed freshwater marsh vegetation. The eastern end of the parcel is deed restricted habitats located along the slopes of drainages.

Soils

The central area of the mitigation site is flat to gently sloping toward the riparian area. Manufactured slopes approximately 20 feet tall with a 2:1 gradient surround the low lying area and mitigation area to the east and west of this parcel.

Soil within the east parcel is mapped as Las Flores loamy fine sand in the NRCS soil survey. These soils are derived from sandstone parent material. Water capacity is low. The typical soil profile includes loamy fine sand from 0-14c inches bls, sandy clay/sand from 14-38 inches bls, and loamy coarse sand from 38-48 inches bls.

Vegetation

Existing habitats on the Hallmark East parcel are CSS, Baccharis scrub, FWM, coastal brackish marsh, riparian forest, non-native woodland, ornamental, DH, and BG (see Figures 3-5). Table 3 presents a summary of the existing vegetation communities and land covers found on Hallmark East.

Table 3
Existing Vegetation Communities for Hallmark East

Community Name/Land Cover	Map Code[1]	Acreage
Bare Ground	BG	0.44
Disturbed Baccharis Scrub	BBS-D	0.28
Coastal Brackish Marsh	CBM	0.32
Disturbed Coastal Brackish Marsh	CBM-D	0.13
Coastal Sage Scrub	CSS	0.78
Disturbed Coastal Sage Scrub	CSS-D	1.14
Disturbed Habitat	DH	0.96
Freshwater Marsh	FWM	0.34
Non-Native Woodland	NNW	0.17
Ornamental	ORN	3.16
Riparian Forest	RF	0.25
Salt Marsh Transitional	SMT	0.05
Disturbed Southern Willow Scrub	SWS-D	0.07

[1] See Figure 3 for mapped vegetation communities.

The CSS is similar in composition to the West parcel with coastal sage brush and coyote bush as the dominant components. The slopes in the center of the parcel off Via Hinton are good quality habitat with trails through the habitat. Further to the west the CSS is disturbed with at least 50 percent of the area either bare ground or annual exotic species including black mustard, pampas grass, myoporum, and sour grass (*Oxalis* sp.).

The disturbed Baccharis scrub (BBS-D) is dominated by coyote bush and mustard with pampas grass and fennel. It occurs at the eastern end of the parcel at the end of the drainage down the canyon.

Brackish marsh (BM) dominated by cattails is found in a drainage in the center of the parcel. This marsh appears to be fed by a combination of urban runoff from the surrounding neighborhood and groundwater from Agua Hedionda Creek. Immediately surrounding the

freshwater marsh area is coastal brackish marsh dominated by spiny rush with some pickleweed, saltgrass, and alkali heath.

Riparian forest (RF) habitat occurs at the base of the slopes east of the sewer easement (Figure 3). This habitat consists of large mature willows (*Salix* spp.) with western sycamore (*Platanus racemosa*) and a few nonnative trees. The understory of this habitat is a mixture of spiny rush, cattails, small willows, and herbaceous plants. There is only a small sliver of riparian forest within the parcel.

Between the houses and the CSS habitats are slopes dominated by ornamental vegetation (ORN) including ice plants (*Malephora* sp. and *Lampranthus* sp.) with mustard, African fountain grass (*Pennisetum setaceum*), fan palm (*Washingtonia robusta*), pampas grass, and wild oats (*Avena* sp.).

Nonnative woodland (NNW) habitat is found between the freshwater marsh and disturbed habitat off Via Hinton and on the slopes at the eastern end of the parcel. The nonnative woodland is a combination of eucalyptus trees (*Eucalyptus* sp.), Brazilian pepper (*Schinus terebinthifolius*), Peruvian pepper (*Schinus molle*), and palms (*Washingtonia* sp. and *Phoenix* spp.). There is one arroyo willow (*Salix lasiolepis*) in the middle of the nonnative woodland off Via Hinton.

DH and BG habitats are similar to those habitats in the Hallmark West parcel. The BG occurs along trails and on the sewer access road at the base of the slope and up to Via Hinton where parent sandstone is exposed. The DH is found between the NNW and ORN, and consists primarily of black mustard.

Wildlife

Birds observed on site were the California towhee, spotted towhee (*Pipilo erythrophthalmus*), common yellowthroat, Nuttall's woodpecker (*Picoides nuttallii*), lesser goldfinch, Anna's hummingbird, and wrentit (*Chamaea fasciata*). In the adjacent riparian forest a number of riparian bird species were detected including yellow-breasted chat (*Icteria virens*), black-headed grosbeak (*Pheucticus melanocephalus*), and brown-headed cowbird (*Molothrus ater*) (see Figures 4 and 6).

One pair of California gnatcatchers was identified on this parcel (see Figures 3, 4 and 6).

Prior and Current Land Use

There has been motorcycle, bicycle, and pedestrian trespassing throughout the properties in the past. This has resulted in erosion, creation of bike jumps on site and degradation of the habitats on site. Neighborhood pets may use the area for foraging. The slopes down from the residential

lots are maintained as fire buffers for the development. Required fire buffers are 100-feet wide in San Diego County.

Existing Utilities/Infrastructure/Easements

There is a sewer easement on the southern edge of the site along the boundary between the CDFG land and the Caltrans parcel, and also through the middle of the site that connects to Via Hinton. These easements must be maintained for utilities access. In addition to underground sewer utilities and facilities access, the easements are informally used by the public for hiking and dog walking. The slopes below the houses have ornamental landscapes and many have deed restrictions. These slopes appear to be managed fire buffer zones (see Figure 8).

MITIGATION PROGRAM

A brief conceptual plan for wetland creation and upland restoration was drafted to get preliminary concurrence from the CDFG that wetland creation on their lands are acceptable to be able to restore areas of the Hallmark West Parcel. The conceptual plan is described below and shown on Figure 9. Detailed conceptual mitigation plans for the East and West parcels will be prepared following additional site investigations. The report will be submitted as part of the Notice of Impending Development (NOID) for review and approval. The detailed conceptual plan will include plant palettes for target vegetation communities and specify material type (container plant, seed, etc.), container sizes and density of planting. Seed mixes will specify species and seed quality by the minimum percentage of pure live seed per pound. Site-specific functions-based performance criteria will be presented based on local reference vegetation of the same vegetation community to be restored and functional data from proposed impact areas.

Hallmark West Parcel

Schedule

Design of the wetland mitigation plan will begin when approval is received from the resource agencies that mitigation is appropriate and will be counted toward mitigating the North Coast Corridor multi modal transportation project impacts. Detailed design will be provided through the NOID approval process during the first phase of implementation of the North Coast Corridor PWP/TREP. As discussed in Section 6.5.3 of the PWP/TREP, the results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., Army Corps, USFWS, CDFG, RWQCB, etc.), as well as all supporting documentation are required to be submitted along with the NOID project report. Accordingly, all design and related project reporting would be submitted to the permitting agencies for consultation as part of the NOID review and approval process.

Mitigation Goal and Purpose

The total created salt marsh area would equal 4.2 acres, 1.3 acres on Caltrans property and 2.9 acres on CDFG property. Creation of salt marsh in the existing fill would enhance flow and habitat quality of the adjacent salt marsh habitat on CDFG land. The additional sub-tidal channels and low marsh/mudflat would increase flushing and provide important foraging habitat for a number of bird species. The additional mid and high marsh will form contiguous salt marsh habitat with the adjacent habitats. Created tidal salt marsh will have similar species composition and structure as observed in representative salt marsh habitat found within Agua Hedionda lagoon near the mitigation site.

Upland mitigation will restore and enhance existing disturbed CSS habitat (4.28 acres) and sparse CSS (0.9 acre) onsite, and preserve extant occupied CSS habitat (1.04 acre). Enhancement will occur through site access restriction to reduce the disturbance regime associated with unauthorized site entry, seed applications, and weed control during a 5-year maintenance period corresponding with the saltmarsh establishment period, and long term management for site protection and weed control.

Establishment of CSS on some bare ground and disturbed habitat areas (approximately 2.0 acres) would include exotic control, container planting and seeding and possibly temporary irrigation.

After approval of the proposed salt marsh and upland mitigation area and proposed work on CDFG property, Caltrans will begin developing a detailed mitigation plan for the sites. The resource agencies will be consulted during the design process to ensure that plans account for any concerns with grading, types of habitats created, and potential temporary impacts to adjacent habitats.

Hydrology

Tidal salt marsh hydrology will be established through topographic modification of the site that will create tidal connections to Agua Hedionda Lagoon and existing adjacent salt marsh habitat. The created salt marsh would have a series of channels to bring flow into the three areas with a combination of low, middle, and high marsh habitats with some mud flats (Figure 9).

Upland hydrology will primarily be maintained as overland sheet flow, terminating at the lagoon/saltmarsh edge. However, some minimal topographic modifications will be implemented in upland areas where erosion has occurred to reduce concentrated runoff and erosive conditions.

Topographic Modification

SANDAG/Caltrans propose to grade the disturbed peninsulas of fill that extend out in between the existing CDFG owned salt marsh habitat. In addition, SANDAG/Caltrans propose to grade additional filled areas owned by the CDFG that are between Caltrans property and the lagoon proper. It is necessary to grade channels to allow water to flow into the created salt marsh habitat and allow for functioning low salt marsh and mud flat with mid to high marsh habitat. The berms that create barriers to water flow will be partially graded to allow water to flow into the creation areas.

Within the upland area, old road cuts and excavation areas will be smoothed to re-establish overland sheet flow. These grade modifications are intended to stabilize the soil surface to reduce erosion and allow the areas to be restored to native CSS vegetation.

Soils

Soil testing would be completed during the design process to determine what soils and groundwater are expected onsite to help in designing the salt marsh restoration. Any soil deficiencies or issues will be examined to ensure that plans take into account soils found onsite.

Soil testing will be conducted in the upland areas where topographic modification is proposed to determine the need for soil amendments that will promote soil and vegetation community restoration.

Target Plant Communities

Coastal sage scrub will be established in uplands areas outside the salt marsh habitat areas that are not deed restricted or are fuel modification zones. Target plant communities in the salt marsh mitigation site include upper and mid salt marsh vegetation communities. Sub-tidal channels and associated low marsh/mudflat will be incorporated into the final design to facilitate tidal flushing and hydrology that will support the target plant communities. Table 4 presents the expected dominant species that will be present within each of these plant communities. Additional herbaceous and annual species will be added to the plant palette in the NOID submittal to provide appropriate species diversity that is typical of comparable adjacent existing habitat.

Table 4
Target Dominant Species by Vegetation Community

Vegetation Community	Botanical Name	Common Name
Coastal Sage Scrub	*Artemisia californica*	California Sagebrush
	Baccharis pilularis	coyote bush
	Distichlis spicata	saltgrass
	Encelia californica	California encelia
	Eriogonum fasciculatum	flat-top buckwheat
	Isocoma menziesii var. *vernonoides*	coast goldenbush
	Opuntia littoralis	prickly-pear cactus
Upper Marsh	*Batis maritime*	saltwort
	Jaumea carnosa	fleshy jaumea
	Juncus acutus	spiny rush
	Limonium californicum var. *mexicanum*	San Diego rosemary
	Monanthochloe littoralis	salt-cedar
	Salicornia subterminalis	Parish's glasswort
	Sueda taxifolia	woolly sea-blite
Middle Marsh	*Frankenia salina*	alkali-heath
	Salicornia virginica	pickleweed

Coastal sage scrub will be established mainly through removal of exotic species and the application of a non-irrigated seed mix. Container planting will be added in areas where construction activities disturb soils and where no existing native vegetation is present (i.e., disturbed habitat/ornamental). Salt marsh vegetation communities will be established using small-size (i.e., flats, rose pots and liners) container plantings. No seed mix is proposed for salt marsh mitigation areas.

Supportive Measures

Limited temporary irrigation may be installed to facilitate vegetation establishment in transitional areas between the tidal limits of the salt marsh mitigation and upland areas. Upland areas lacking existing native cover and areas disturbed by construction of the mitigation site (e.g. access routes, staging areas, etc.) will be temporarily irrigated to increase the certainty of mitigation performance and success. No irrigation is proposed in upland areas with existing disturbed or undisturbed CSS vegetation. Areas with tidal influence will not be irrigated. All

temporary irrigation will cease after 1-3 years depending upon vegetation establishment as determined by the project biologist.

Performance Criteria

Performance criteria will be developed from reference sites within or adjacent to the mitigation parcel. Existing CSS vegetation on site will be sampled using vegetation transects to establish appropriate vegetation cover and species diversity criteria. Other performance criteria will include native seedling recruitment, non-native vegetation cover, soil stability (lack of erosion), and wildlife use of the area. Criteria will be established that provides a high level of confidence that, once performance criteria are achieved, the resultant vegetation communities will be resilient and persistent as a demonstration of self-sustainability under a long term management program.

Mitigation results for uplands on the west parcel are expected to increase native cover and species diversity to around 85% of adjacent undisturbed habitat, while reducing non-native cover to 5% or less of total vegetation cover. The specifics of the performance criteria will be detailed in the Conceptual Mitigation Plan for the Hallmark Parcels, through the NOID process and/or Coastal Development Permit. Erosive slope areas will be stabilized through grading, long term Best Management Practices mainly in the form of bioengineered solutions, and vegetation establishment to re-establish overland sheet flow. Stabilization of disturbed slopes will improve water quality in the lagoon by reducing elevated sediment transport into upland terraces and tidal wetlands.

Saltmarsh performance criteria will be similarly based on a local reference site. Criteria appropriate to each salt marsh habitat type (e.g., middle/upper salt marsh, mud flat, etc.) will include appropriate tidal hydrology (prism), native vegetation cover and species diversity, native seedling recruitment, microtopographic variation, tidal channel stability, biochemical activity, wildlife use, and benthic macro-invertebrate diversity.

Comparative analysis of pre-and post-mitigation site conditions will demonstrate the anticipated improvements in biological resources and ecological function. A description of the pre- and post-mitigation condition is listed below to demonstrate the benefits anticipated from the proposed mitigation.

- Tidal hydrology is absent at the proposed salt marsh mitigation site. Site grading to elevations within the tidal prism will establish tidal hydrology that will support salt marsh habitat.
- No salt marsh vegetation is present within the mitigation areas. Therefore, a significant increase in vegetation resources can be expected in the post-project condition. Salt marsh

vegetation provides forage, cover, and nesting opportunities for numerous avian species, and biological resources (habitat) for aquatic species.

- Exotic, perennial non-native vegetation will represent less than 0% relative vegetation cover at the end of the mitigation maintenance and monitoring period. This low level of non-native vegetation will result in high-quality, self-sustaining habitat that can transition into long term management.
- Implementation of the proposed mitigation treatment will substantially change soil texture characteristics that will directly benefit macro-invertebrate populations where none presently exist. Macro-invertebrates will provide expanded forage for shorebird and fish populations that utilize the lagoon.

Criteria metrics will be developed in accordance with functional analysis methodologies to establish interim and final functional criteria. Interim target functional criteria scores will be used to inform maintenance decisions and regimes during the five-year monitoring and maintenance period to achieve the final target functional criteria scores.

Hallmark East Parcel

Schedule

Design of the wetland mitigation will begin when approval is received from the resource agencies that mitigation is appropriate and will be counted toward mitigating the North Coast Corridor multi modal transportation project impacts. Detailed design will be provided through the NOID approval process, during the first phase of implementation of the North Coast Corridor PWP/TREP. As discussed in Section 6.5.3 of the PWP/TREP, the results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., Army Corps, USFWS, CDFG, RWQCB, etc.), as well as all supporting documentation are required to be submitted along with the NOID project report. Accordingly, all design and related project reporting would be submitted to the permitting agencies for consultation as part of the NOID review and approval process.

Mitigation Goal and Purpose

SANDAG and Caltrans propose to mitigate impacts to Army Corps jurisdictional and State wetlands, as well as sensitive upland habitats associated with the North Coast Corridor PWP/TREP by rehabilitating and restoring (0.45 acres) of brackish marsh habitat, and establishing southern willow scrub in a drainage which is currently nonnative woodland (0.17 acre). Approximately 1.5 acre of CSS will be established in areas that are currently disturbed/ornamental, but are not deed restricted or located within fire buffer areas. The existing

good quality CSS (0.78 acres) will be preserved, and disturbed CSS (1.14 acre) and Baccharis scrub (0.28 acre) will be enhanced. In addition, the project will enhance the functions and services of the wetland buffer that separates residential development from the adjacent riparian habitat on Agua Hedionda Creek. CSS vegetation will be created and enhanced to provide greater resources for California gnatcatcher and other sage scrub obligate species. Nonnative trees and perennial plants in the wetland in the middle of the parcels and annual and perennial exotic plants within the CSS on site will be removed.

Hydrology

Existing hydrology is sufficient to support wetlands as evidenced by the presence of existing wetlands vegetation. Upland hydrology via sheet flow also is sufficient to support CSS as evidenced by existing habitat on the slopes that is occupied by one California gnatcatcher.

Topographic Modification

No grading is proposed to lower site elevations to alter site hydrology. Minor re-contouring may help to disperse concentrated flows. These modifications would provide greater distribution of runoff through the wetland areas and would facilitate wetlands enhancement and rehabilitation.

No grading is proposed in upland areas.

Soils

Soils are suitable for the proposed upland and wetlands mitigation. Soil amendments may be recommended based on test results.

Target Plant Communities

Coastal sage scrub will be established in all upland areas between the established 100-foot wide fire buffer and existing wetlands habitat. Target plant communities in the wetlands mitigation site include coastal brackish marsh and southern willow scrub, and buffer plantings of transitional vegetation communities on the surrounding slopes. Table 5 presents the expected dominant species that will be present within each of these plant communities. Additional herbaceous and annual species will be added to the plant palette in the NOID submittal to provide appropriate species diversity that is typical of comparable adjacent existing habitat.

Table 5
Target Dominant Species by Vegetation Community

Vegetation Community	Botanical Name	Common Name
Coastal Sage Scrub	*Artemisia californica*	*California Sagebrush*
	Baccharis pilularis	*coyote bush*
	Distichlis spicata	*saltgrass*
	Encelia californica	*California encelia*
	Eriogonum fasciculatum	*flat-top buckwheat*
	Isocoma menziesii var. *vernonoides*	*coast goldenbush*
	Leymus condensatus	*Giant wild rye*
	Opuntia littoralis	*prickly-pear cactus*
Coastal Brackish Marsh	*Frankenia salina*	*alkali-heath*
	Distichlis spicata	*saltgrass*
	Juncus acutus	*spiny rush*
	Salicornia subterminalis	*Parish's glasswort*
	Salicornia virginica	*pickleweed*
Southern willow scrub	*Juncus acutus*	*spiny rush*
	Platanus racemosa	*sycamore*
	Pluchea sericera	*arrowweed*
	Salix exigua	*sandbar willow*
	Salix lasiolepis	*arroyo willow*

Coastal sage scrub will be enhanced mainly through exotic removal and the application of a non-irrigated seed mix. Container planting and seeding will be used in areas where construction activities disturb soils and where no existing native vegetation is present (i.e., disturbed habitat). Coastal brackish marsh vegetation will be established using small-size (i.e., flats, rose pots and liners) container plantings. Southern willow scrub habitat will be established through the installation of 1-gallon container trees, willow cuttings, and smaller containers for understory species.

Supportive Measures

An irrigation system may be required to supplement natural rainfall in the first few growing seasons after initial installation. Maintenance and monitoring will be performed during the 5-year monitoring period to guide the emerging native vegetation toward meeting performance standards. Primary maintenance activities will be to apply seasonally appropriate supplemental irrigation water and weed control activities, and removal of exotic plant species by hand or through spraying with herbicides (glyphosate).

Performance Criteria

Performance criteria will be developed from reference sites within or adjacent to the mitigation parcel. Existing CSS vegetation on site will be sampled using vegetation transects to establish appropriate vegetation cover and species diversity criteria. Other performance criteria will include native seedling recruitment, non-native vegetation cover, soil stability (lack of erosion), and wildlife use of the area. Criteria will be established that provides a high level of confidence that, once performance criteria are achieved, the resultant vegetation communities will be resilient and persistent as a demonstration of self-sustainability under a long term management program.

Mitigation results for uplands on the east parcel are expected to increase native cover and species diversity to around 85% of adjacent undisturbed CSS habitat, while reducing non-native cover to 5% or less of total vegetation cover. The specifics of the performance criteria will be detailed in the Conceptual Mitigation Plan for the Hallmark Parcels, through the NOID process and/or Coastal Development Permit. Presently, slopes are dominated by non-native and ornamental vegetation. Lower sloped areas will be type converted from non-native vegetation to CSS in support existing California gnatcatchers.

Wetlands performance criteria will be based on existing on site wetlands vegetation of similar vegetation communities. In addition to native wetlands vegetation cover, structure, and species diversity, performance criteria will include evidence of appropriate hydrology, biochemical processes, non-native cover cap, micro-topographic variation and wildlife use.

Pre-and post-mitigation site conditions will demonstrate the anticipated improvements in biological resources and ecological function. A description of the pre- and post-mitigation condition is listed below to demonstrate the benefits anticipated from the proposed mitigation.

- Existing wetlands vegetation is degraded by exotic species within and surrounding the wetlands. The post-mitigation vegetation will include no more than 0% relative cover of non-native perennial vegetation. Native wetlands vegetation cover will achieve a minimum of 70% of adjacent brackish marsh habitat by the end of the 5-year maintenance and monitoring period.
- Existing native wetlands are separated from the adjacent riparian open space by non-native vegetation. Removal of exotic vegetation and replacement with appropriate native vegetation will increase wildlife connectivity within the area.
- Hydrology that is presently constrained by site topography can be spread with minor re-contouring to expand wetlands vegetation. These additional resources will provide increased biological resources for native wildlife species.

Criteria metrics will be developed in accordance with functional analysis methodologies to establish interim and final functional criteria. Interim target functional criteria scores will be used to inform maintenance decisions and regimes during the five-year monitoring and maintenance period to achieve the final target functional criteria scores.

SITE PROTECTION

Caltrans will deed all three Hallmark Parcels to the CDFG with an endowment, once the creation and restoration projects are complete. These parcels will add to the CDFGs habitat along Agua Hedionda Lagoon creating a more continuous property boundary with upland buffer habitat to the marsh habitat.

Existing fencing will be maintained. No additional fencing is proposed for the eastern parcels.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the biological resources that are established through the mitigation project. CDFG will assume long term management responsibilities in association with other CDFG properties around Agua Hedionda Lagoon (see Figure 10). Funds for long term management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

ADDITIONAL STUDIES

Further studies will be required to support the design that will be presented in the NOID submittal. These studies include a tidal hydrology study to establish target grade elevations that will create appropriate tidal inundation to support and sustain salt marsh habitat.

Soils testing will be needed to determine the appropriateness of existing soils for salt marsh mitigation and need for soil import in salt marsh mitigation areas. A topographic survey is required to support construction grading design and construction plans. In addition, deed restricted, easement, and fuel / fire zone areas will need to be quantified to determine boundaries and acreages that can be counted toward mitigation credit.

The location of culverts, stormwater outfalls, or low areas where runoff from the adjacent community is flowing onto the property shall be mapped and analyzed to determine how flows onsite may affect restoration efforts.

Additional field surveys will also need to occur to determine a more accurate plant palette to be installed at both the East and West Parcels.

REQUIRED PERMITS

404, 401, 1602, and a NOID and accompanying project report would likely be required for connection of the proposed wetland creation areas to the existing wetlands of Agua Hedionda Lagoon.

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Batiquitos Bluffs

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

TBD

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Dean Parcel

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

JULY 2012

Printed on 30% post-consumer recycled material.

Site Location: The Dean Family Partnership Parcel is located along and immediately east of the Interstate 5 (I-5) right-of-way between Del Mar Heights Road and the I-5/San Dieguito Lagoon Bridge (Figure 1).

Latitude/Longitude: 35.9572/-117.2399

APNs: Within Caltrans right-of-way ownership; previous APN: 304-090-02 (23.11 ac)

Ownership: Caltrans currently owns this parcel

Correspondence with Resource Agencies: June 2008, Resource agencies received request from Caltrans and SANDAG to approve site for acquisition; Letters acknowledging consideration of site for mitigation received from CCC March 2009, CDFG July 2008, USFWS August 2008, and NMFS July 2008.

MITIGATION GOAL

The San Diego Association of Governments (SANDAG) and California Department of Transportation (Caltrans) propose to mitigate impacts to sensitive upland habitats associated with the projects covered under the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by restoring and establishing coastal sage scrub and enhancing and preserving southern maritime chaparral on the Dean Family Partnership Parcel (Dean parcel; see also Figure 2 and Table 1).

The goal of the mitigation site is to permanently retire development potential of the site, preserve existing high quality upland habitat through site protection (easements and fence), and restore existing disturbed upland habitat through exotics removal and active restoration to increase native species cover and diversity.

The proposed mitigation treatments and native vegetation community establishment will improve habitat adjacent to the San Onofre Nuclear Generation Station (SONGS) San Dieguito Wetland Restoration Project. The Dean parcel is situated between SONGS and existing high quality uplands on slopes located south of the lagoon. Therefore, restoration of this site will strengthen the wetlands/uplands connection, which is especially important given the difficulties experienced on the SONGS project to restore uplands habitat on dredged lagoon materials south of the lagoon and immediately east of the Dean parcel.

Table 1
Habitat Mitigation Goals

Habitat Types	Mitigation Type	Mitigation Acreage
Coastal sage scrub	Creation and Restoration	20.8 ac.
Southern maritime chaparral/Coastal sage scrub	Preservation	1.45ac.

EXISTING CONDITIONS

Ecological Context

The 23.1 acre property is immediately north of the City of San Diego's Crest Open Space and west of fallow agricultural fields that are being restored to coastal sage scrub by the SONGS San Dieguito Wetland Restoration Project. The Dean parcel is located within the City of San Diego Multi-Habitat Planning Area (MHPA). Most of the San Dieguito Lagoon, San Dieguito River Valley, and Crest Open Space are also within the MHPA (see Figure 3). The California Natural Diversity Database (CNDDB) indicates numerous sensitive plant and wildlife species are present in the vicinity of the Dean parcel and on analogous upland areas west of I-5 and south of the lagoon. In addition to coastal California gnatcatcher (*Poliptila californica californica*) that presently occupies the Dean parcel, other sensitive wildlife species that could utilize a restored Dean parcel include northwestern San Diego pocket mouse (*Perognathus fallax fallax*), San Diego desert woodrat (*Neotoma lepida intermedia*), and orange-throated whiptail (*Cnemidophorus hyperythrus*) (Figure 4). Sensitive plant species that could become established in the long term include Del Mar sand aster (*Lessingia filaginifolia var. linifolia*), Nuttall's scrub oak (*Ceanothus verrucosus*), and southern tarplant (*Centromadia parryi*).

Drainage and Hydrology

Overland drainage (sheet flow) is generated from the watershed area that occupies the steeper slopes to the south within the City of San Diego's Crest Open Space. These slopes are mostly undisturbed vegetated sandstone bluffs. The overland flow was modified into more concentrated flow patterns by a dirt road that was graded in the early 1990's.

There is one large and several small erosion gullies through the site where water has flowed downhill while the site has laid fallow. These gullies are actively down-cutting and have likely carried sediment downhill toward the lagoon. The largest of these gullies aligns with an old farm road that is visible in 2004 aerial imagery. Prior to this date, agricultural practices appear to have maintained dispersed runoff and kept erosion from occurring. Concentrated runoff created by the access road and farm road are the likely source of these gullies

that first appear on aerial photographs from 2004 after farm activities ceased. The road collects and concentrates flows that are discharged in the southeast corner of the parcel. From that point, the water flows down the alignment of the old farm road.

Based on site topography, hydrology, and historic land use, erosion appears to be caused by the road on the south side of the project. A thorough evaluation of the gullies will need to occur to determine whether the erosional issues could affect restoration efforts made in this area. A thorough evaluation of the gullies will be detailed and provided through the Notice of Intent to Develop (NOID) approval process during the first phase of implementation of the North Coast Corridor PWP/TREP. The findings will assist in the design and implementation of the rehabilitation of the gullies.

Soils

Two soil types are present onsite: Terrace escarpments occupy the relatively steep, undisturbed slopes on the southeast portion of the parcel (NRCS, Web Soil Survey), and the remainder of the site where agricultural land use historically occurred is Corralitos loamy sand. These soils are essentially an alluvial fan from natural bluff erosion off of the Terrace escarpments.

Vegetation

This parcel is dominated by disturbed habitat and disturbed baccharis scrub with a small area of coastal sage scrub/southern maritime chaparral in the southeastern comer of the parcel and some bare ground on the road around the perimeter (Figure 5). The coastal sage scrub/southern maritime chaparral habitat is dominated by lemonadeberry (*Rhus integrifolia*), chamise (*Adenostoma fasciculatum var. fasciculatum*), and black sage (*Salvia mellifera*) with wart-stemmed ceanothus (*Ceanothus verrucosus*), sea dahlia (*Coreopsis maritima*), Mohave yucca (*Yucca schidigera*), and scrub oak (*Quercus berberidifolia*). There is approximately 1.45 acres of this habitat above the road at the southeastern end of the parcel. It has very little disturbance except along the edges and is contiguous with the same habitat upslope in the Crest Open Space.

The main portion of the parcel is fallow agricultural field that is now either dominated entirely by exotic species or is dominated by coyote bush (*Baccharis pilularis*) with weedy species. Bare ground consists of the hard packed cleared road on the southern and western ends of the parcel. Disturbed habitat onsite is dominated by a thick layer of filaree (*Erodium spp.*) and black mustard (*Brassica nigra*), with scattered tamarisk (*Tamarix sp.*), tree tobacco (*Nicotiana glauca*), pampas grass (*Cortaderia sp.*), goldenbush (*Isocoma menziesii*) and ice plant (*Carpobrotus edulis*). Disturbed Baccharis scrub is dominated by coyote bush with twiggy leaf plant (*Stephanomeria spp.*), deerweed (*Lotus scoparius*), filaree, miniature lupine (*Lupinus bicolor*), acacia (*Acacia latifolia*), and Mexican elderberry (*Sambucus mexicanus*). There is approximately 0.85 acres of bare ground, 8.5 acres of disturbed baccharis scrub, and 12.3 acres of disturbed habitat onsite. A summary of existing habitat types and acreage on the Dean parcel is provided in Table 2, below.

Table 2
Existing Vegetation Communities

Habitat Type	Acreage
Coastal sage scrub / Southern maritime chaparral	1.45
Disturbed baccharis scrub	8.5
Disturbed habitat	12.3
Bare ground	0.85
TOTAL	23.1

Wildlife

Bird species that were observed onsite include California towhee (*Pipilo crissalis*), song sparrow (*Melospiza melodia*), Anna's hummingbird (*Calypte anna*), bushtit (*Psaltriparus minimus*), Say's phoebe (*Sayornis saya*), and American kestrel (*Falco sparverius*). Other wildlife species observed onsite include coyote (*Canis latrans*), western fence lizard (*Sceloporus occidentalis*), desert cottontail (*Sylvilagus audubonii*), and California ground squirrel (*Spermophilus beecheyi*).

Prior and Current Land Use

The majority of the parcel was farmed for tomato crops until 2003. Since that time the land has been fallow, and was later abandoned. A small amount of coastal sage scrub/southern maritime chaparral exists at the southeastern comer of the parcel. The proposed land use for the entirety of the site will be for open space, habitat preservation, and management.

Constraints/Existing Utilities/Infrastructure/Easements

There are utilities (cable lines) located along the fence line at the western end of the parcel, as well as existing access roads through the site for maintenance purposes that could minimally constrain the mitigation project.

A small area of the Dean Parcel could potentially be impacted by the eventual widening of Interstate 5. Any portion of the property affected by future widening of Interstate 5 will not be included in the restoration totals of the site.

MITIGATION PROGRAM

There is potential onsite to create and restore coastal sage scrub and possibly some maritime succulent scrub, as well as enhance southern maritime chaparral. Creation and restoration activities onsite would include a significant weed eradication program with container planting and seeding of native species, along with some temporary irrigation. In areas where erosion gullies exist, the reestablishment of target native vegetation communities within the gullies would also assist in stabilizing the area, as well as the implementation of an upstream Best Management Practices (BMPs) and/or installed check dam or drop structures at the downstream end of the gullies.

Schedule

Design of the mitigation plan will begin when approval is received from the resource agencies that mitigation is appropriate and will be counted toward mitigating the North Coast Corridor multi modal transportation program impacts. Detailed design will be provided through the NOID approval process during the first phase of implementation of the North Coast Corridor PWP/TREP. As discussed in Section 6.5.3 of the PWP/TREP, the results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., Army Corps, USFWS, CDFG, RWQCB, etc.), as well as all supporting documentation are required to be submitted along with the NOID project report. Accordingly, all design and related project reporting would be submitted to the permitting agencies for consultation as part of the NOID review and approval process.

Mitigation Goal and Purpose

A total of 12.3 acres of coastal sage scrub could be established. An additional 8.5 acres of coastal sage scrub could also be restored by increasing species diversity within the existing disturbed Baccharis scrub onsite. Existing high quality coastal sage scrub/maritime chaparral

(1.45 acre) would be preserved. The existing dirt roads would be minimized, but maintained for utility access.

Hydrology

In areas where erosional gullies exist, several stabilizing solutions may be explored including redirecting flows from the adjacent road through upstream BMPs, and/or installing check dam or drop structures at the downstream end of the gullies to prevent future headcutting. Reestablishing target native vegetation communities within the gullies would also assist in stabilizing the area, support and maximize sensitive biological resources on-site, and create a seamless connection to adjacent open space lands.

Mapping, measurements, and a thorough evaluation of the gullies will need to occur in order to determine whether erosional gullies are conveying ephemeral flows, and how restoration efforts in the area would be affected by the flows. A thorough evaluation of the gullies will occur through the NOID approval process. The findings of the gully evaluations will assist in the design and implementation of the restoration and rehabilitation of the gullies.

A small sediment basin at the lower (north) edge of the parcel could also be constructed to minimize sedimentation into the lagoon, and to act as a transition to adjacent property where a significantly larger (i.e., deeper) erosion gully is present.

Topographic Modification

SANDAG/Caltrans does not propose to re-contour or grade the site, but would instead redirect flows from the adjacent road through appropriate BMPs, and/or install check dam or drop structures at the downstream end of the gullies to prevent future headcutting. In addition to corrections of the erosion gullies, appropriate BMPs would be implemented on site to minimize sedimentation and re-establishment of erosion gullies during the restoration process.. BMPs may include temporary or permanent sediment basins, use of fiber rolls, erosion control textiles, and fiber mulch products to hold soil in place until vegetation density and cover are established.

Soils

Based on past agricultural activities, adjacent restoration activities, and the presence of natural recruitment of native and non-native vegetation, it appears that soils are suitable for habitat establishment. Soil testing would be conducted to determine the need for soil amendments to promote soil and vegetation community restoration.

Target Plant Communities

Coastal sage scrub will be established in all disturbed areas. In addition, the same species will be used to restore species diversity and vegetation structure within the existing disturbed Baccharis Scrub. Table 3 presents the expected dominant species that will establish resources within the plant community.

Table 3
Target Dominant Species by Vegetation Community

Vegetation Community	Botanical Name	Common Name
Coastal Sage Scrub	*Artemisia californica*	*California Sagebrush*
	Cylindropuntia prolifera	*Coastal cholla*
	Encelia californica	*California encelia*
	Eriogonum fasciculatum	*flat-top buckwheat*
	Isocoma menziesii var. *vernonoides*	*coast goldenbush*
	Leymus condensatus	*Giant wild rye*
	Lotus scoparius	*deerweed*
	Heteromeles arbutifolia	*toyon*
	Nassella pulchra	*Purple needlegrass*
	Opuntia littoralis	*prickly-pear cactus*
	Rhus integrifolia	*lemonadeberry*
	Salvia mellifera	*Black sage*
	Sambucus mexicana	*elderberry*

Coastal sage scrub will be established mainly through planting of container stock and the application of a seed mix. A significant weed eradication program will be needed due to the high concentration of weedy species and seed existing onsite.

Supportive Measures

Limited temporary irrigation may be installed to facilitate vegetation establishment. The system will be used to increase the certainty of mitigation performance and success. All temporary irrigation will cease after 1-3 years depending upon vegetation establishment as determined by the project biologist.

Performance Criteria

Performance criteria will be developed from reference sites within or adjacent to the mitigation parcel. Nearby reference coastal sage scrub vegetation within the San Dieguito Lagoon complex will be identified and sampled using vegetation transects to establish appropriate vegetation cover and species diversity criteria. Other performance criteria will include native seedling

recruitment, non-native vegetation cover, soil stability (lack of erosion), and wildlife use of the area. Criteria will be established that provides a high level of confidence that, once performance criteria are achieved, the resultant vegetation communities will be resilient and persistent as a demonstration of self-sustainability under a long term management program.

Mitigation results for uplands are expected to increase native cover and species diversity to around 85% of reference habitat, while reducing non-native annual cover to 5% or less of total vegetation cover. The specifics of the performance criteria will be detailed in the Conceptual Mitigation Plan for the Dean Parcel, through the NOID process and/or Coastal Development Permit. Presently, the mitigation site is dominated by non-native and/or disturbed native vegetation. Disturbed areas will be type converted from non-native vegetation to coastal sage scrub in support of existing California gnatcatchers.

Criteria metrics will be developed in accordance with functional analysis methodologies to establish interim and final functional criteria. Interim target functional criteria scores will be used to inform maintenance decisions and regimes during the five-year monitoring and maintenance period to achieve the final target functional criteria scores.

SITE PROTECTION

Caltrans will deed the Dean parcel to an approved land manager with a fully funded endowment, once the mitigation projects have reached the end of interim maintenance period and satisfy established performance criteria. This parcel will add to open space along the edges of the San Dieguito Lagoon creating a more continuous property boundary with upland buffer habitat to the marsh habitat.

No new fencing is anticipated at the project site assuming access continues to be restricted along El Camino Real and from I-5 via the existing freeway right-of-way fence.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the biological resources that are established through the mitigation project. Primary management issues to be addressed in the HMP include site access and security, trash and weed control, and erosion control. Funds for long term management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

ADDITIONAL STUDIES

Further studies will be required to support the final design to be presented in the NOID submittal. Mapping, measurements, and a thorough evaluation of the erosional gullies will need to occur in order to determine how restoration efforts in the area would be affected by the flows onsite. A thorough evaluation of the gullies will occur through the NOID approval process. The findings of the gully evaluations will assist in the design and implementation of the restoration and rehabilitation of the gullies.

Other additional studies include soils testing to determine the appropriateness of existing soils for the target vegetation community, as well as potential archaeological testing and/or monitoring due to the potential for cultural resources.

In addition, a reference site with appropriate coastal sage scrub will be identified and sampled using line-transect methods to obtain vegetation community data such as cover, density, and species diversity. The specifics of the performance criteria will be investigated and detailed in the Conceptual Mitigation Plan for the Dean Parcel.

If some portion of the Dean Property may be affected by the future widening of Interstate 5, mitigation acreages available on the property should be adjusted to remove impact areas. This acreage change will be clearly documented in the text and figures of the Conceptual Mitigation Plan for the Dean Parcel.

REQUIRED PERMITS

A City of San Diego Site Development Permit and NOID with accompanying project report will likely be required for project implementation.

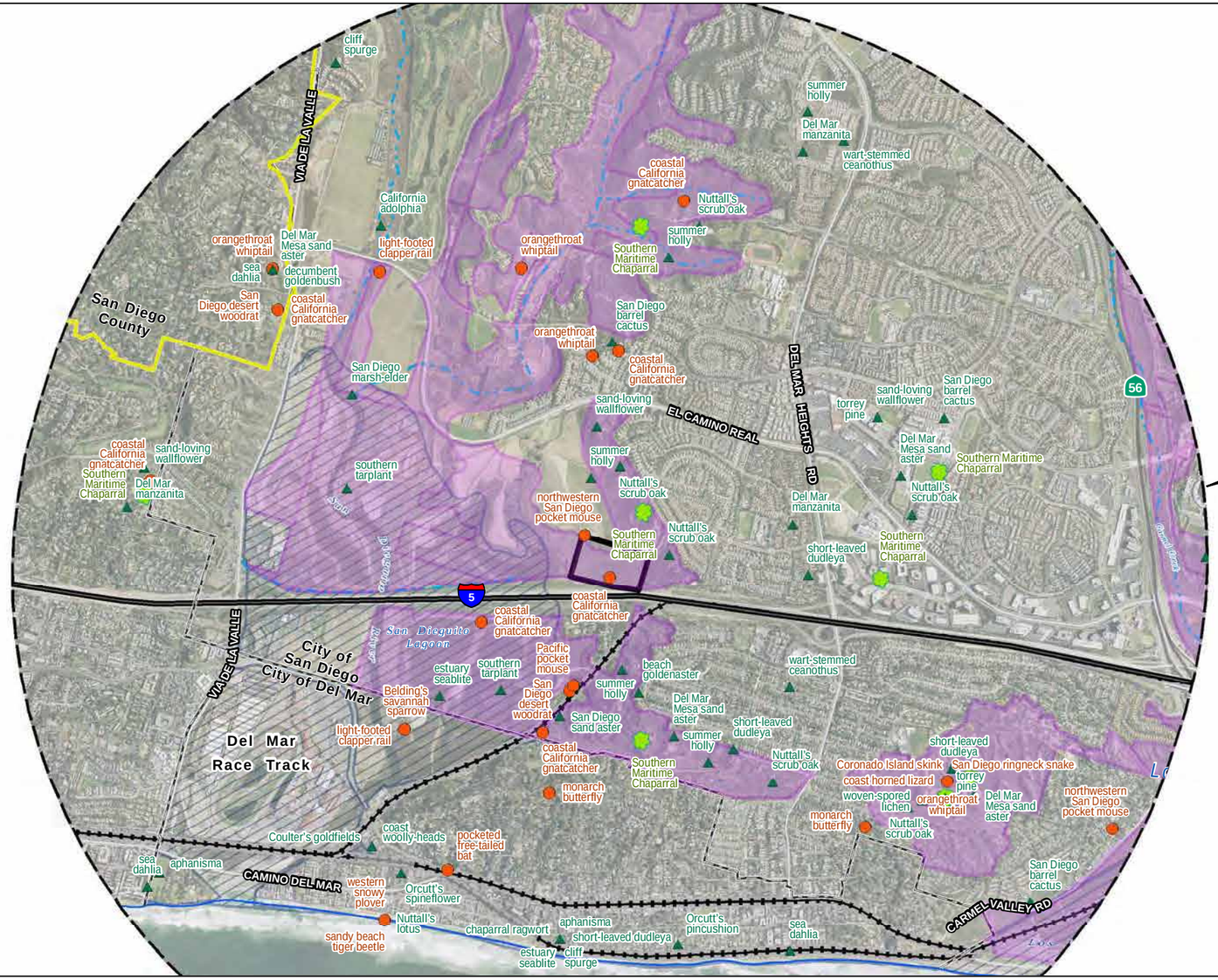
Figure 1. Dean Mitigation Parcel





FIGURE 2

VEGETATION AND CALIFORNIA GNATCATCHERS ONSITE



Dean Parcel
I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Stream/River

North County MSCP Boundary
San Diego MSPA
Coastal Commission Permit Jurisdiction

CNDDB Resources
Plant
Animal
Terrestrial Comm
Aquatic Comm



NORTH

0 500 1,000 1,500 Feet

DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, CNDDB, Imagery: DigitalGlobe March 2008

The Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map are for planning and engineering study purposes only. Data are derived from multiple sources. The digital Coastal Zone boundary, jurisdiction and Local Coastal Program data in this map have not been adopted by the Coastal Commission, and do not supersede the official versions certified by the Coastal Commission as may be amended from time to time.
Disclaimer: The State of California makes no representations or warranties regarding the accuracy or completeness of the files or the data from which they were derived. The State shall not be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of these Coastal Zone boundary, jurisdiction and Local Coastal Program files or the data from which they were derived. Because the Coastal Zone boundary, jurisdiction and Local Coastal Program data files are merely representational, they and the data from which they were derived are not binding and may be revised at any time.

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FIGURE 3

Dean Parcel CNDDB Resources within 2 miles

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Dean Parcel
Dean Parcel Buffer (2 miles)
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Coastal Zone Boundary
Stream/River
City of San Diego Community Plan Area
Coastal Commission Permit Jurisdiction
San Diego MSPA
Mitigation Site - Secured
Mitigation Site Parcel Lines

Special Status Vegetation

Caltrans CNDDB — Upland Vegetation

CSS = Coastal Sage Scrub
dCSS = Coastal Sage Scrub (Disturbed)
dCSS-AM = Coastal Sage Scrub (Disturbed) Already Mitigated
NNG = Non-native Grassland
SMC = Southern Maritime Chaparral
dSMC = Southern Maritime Chaparral (Disturbed)

Special Status Vegetation

Caltrans CNDDB — Wetland Vegetation

dCBM = Coastal Brackish Marsh (Disturbed)
DW = Disturbed Wetland
FWM = Freshwater Marsh
MF = Mule Fat Scrub
OW = Open Water
SBS = Salt Bush Scrub
SF = Salt Flat
SMT = Salt Marsh Transition
SM = Southern Coastal Salt Marsh
dSM = Southern Coastal Salt Marsh (Disturbed)
SWS = Southern Willow Scrub
dSWS = Southern Willow Scrub (Disturbed)
SWS/FWM = Southern Willow Scrub/ Freshwater Marsh
WUS = Waters of the US

Special Status Plants

Caltrans — Plants

DM = Del Mar manzanita
NSO = Nuttall's scrub oak
SA = Del Mar sand aster
ST = Southern tarplant
WC = wart-stemmed ceanothus

Other Sources (CNDDB, SanGIS)

California adolphia
Coast barrel cactus
Del Mar Manzanita
Sea dahila
Summer holly
Torrey pine
Wart-Stemmed ceanothus

Special Status Plants

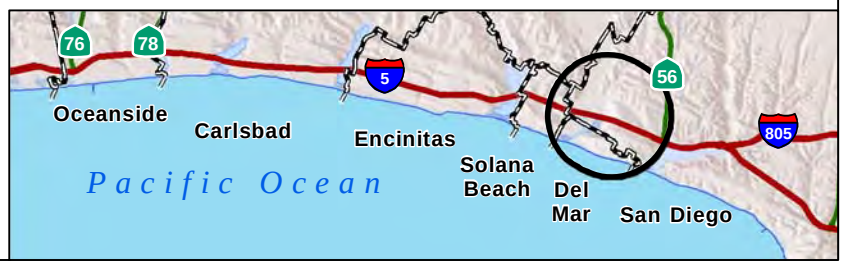
Other Sources (CNDDB, SanGIS) — Other Species

BG = Beach goldenaster
CL = Del Mar Mesa sand aster
CN = San Diego sand aster
CO = Orcutt's spineflower
DB = Short-leaved dudleya
DO = Western dichondra
IH = San Diego marsh-elder
TP = Southern tarplant
WO = Woven-spored lichen

NORTH

0 1,150 2,300 Feet

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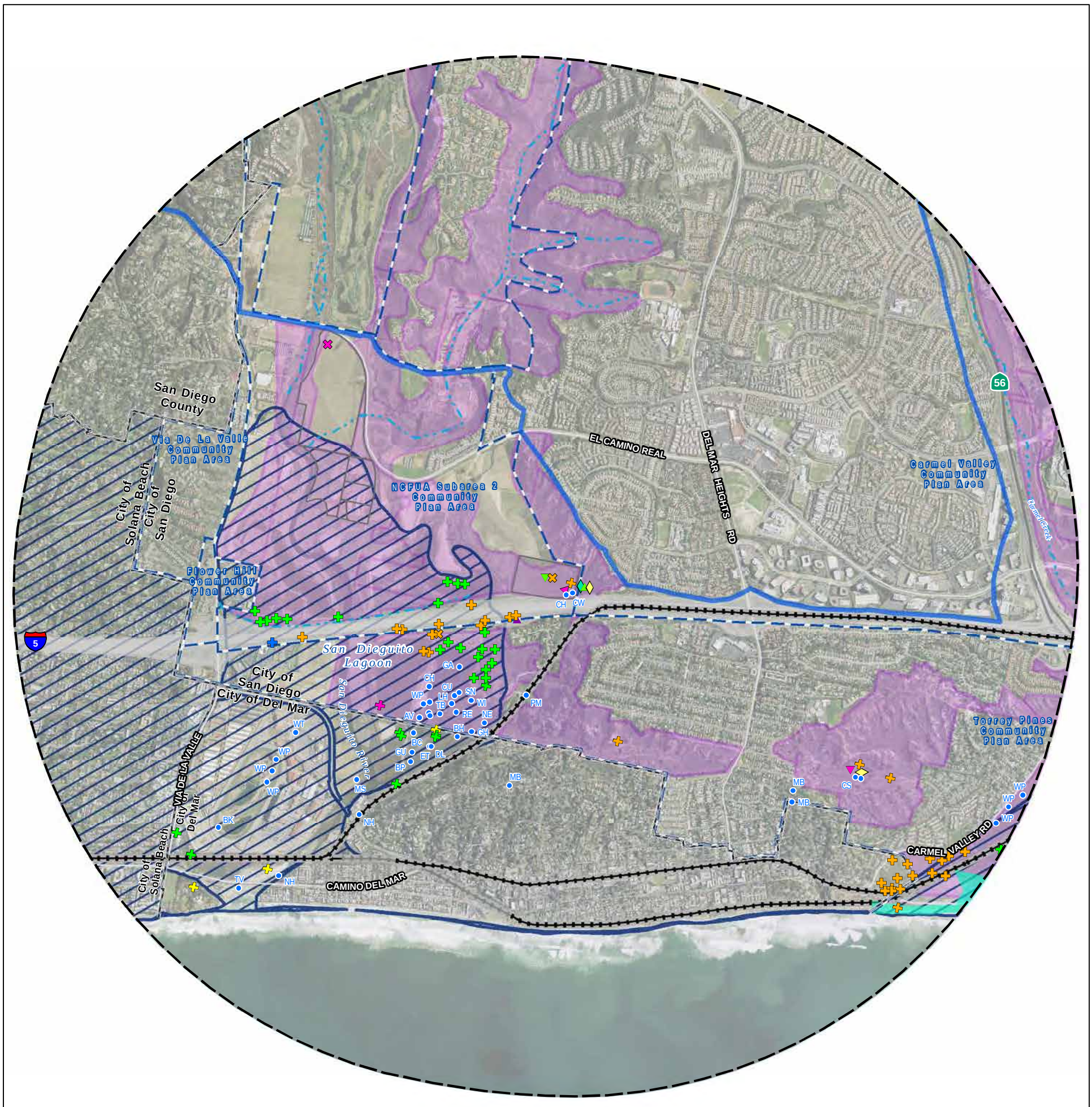
DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 4

Dean Parcel Special Status Plant Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Dean Parcel
Dean Parcel Buffer (2 miles)
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Coastal Zone Boundary
Stream/River
City of San Diego Community Plan Area
Coastal Commission Permit Jurisdiction
San Diego MSPA
Mitigation Site - Secured
Mitigation Site Parcel Lines
US Fish and Wildlife Service
Western Snowy Plover Critical Habitat

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Belding's savannah sparrow
✚	✖	California gnatcatcher
	✖	California least tern
✚		Least bittern
	✖	Light-footed clapper rail
▲	▼	NW San Diego pocket mouse
	▼	Orange-throated whiptail
▲		Rufous-crowned sparrow
♦		San Diego desert woodrat
♦	◆	San Diego horned lizard

Special Status Plants
Other Sources (CNDDB, SanGIS)

Other Species

AV = American avocet
BC = Long-billed curlew
BH = Great blue heron
BK = Black-shouldered kite
BP = California brown pelican
CH = Cooper's hawk
CS = Coronado sink
CU = Canada goose
CW = Coastal cactus wren
DL = Double-crested cormorant
DW = Downy woodpecker
ET = Elegant tern
GA = Gadwall
GH = Green Heron
GU = California gull

Special Status Plants
Other Sources (CNDDB, SanGIS)

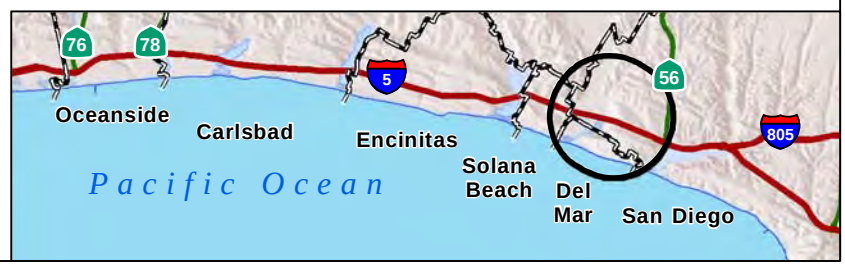
Other Species

LA = California horned lark
LH = Loggerhead shrike
MB = Monarch butterfly
NE = Black-crowned night heron
NH = Northern harrier
PM = Pacific pocket mouse
RE = Reddish egret
RN = San Diego ringneck snake
SK = Black skimmer
SN = Snow goose
TB = Tricolored blackbird
TV = Turkey Vulture
WI = White-faced ibis
WP = Western snowy plover
WT = Southwestern pond turtle

NORTH

0 1,150 2,300 Feet

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DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 5
Dean Parcel Special Status Wildlife Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Deer Canyon II Site

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

JULY 2012

Printed on 30% post-consumer recycled material.

Site Location: The Deer Canyon II mitigation site is located south of State Route (SR) 56 and south of McGonigle Canyon (see Figure 1).

Latitude/Longitude: 32º 57' 1.2443 north and -117º 11' 13.8728 west

APN: Portions of 305-031-20 and 305-040-23 (22.2 acres)

Ownership: California Department of Transportation (Caltrans) and San Diego Association of Governments (SANDAG) are currently in negotiations to purchase the property from the owner. Purchase of the upper slope parcel has an agreed upon price, is currently in escrow, and is anticipated to be complete in 2012.

Correspondence with Resource Agencies: Agencies have approved wetland and upland mitigation on the lower parcel, and upland mitigation on portions of the upper parcel.

MITIGATION GOAL

SANDAG and Caltrans propose to mitigate impacts to sensitive upland habitats associated with the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by enhancing poor quality upland habitat on the Deer Canyon II mitigation site, located in Deer Canyon adjacent to Deer Canyon Creek. The Deer Canyon II mitigation site consists of approximately 22.2 acres and is located adjacent to lands subject to a separate mitigation proposal for the I-5/Genesee Avenue Interchange Reconstruction Project, I-805 North Managed Lanes Project, Carroll Canyon Road Extension and Direct Access Ramp, and double-tracking projects on the LOSSAN corridor. For the North Coast Corridor PWP/TREP, only the upland creation/restoration located within the Upper Parcel slope of this larger mitigation area will be described herein (see Figure 2).

The goal of the upland creation in Deer Canyon is to create coastal sage scrub habitat in areas that are currently nonnative grassland, and then manage the parcel as open space in perpetuity. The proposed creation and in-perpetuity management of the native uplands vegetation communities will:

- Provide wildlife habitat for the California gnatcatcher (*Polioptila californica californic*a) and other native wildlife species habitat by removing nonnative grassland and converting it to high quality coastal sage scrub habitat;
- Improve coastal sage scrub habitat and ecosystem continuity through connectivity between coastal wetlands and native uplands;
- Stabilize slopes in Deer Canyon by converting nonnative grassland habitat to more appropriate coastal sage scrub habitat;

- Provide a buffer between the riparian habitat and the surrounding land uses; and
- Preserve the restored areas in Deer Canyon as permanent open space.

Table 1
Habitat Mitigation Goals

Habitat Types	Mitigation Type	Mitigation Acreage
Coastal sage scrub	Creation and Restoration	14.6 ac.

EXISTING CONDITIONS

Ecological Context

The Deer Canyon II site is within the Peñasquitos Hydrologic Unit. In total, the Deer Canyon II site is approximately 22.2 acres in size, including the majority of the upper slopes of the larger Deer Canyon Mitigation site. The larger site is split into two parcels: 1) the lower portion that abuts the creek; and 2) the upland slopes to the north, where the upper parcel mitigation described herein is proposed to take place. Approximately 7.6 acres of the 22.2 acre upper parcel is already planned and approved for coastal sage scrub creation and preservation of some nonnative grassland for associated impacts to that habitat on coastal projects.

The Deer Canyon II site is within a Multiple Habitat Planning Area and is identified for preservation. California Natural Diversity Database (CNDDB) mapped resources for the upper parcel of the Deer Canyon Mitigation Site includes a variety of data points within a 2 mile radius (see Figure 3). Special status plant species identified within the 2 mile radius include California adolphia (*Adolphia californica*), wart stemmed ceanothus (*Ceanothus verrucosus)*, summer holly (*Comarostaphylis diversifolia*), Del Mar manzanita (*Arctostaphylos glandulosa ssp. crassifolia*), and others as identified in Figure 4. Numerous special status wildlife species are also identified within a 2 mile radius of the Deer Canyon II site, and include the California gnatcatcher (*Polioptila californica*) (see Figure 5). No sensitive species currently occur on the upper parcel due to its disturbed nature. However, California adolphia is immediately across (and north of) the dirt road from the upper parcel.

Drainage and Hydrology

Hydrology of the site consists primarily of overland drainage (sheet flow) and a few hillside drainages, which drain site runoff southerly to Deer Canyon Creek. Deer Canyon Creek is a small, ephemeral to intermittent creek that is fed primarily by urban runoff, precipitation, and stormwater flows.

Soils

Soils located on the lower parcel are primarily sandy with some clay and silt, whereas the upper parcel consists of more clayey sands and clays. Locally, gravelly and cobbly layers were found within the lithologic unit (Caltrans 2011).

Vegetation

The majority of the upper parcel supports nonnative grassland habitat, with a few small patches of disturbed Diegan coastal sage scrub along the eastern and southern borders (see Figure 2). The nonnative grassland is comprised primarily of brome grasses (*Bromus* spp.), wild oat (*Avena* sp.), and barley (*Hordeum* spp.). The nonnative grassland habitat provides some wildlife and foraging habitat for common bird and mammal species.

Native species in the disturbed Diegan coastal sage scrub communities include deerweed (*Lotus scoparius*) and coyote bush (*Baccharis pilularis*); however, this habitat is dominated by nonnative grasses such as ripgut grass (*Bromus diandrus*), wild oat (*Avena* sp.), red brome (*Bromus madritensis* ssp. *rubens*), and barley (*Hordeum* spp.).

Disturbed habitat is found in portions of the upper parcel and concentrated to the east. The disturbed habitat is dominated by black mustard (*Brassica nigra*), filaree (*Erodium* sp.), tocalote (*Centaurea melitensis*) wild radish (*Raphanus sativus*), clover (*Medicago* sp.), sweet fennel, and horseweed (*Conyza canadensis*).

Nonnative grassland, disturbed Diegan coastal sage scrub, and disturbed habitat communities were identified on the upper parcel. Overall, the parcel contains poor habitat, with weed invasion in most places. A summary of existing habitat types and acreage on the Deer Canyon II site is provided in Table 2 below.

Table 2
Existing Vegetation Communities

Preserved Habitat Type	Mitigation Acreage
Disturbed Coastal Sage Scrub	0.48 ac.
Disturbed Habitat	0.6 ac.
Nonnative grassland	21.12 ac.
Total	22.2 ac.

Wildlife

Bird species that were observed onsite include California towhee (*Pipilo crissalis*), song sparrow (*Melospiza melodia*), Cassin's kingbird (*Tyrannus vociferans*), and common yellowthroat (*Geothlypis trichas*) (Scatolini 2012). Northern harriers (*Circus cyaneus*) and white-tailed kites (*Elanus leucurus*) were observed foraging onsite.

One San Diego horned lizard (*Phrynosoma coronatum blainvillii*) was observed on the dirt road along the northern boundary of the site.

Prior and Current Land Use

The habitat creation on the upper parcel slopes will be adjacent to the upland and wetland mitigation immediately to the south on the Deer Canyon (I) Mitigation Site and additional coastal sage scrub creation that is already planned on a portion of the upper parcel (Caltrans 2011). There are additional riparian mitigation sites immediately to the west, north, and south of the upper parcel.

The fire road immediately north of the site at the top of the slope is used as a trail by horse-back riders, walkers, and mountain bikes.

Existing Utilities/Infrastructure/Easements

There are utility power lines immediately west of the project. There is a sewer easement along dirt roads to the west and south of the Deer Canyon parcels. There are no known utilities onsite.

MITIGATION PROGRAM

The main goals of the mitigation are to provide wildlife habitat for the California gnatcatcher (*Polioptila californica californica*) and other native wildlife species habitat by removing nonnative grassland and creating high quality coastal sage scrub habitat, improve coastal sage scrub habitat and ecosystem continuity through connectivity between coastal wetlands and native uplands, and preserve the restored areas in Deer Canyon as permanent open space. The coastal sage scrub habitat created onsite will also provide a buffer to the riparian habitat at the base of the slope in the adjacent mitigation areas, and provide slope stability and protection from erosion during rain events. The following program is intended to promote the established goals.

Schedule

Design of the mitigation plan will begin when full approval is received from the resource agencies that mitigation is appropriate at the Deer Canyon II site, and will be counted toward mitigating the North Coast Corridor multi modal transportation program impacts. Detailed

design will be provided through the Notice of Intent to Develop (NOID) approval process during the first phase of implementation of the North Coast Corridor PWP/TREP. As discussed in Section 6.5.3 of the PWP/TREP, the results of consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., USFWS, CDFG, etc.), as well as all supporting documentation are required to be submitted along with the NOID project report. Accordingly, all design and related project reporting would be submitted to the permitting agencies for consultation as part of the NOID review and approval process.

Mitigation Goal and Purpose

Upland mitigation will create Diegan coastal sage scrub in existing nonnative grassland habitat onsite. Creation will include exotic control, dethatching, container planting, seeding, and will likely use temporary irrigation.

Hydrology

Upland hydrology will primarily be maintained as overland sheet flow and within the existing hillside drainages that currently exist. However, some minimal topographic modifications and/or appropriate Best Management Practices (BMPs) will be implemented in upland areas if necessary to reduce concentrated runoff and erosive conditions.

Topographic Modification

SANDAG/Caltrans do not propose to re-contour or grade the site. Appropriate BMPs would be implemented on the site, as needed, to minimize erosion and sedimentation. BMPs may include use of fiber rolls, erosion control textiles, and fiber mulch products to hold soil in place until vegetation density and cover are established.

Site Preparation

The nonnative grassland onsite will be dethatched and sprayed with herbicide prior to planting.

After dethatching and prior to seeding and planting, a grow/kill program involving two or more watering events using a temporary irrigation system or watering truck followed by kill/herbicide application shall be implemented to reduce the nonnative seed bank. All nonnative plant material will be taken offsite and disposed of properly. Prior to hydroseed installation, soil testing will be conducted to test viability; fertilizer will be incorporated into the slurry mix per soil test results and recommendations.

Target Plant Communities

Table 3 contains a list of container species that will be used onsite. Table 4 contains a list of coastal sage scrub species that will be hydroseeded on all coastal sage scrub planting areas. Hydroseeding of the non-irrigated slopes will occur between October and February to take advantage of the rainy season.

Table 3
Coastal Sage Scrub Species to be Planted on the Slope

Scientific Name	Common Name	Container Size
Rhus integrifolia	lemonadeberry	1 gallon
Heteromeles arbutifolia	toyon	1 gallon
Artemisia californica	coastal sagebrush	1 gallon
Salvia mellifera	black sage	1 gallon
Salvia apiana	white sage	1 gallon
Isomeris arborea	bladderpod	1 gallon
Mirabilis californica	four o'clock	1 gallon
Encelia californica	California sunflower	1 gallon
Leymus condensatus	giant wild rye	1 gallon
Cylindopuntia prolifera	coast cholla	1 gallon

Table 4
Hydroseed for Coastal Sage Scrub Enhancement Area

Scientific Name	Common Name	Percent Germination (Minimum)	Pounds Pure Live Seed per Acre
Artemisia californica	coastal sagebrush	40	1.0
Bromus carinatus	California brome	70	2.0
Camissonia cheiranthifolia	Beach evening-primrose	65	1.0
Castilleja exserta	purple owl's clover	40	1.0
Clarkia purpurea quadivulnera	four spot clarkia	65	0.5
Encelia californica	California sunflower	50	1.0
Eriogonum fasciculatum var. fasc.	flat-topped buckwheat	55	3.0

Scientific Name	Common Name	Percent Germination (Minimum)	Pounds Pure Live Seed per Acre
Deinandra fasciculata	fascicled tarweed	15	2.0
Lupinus bicolor	Miniature lupin	70	2.0
Lupinus succulentus	Arroyo lupin	75	2.0
Gnaphalium californicum	California everlasting	15	0.25
Lasthenia californica	goldfields	50	2.0
Lotus scoparius	deerweed	50	2.5
Nassella pulchra	purple needlegrass	50	6.0
Salvia apiana	White sage	40	1.0
Sisyrinchium bellum	Blue-eyed grass	65	1.0
Salvia mellifera	black sage	40	2.0

NOTE: Hydroseed mixes shall include seed mix, amendments per soil test recommendation, and virgin wood cellulose fiber mulch at 2,500 lbs per acre.

Supportive Measures

Temporary irrigation will likely be used to initiate a nonnative grow/kill program to reduce the nonnative seed bank onsite prior to hydroseeding and planting. Temporary irrigation will likely also be used for the first year or two to get the container plants established. Maintenance and monitoring will be performed during the 5-year monitoring period to guide the emerging native vegetation toward meeting performance standards. Maintenance onsite will require several years of intense weed removal through hand pulling and spraying with herbicide (glyphosate) to control the nonnative grasses and allow the coastal sage scrub species to become established.

Performance Criteria

Performance criteria will be developed from reference sites within or adjacent to the mitigation parcel and will be established with the aim of matching the reference habitats. Other performance criteria will include native seedling recruitment, non-native vegetation cover, soil stability (lack of erosion), and wildlife use of the area. Criteria will be established that provides a high level of confidence that, once performance criteria are achieved, the resultant vegetation communities will be resilient and persistent as a demonstration of self-sustainability under a long term management program.

Mitigation results for uplands are expected to increase native cover and species diversity to around 85% of reference habitat, while reducing non-native annual cover to 5% or less of total vegetation cover. The specifics of the performance criteria will be detailed in the Conceptual

Mitigation Plan for the Deer Canyon II Site, through the NOID process and/or Coastal Development Permit. Presently, the mitigation site is dominated by non-native vegetation.

SITE PROTECTION

Caltrans will deed the site to the City of San Diego with a fully funded endowment, once the mitigation projects have reached the end of interim maintenance period and satisfy established performance criteria. A management endowment account will be established once the property acquisition is complete. The endowment funds will be used by the management entity to monitor and maintain site access restrictions and habitat quality. The upper parcel, once restored, is intended to be preserved in a natural, scenic, open condition to maintain its ecological, historical, visual and educational values.

Site restrictions might be required to fully protect existing biological resources from local residential land use and motorists at the viewpoint parking area. Any fence installed will be maintained as part of the land management.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the functions and services of the preserved biological resources. The City of San Diego will assume long term management responsibilities. Funds for long term management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

Anticipated potential management issues related to this parcel include site access control, weed control, trash accumulation control.

ADDITIONAL STUDIES

Further studies will be required to support the final design to be presented in the NOID submittal. These studies include soils testing to determine if there are any nutrient deficiencies. Cultural resource studies have already been completed and no resources were identified. In addition, a reference site with appropriate coastal sage scrub will be identified and sampled using line-transect methods to obtain vegetation community data such as cover, density, and species diversity.

REQUIRED PERMITS

A NOID with accompanying project report will likely be required for project implementation.

REFERENCES

CalIPC. 2012. Website http://www.cal-ipc.org/ip/management/ipcw/categories.php, accessed May 4, 2012.

Caltrans. 2011. Final Compensatory Wetland/Upland Mitigation Plan for Deer Canyon. May 2011.

Scatolini, Susan. 2012. Email correspondence occurring on May 2, 2012.



DUDEK

6264

MAY 2012

SOURCE: USGS Topo 7.5 min Quards

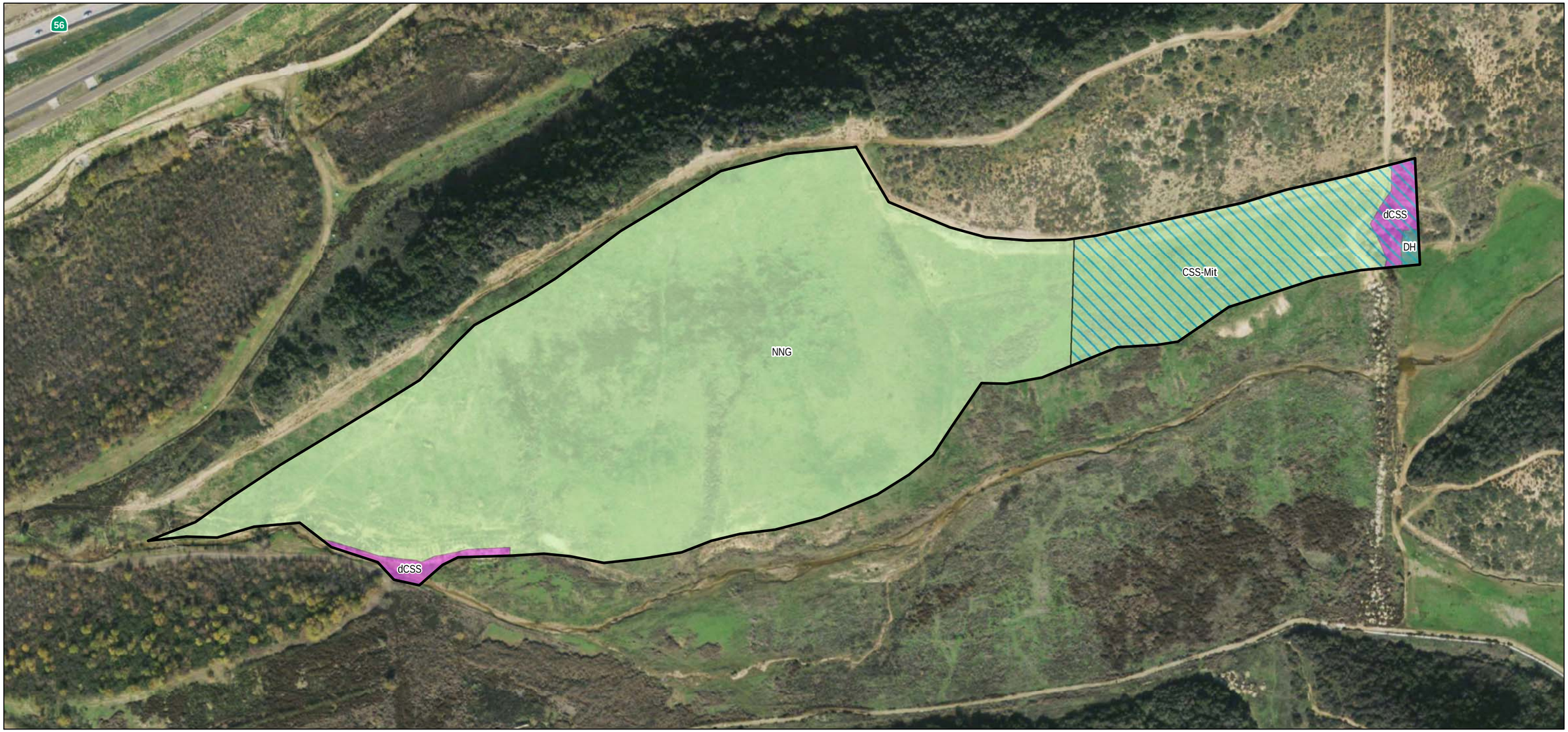
FIGURE 1

Deer Canyon II - Vicinity Map

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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Deer Canyon North Boundary

Vegetation Communities:

- DH = Disturbed Habitat
- NNG = Non-Native Grass
- dCSS = Disturbed Coastal Sage Scrub
- CSS-Mit = Coastal Sage Scrub Mitigation w/ Lower parcel

NORTH

0 200 400 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

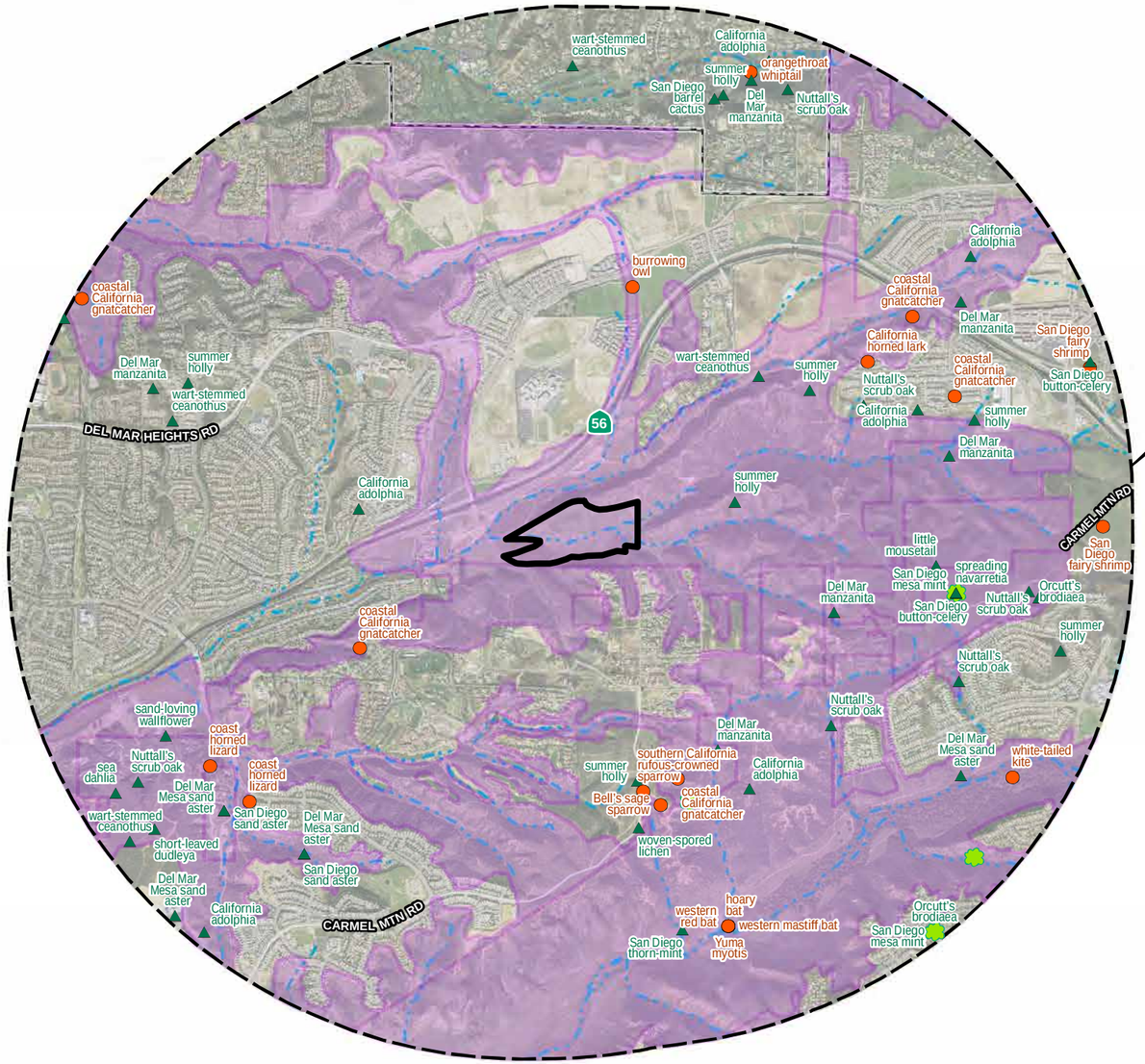
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FIGURE 2

Deer Canyon II Parcel Existing Vegetation

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Deer Canyon II Parcel
San Diego MSPA
I-5 NCC Project Area
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Stream/River

CNDDB Resources
Plant
Animal
Terrestrial Comm
Aquatic Comm



NORTH

0 1,500 3,000 Feet

DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, CNDDB, Imagery: DigitalGlobe March 2008

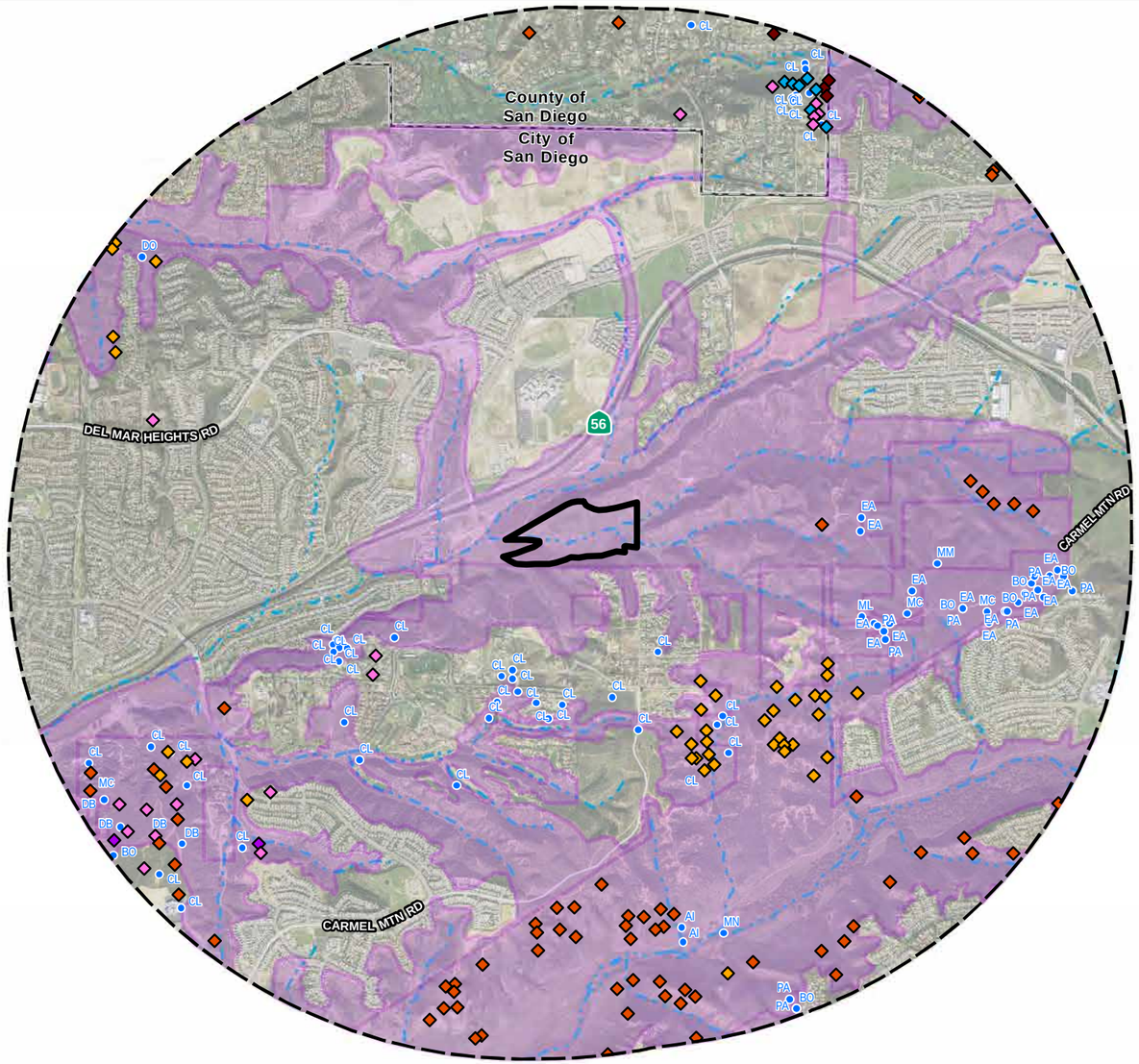
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FIGURE 3

Deer Canyon II Parcel CNDDB Resources within 2 miles

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Deer Canyon II Parcel

Deer Canyon II Parcel Buffer (2 miles)

San Diego MSPA

City Boundary

Stream/River

Special Status Plants
Other Sources
(SanGIS)

- California adolphia
- Coast barrel cactus
- Del Mar Manzanita
- Summer holly
- Torrey pine
- Wart-Stemmed ceanothus

Special Status Plants
Other Sources
(SanGIS)

Other Species

AI = San Diego thorn-mint
BO = Orcutt's brodiaea
CL = Del Mar Mesa sand aster
DB = Short-leaved dudleya
DO = Western dichondra
EA = San Diego button-celery
MC = San Diego goldenstar
ML = Willowy monardella
MM = Little mousetail
MN = Nevin's mahonia
PA = San Diego Mesa-mint



NORTH

0 1,500 3,000 Feet

DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

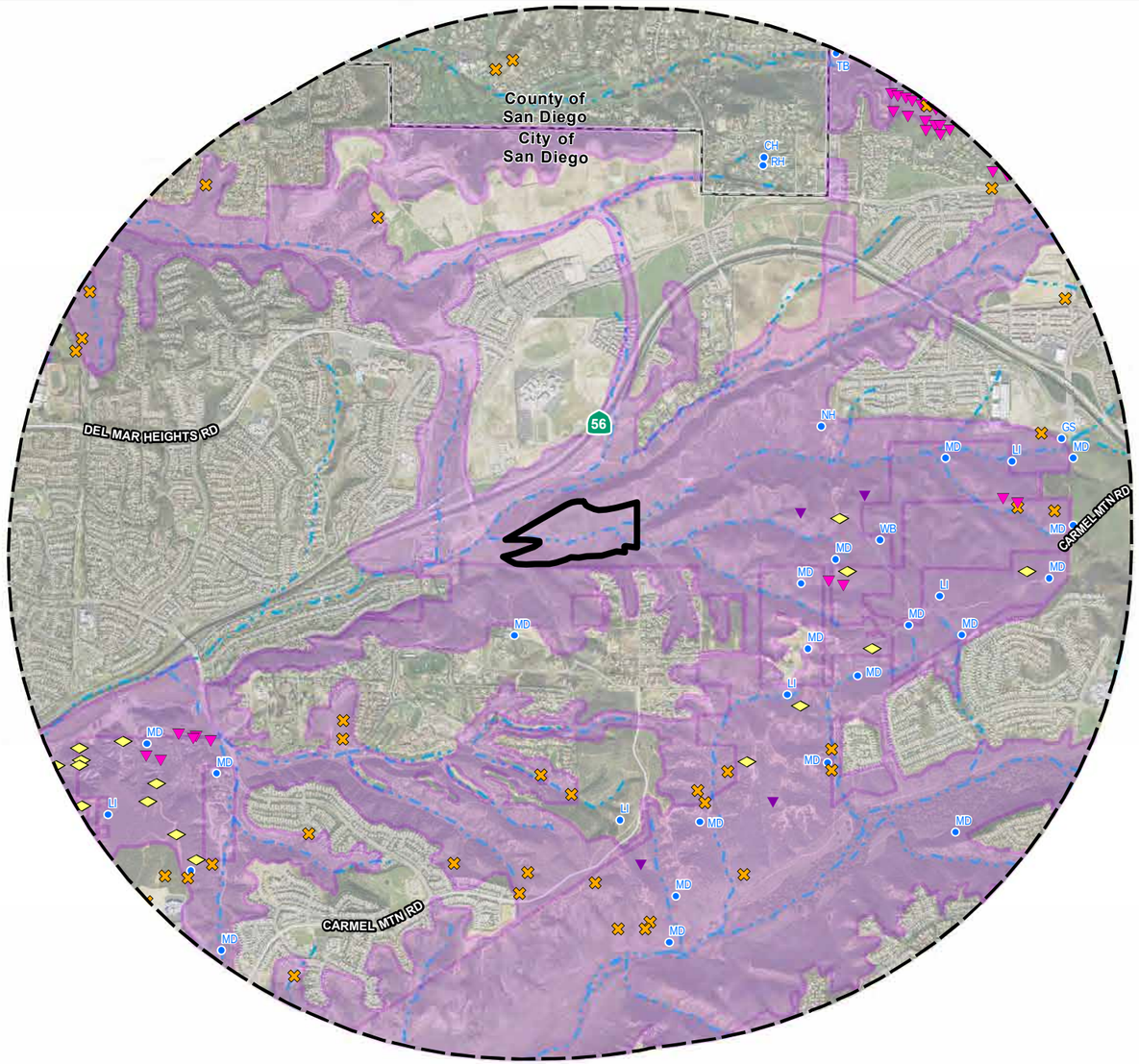
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FIGURE 4

Deer Canyon II Parcel Special Status Plant Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Deer Canyon II Parcel

Deer Canyon II Parcel Buffer (2 miles)

San Diego MSPA

City Boundary

Stream/River

Special Status Wildlife
Other Sources (SanGIS)

- California gnatcatcher
- Orange-throated whiptail
- Rufous-crowned sparrow
- San Diego horned lizard

Special Status Wildlife
Other Sources (SanGIS)

Other Species

CH = Cooper's hawk
GS = Grasshopper sparrow
LI = Mountain lion
MD = Southern mule deer
NH = Northern harrier
RH = Red-shouldered Hawk
TB = Tricolored blackbird
WB = Western bluebird



NORTH

0 1,500 3,000 Feet

DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, Imagery: DigitalGlobe March 2008

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DRAFT

FIGURE 5

Deer Canyon II Parcel Special Status Wildlife Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the La Costa Preservation Parcel

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

AUGUST 2012

Printed on 30% post-consumer recycled material.

Site Location: The La Costa preservation parcel is located east of Interstate 5 (I-5), south of La Costa Avenue and east of Piraeus Street (see Figure 1). The parcel is situated across La Costa Avenue from Batiquitos Lagoon.

Latitude/Longitude: 33.0878/-117.2896

APN: 216-110-31 (19.75 acres)

Ownership: Caltrans has purchased this parcel

Correspondence with Resource Agencies: June 2008, Resource agencies receive request from Caltrans and SANDAG to approve site for acquisition; Letters acknowledging consideration of site for mitigation received from CCC March 2009, CDFG July 2008, USFWS August 2008, and NMFS July 2008.

MITIGATION GOAL

The San Diego Association of Governments (SANDAG) and California Department of Transportation (Caltrans) propose to mitigate impacts to sensitive upland habitats associated with the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) of multi modal transportation projects by preserving and managing existing high quality uplands habitat on the La Costa preservation parcel located along the south shore of Batiquitos Lagoon (see Figure 2). The goal of the preservation acquisition and mitigation program is to remove development potential of the parcel, enhance disturbed Coastal Sage Scrub (CSS) areas through rehabilitation efforts, preserve existing high quality upland habitat through site protection (easements and fence), and manage the parcel in perpetuity.

The proposed preservation and management of the native uplands vegetation communities will preserve:

- Occupied California gnatcatcher habitat by removing extant habitat from the threat of development;
- Chaparral and coastal sage scrub habitat and ecosystem continuity through connectivity between coastal wetlands and native uplands;
- Sensitive plants and cultural resources onsite;
- Wildlife connectivity with Batiquitos Lagoon and surrounding native open space that connects to Encinitas Creek and other drainages into the lagoon and out to the Pacific coastline; and,
- Natural topography adjacent to Batiquitos Lagoon that is highly visible from the I-5 corridor and significantly contributes to scenic quality and landscape character.

The proposed rehabilitation of the disturbed CSS communities will involve:

- The removal of nonnative species from areas mapped as disturbed CSS
- Replanting and/or hydroseeding disturbed areas with appropriate native species.

EXISTING CONDITIONS

Ecological Context

The parcel was identified as consisting of high to very high habitat values in the Multiple Habitat Conservation Plan (MHCP) for coastal northern San Diego County, and is located within a Biological Core Linkage area. The preservation area abuts the Carlsbad HCP core area #8 that comprises Batiquitos Lagoon. The lagoon is owned and managed by the California Department of Fish and Game. California Natural Diversity Database (CNDDB) mapped resources for these adjacent uplands to Batiquitos Lagoon includes a variety of nearby data points (Figure 3). Special status plant species identified onsite include California adolphia (*Adolphia californica*) and wart stemmed ceanothus (*Ceanothus verrucosus)*, while sea dahlia (*Coreopsis maritima*) and Del Mar sand aster (*Lessingia filaginifolia var. linifolia*) have been identified nearby (Figure 4). Numerous special status wildlife species are also identified within and adjacent to Batiquitos Lagoon (Figure 5), and critical habitat for the California gnatcatcher is designated on the entirety of the parcel. Adjacent upland areas, including the subject parcels, are utilized by California gnatcatcher.

Other open space lands are present south and east of the preservation parcel. These open space areas are located on slopes and canyons that topographically form the southern boundary of Batiquitos Lagoon. These slopes provide linkages to inland areas associated with Encinitas Creek and other drainages that flow into the lagoon and ultimately connect to the Pacific.

Soils

The acquired parcel consists of steep north and northwest facing slopes. Three soil types are present on the parcel including Carlsbad gravelly loamy sand at the base of the slope, Gaviota fine sandy loam on the steepest slopes, and Corralitos loamy sand on the mesa top (NRCS, Web Soil Survey).

Vegetation

Diegan coastal sage scrub, chaparral (both southern maritime chaparral and chamise chaparral), and disturbed habitat communities were identified on the parcel. The parcel has good habitat with excellent habitat found on the top of the mesa. It provides habitat for sensitive plants as well as the threatened California gnatcatcher and supports rare plants and communities. There is little

weed invasion in most places, and minimal effort would be needed to fence these parcel to control access and preserve the habitat in place.

A general description of each community and a description of its occurrence within the parcel are provided below.

Diegan Coastal Sage Scrub. This vegetation type was once widespread in coastal southern California, and now it occurs in patches from Los Angeles into Baja California. This plant community on the parcel totals about 11.75 acres and is composed of a variety of low, soft aromatic shrubs dominated by drought-deciduous species such as California sagebrush (*Artemisia californica*), flat-topped buckwheat (*Eriogonum fasciculatum* var. *fasciculatum*), white sage (*Salvia apiana*), and black sage (*Salvia mellifera*). Coastal sage scrub (CSS) on site is dominated by California sagebrush and buckwheat with prickly pear (*Opuntia littoralis*), laurel sumac (*Malosma laurina*), lemonade berry (*Rhus integrifolia*), black sage, desert elderberry (*Sambucus mexicana*), California sunflower (*Encelia californica*), and golden yarrow (*Eriophyllum confertifolium* var. *confertifolium*) (Figure 2). California adolphia (*Adolphia californica*), a sensitive plant, occurs in this community on site. The top of the mesa is relatively densely vegetated except along walking trails. The top of the slope on the northern end of the mesa has patches that are more disturbed with nonnative grasses and weedy annuals including ripgut grass (*Bromus diandrus*), foxtail chess (*Bromus madritensis* var. *rubens*), mustard (*Brassica* sp.), and ice plant (*Carpobrotus edulis*).

The base of the canyon on the northeastern end of the parcel consists of approximately 3.65 acres of disturbed coastal sage scrub dominated by coyote bush (*Baccharis pilularis*), California sunflower, and black sage with large patches of fennel (*Foeniculum vulgare*).

Chaparral. Two types of chaparral are found on site including chamise chaparral and southern maritime chaparral. There is approximately 3.38 acres of chaparral on site. Chamise chaparral is dominated by chamise (*Adenostoma fasciculatum*) in dense almost monotypic stands. This is a fire-adapted community that is found primarily on east-facing slopes. Chamise chaparral on site occurs in small patches on north-facing slopes of the parcel.

Southern maritime chaparral occurs on the upper north-facing slopes at the western end of the parcel and on the north facing slopes of the canyon. This community is dominated by wart-stemmed ceanothus (*Ceanothus verrucosus)* with chamise, toyon (*Heteromeles arbutifolia*), laurel sumac, fuchsia-flowered gooseberry (*Ribes speciosum*), mission manzanita (*Xylococcus bicolor*), and Mohave yucca (*Yucca schidigera*). Elements of Diegan coastal sage scrub are interspersed within this community.

A summary of existing habitat types and acreage on the La Costa parcel is provided in Table 1, below.

Table 1
Preservation Acreage by Habitat Type

Preserved Habitat Type	Mitigation Acreage
Coastal Sage Scrub	11.75 ac.
Disturbed Coastal Sage Scrub	3.65 ac.
Chaparral	3.38 ac.
Disturbed Habitat (Coastal Sage Scrub Enhancement)	0.97 ac.
Total	19.75 ac.

Wildlife

One pair of threatened coastal California gnatcatcher (*Poliptila californica californica*) was observed at the top of the parcel (see Figures 2 and 5). Other bird species that were observed on site include California towhee (*Pipilo crissalis*), song sparrow (*Melospiza melodia*), Anna's hummingbird (*Calypte anna*), bushtit (*Psaltriparus minimus*), and California thrasher (*Toxostoma redivivum*). Other wildlife species observed on site include coyote (*Canis latrans*), western fence lizard (*Sceloporus occidentalis*), desert cottontail (*Sylvilagus audubonii*), and California ground squirrel (*Spermophilus beecheyi*).

Prior and Current Land Use

The parcel is adjacent to La Costa Avenue on the north. Piraeus Street is located to the west and Sky Loft Road to the south. La Costa Avenue is a four-lane road with high traffic speeds and no roadside parking. Access from La Costa Avenue is extremely limited and roadside parking is dangerous. Limited parking is available on the shoulder of Piraeus Street adjacent to the south at the intersection with La Costa Avenue. Roadside parking along Sky Loft Road is limited by an asphalt curb that runs the length of this road up to the existing residential development.

Some informal hiking trails are present on the parcel. These trails appear to be used to access high points that provide vistas of Batiquitos Lagoon and the Pacific Ocean. Due to the lack of parking, these trails are likely used only by local residents.

Existing Utilities/Infrastructure/Easements

There are no known utilities, infrastructure, or easements located on the parcel that could affect implementation of the proposed mitigation/preservation opportunity (see Figure 6).

MITIGATION PROGRAM

The proposed mitigation for the entirety of the site will be for protected open space, habitat preservation and management. The goal of the preservation acquisition is to remove development potential of the parcel, preserve existing upland habitat through site protection (easements and fence), and ensure management in perpetuity.

Rehabilitation

Areas that are mapped as disturbed CSS will be rehabilitated through the removal of nonnative species and the replanting and/or seeding with an appropriate native CSS plant palette.

Target Plant Communities

The design and plant palette used to rehabilitate the disturbed CSS areas will include native species found in adjacent native areas. To provide appropriate native species diversity that is comparable to adjacent high quality habitat, additional field surveys of the La Costa Parcel, detailing annual and perennial species will need to occur and the recorded species added to the plant palette in the NOID submittal, as appropriate.

SITE PROTECTION

Caltrans will deed the preservation parcel to a local land management agency that is acceptable to the resource agencies. A management endowment account will be established once the property acquisition is complete. The endowment funds will be used by the management entity to monitor and maintain site access restrictions and habitat quality.

Site restrictions might be required to fully protect existing biological resources. However, some controlled access opportunity for local residents to access vistas should be considered to minimize vandalism on the preserved land. Any fence installed will be maintained as part of the preserved land management.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the functions and services of the preserved biological resources. A resource agency-approved management entity will assume long term management responsibilities. Funds for long term management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

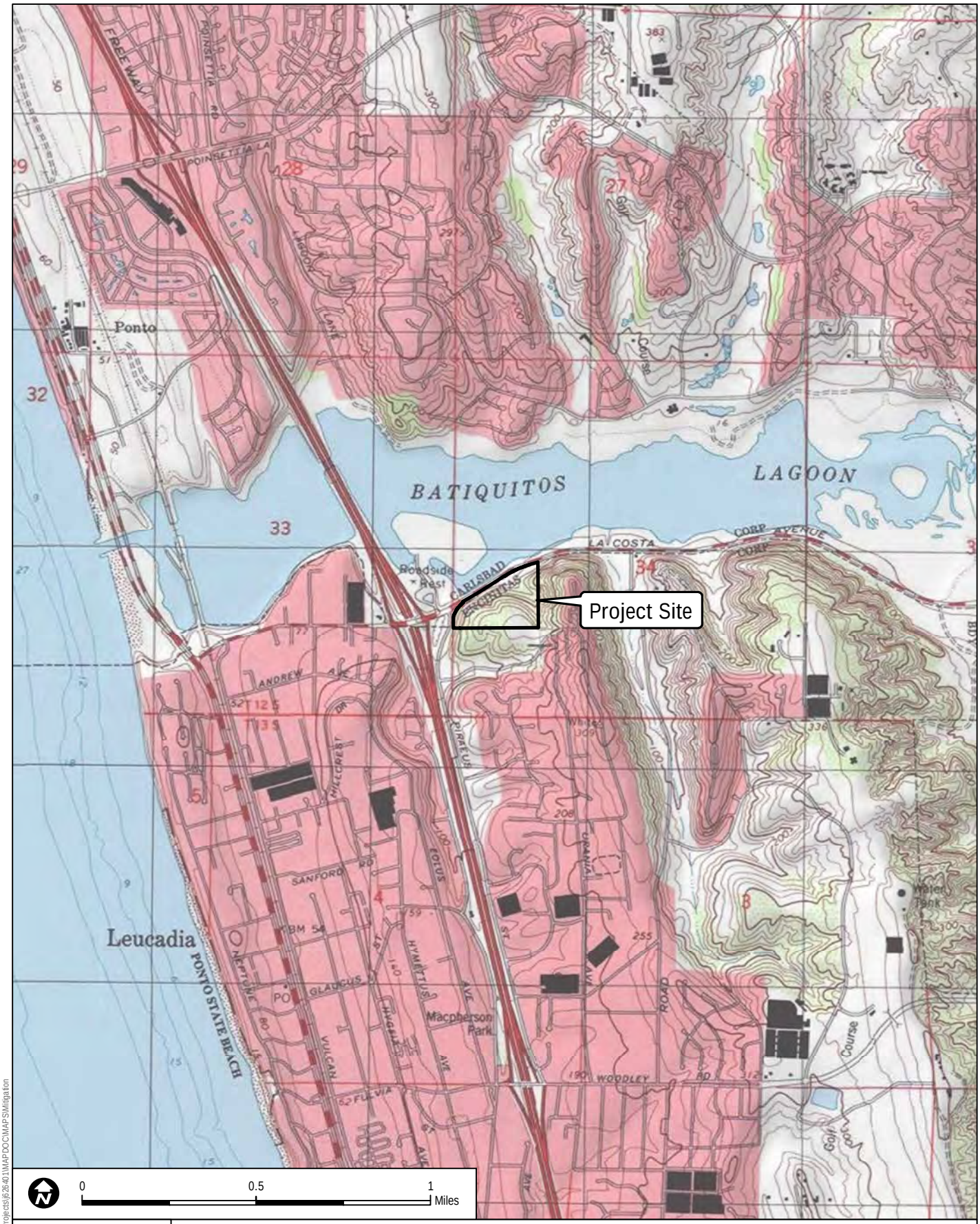
Anticipated potential management issues related to this parcel include site access control, weed control, trash accumulation control.

ADDITIONAL STUDIES

Rehabilitation of disturbed CSS areas may occur as a portion of the proposed mitigation program for the La Costa Parcel. Additional field surveys of the La Costa Parcel will need to occur to determine appropriate plant palettes to be used in the rehabilitation efforts onsite.

REQUIRED PERMITS

No permits are anticipated to be required to implement site protection and management actions.



DUDEK

SOURCE: USGS Topo 7.5 Minute Series - Encinitas Quadrangle

FIGURE 1

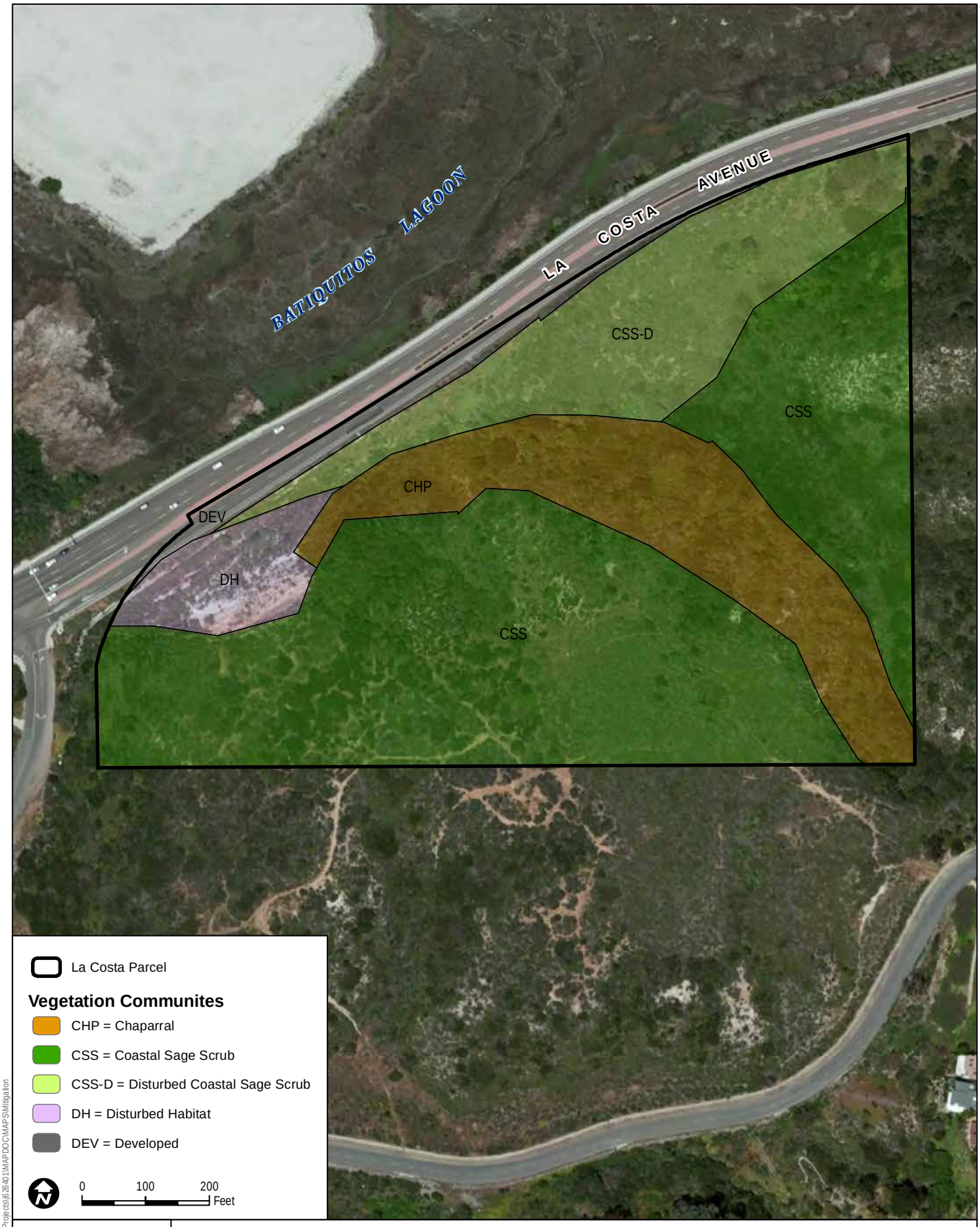
Project Vicinity

6264-06

NOVEMBER 2011

La Costa Preservation Parcel

\\HQTR-DATA1\Gisdata_Old\Projects\6264\011\MAPDOC\MAPS\Mitigation



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DUDEK

6264-06

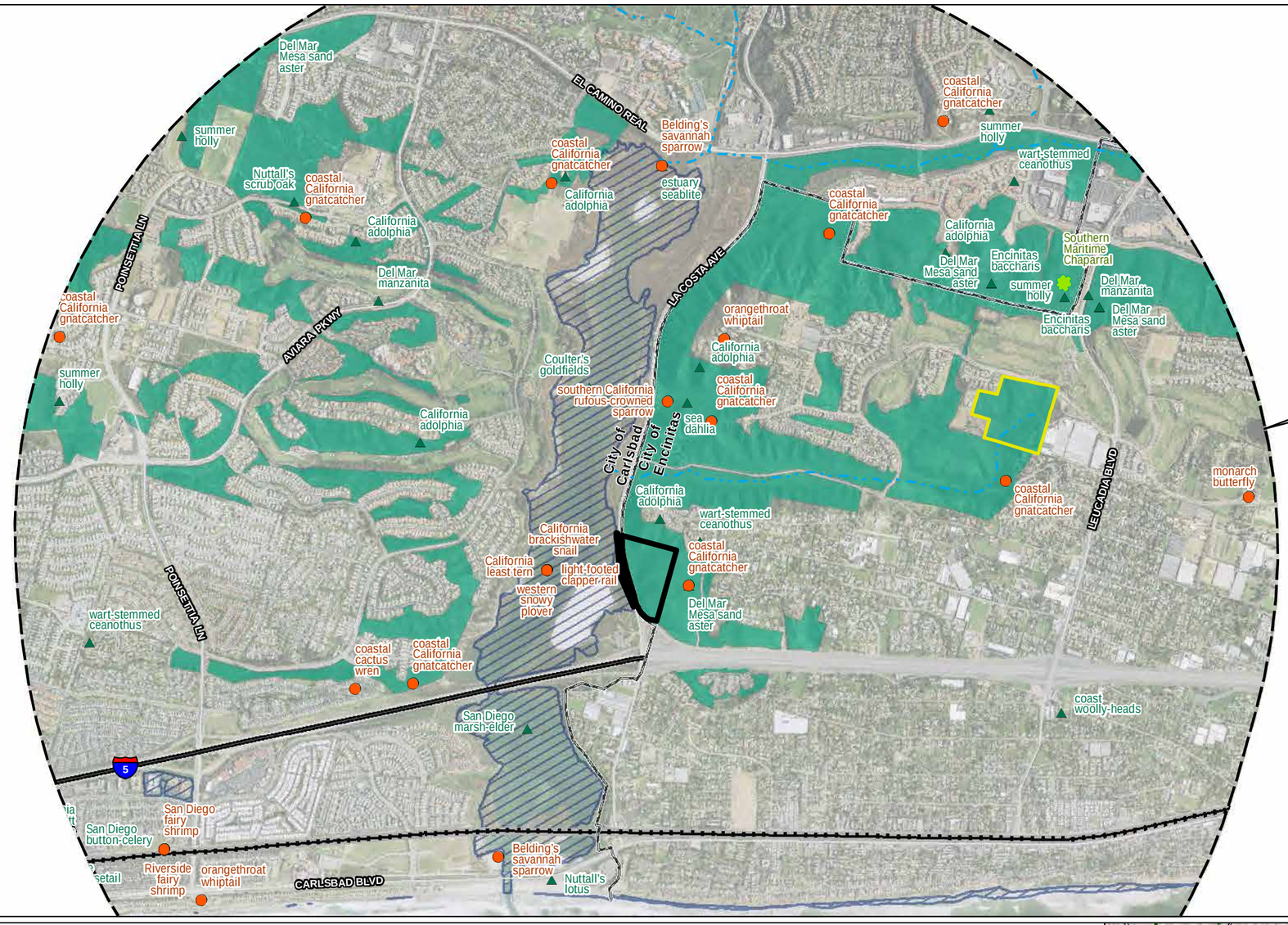
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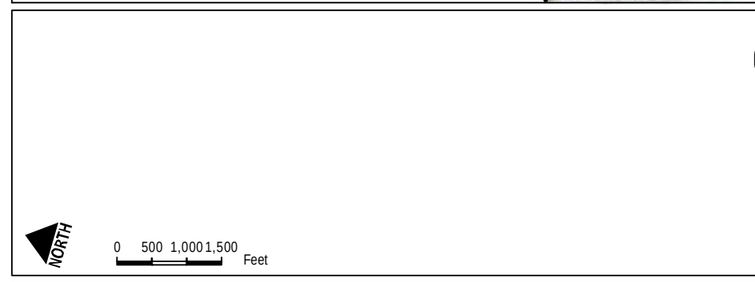
VEGETATION SOURCE: Caltrans 2011
AERIAL SOURCE: DigitalGlobe 2008

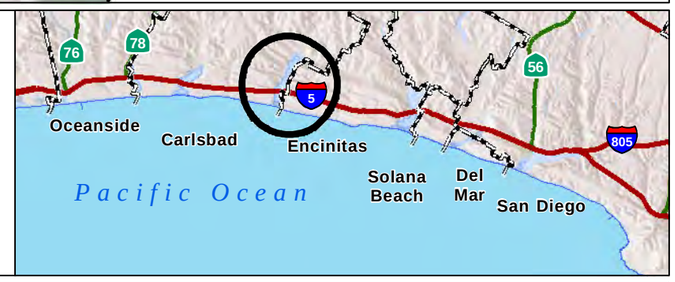
FIGURE 2

Existing Vegetation

La Costa Preservation Parcel







DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

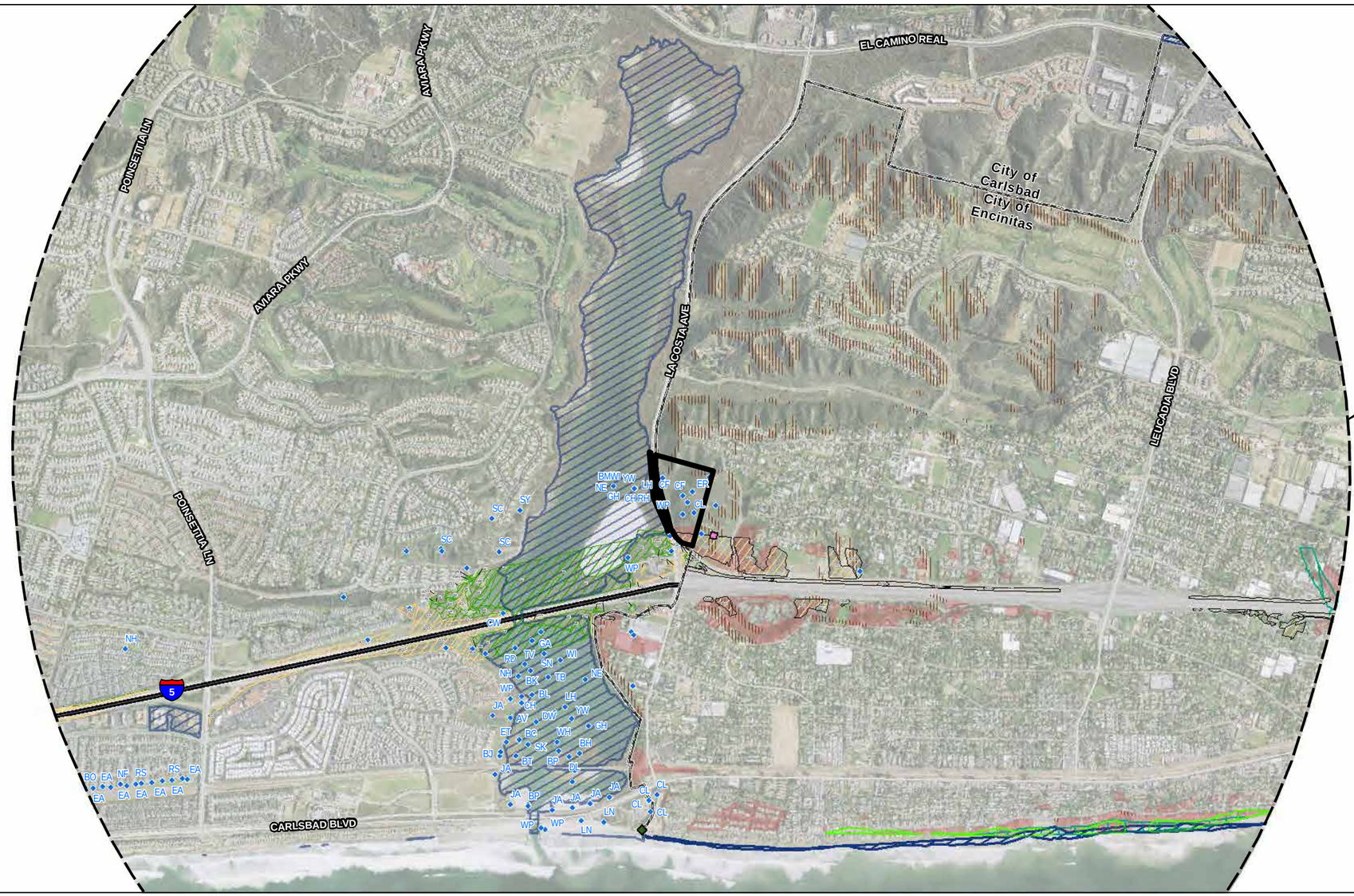
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FIGURE 3

La Costa Parcels CNDDB Resources within 2 miles

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Legend

- I-5 NCC Project Area
- I-5 NCC Project Overlay
- City Boundary

Encinitas LCP Designated ESHA

- Natural Sensitivity
- Hillside and Inland Bluff Overlay Zone
- Wetland Study Overlay Zone
- Slopes 25% or Greater
- Coastal Commission Permit Jurisdiction

Special Status Vegetation

Caltrans CNDDB

- Upland Vegetation
  - CBS = Coastal Bluff Scrub
  - CSS = Coastal Sage Scrub
  - dCSS = Coastal Sage Scrub (Disturbed)
  - NNG = Non-native Grassland
  - SMC = Southern Maritime Chaparral
  - dSMC = Southern Maritime Chaparral (Disturbed)

Special Status Vegetation

Caltrans

- Wetland Vegetation
  - CBM = Coastal Brackish Marsh
  - dCBM = Coastal Brackish Marsh (Disturbed)
  - DD = Drainage Ditch (Concrete)
  - FWM = Freshwater Marsh
  - dFWM = Freshwater Marsh (Disturbed)
  - MF = Mud Flat
  - MFS = Mule Fat Scrub
  - OW = Open Water
  - SMT = Salt Marsh Transition

Special Status Vegetation

Caltrans

- Wetland Vegetation
  - SAWW = Southern Arroyo Willow Woodland
  - dSAWW = Southern Arroyo Willow Woodland (Disturbed)
  - SM = Southern Coastal Salt Marsh
  - dSM = Southern Coastal Salt Marsh (Disturbed)
  - SWS = Southern Willow Scrub
  - dSWS = Southern Willow Scrub (Disturbed)

Special Status Plants

Caltrans

- Plants
  - AC = Adolphia californica
  - CB = Coast barrel cactus
  - DM = Del Mar manzanita
  - NSO = Nuttall's scrub oak
  - OP = Orcutt's pincushion
  - SA = Del Mar sand aster
  - SCS = South coast saltscale
  - SD = Sea dahlia
  - TP = Torrey pine
  - WC = wart-stemmed ceanothus

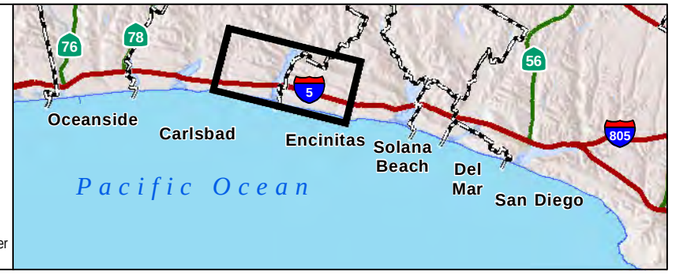
Special Status Plants

Caltrans | Other Sources (CNDDB, SanGIS)

- California adolphia
- Coast barrel cactus
- Del Mar Manzanita
- Del Mar sand aster
- Nuttall's scrub oak
- Orcutt's pincushion
- Sea dahlia
- South coast saltscale
- Torrey pine
- Wart-Stemmed ceanothus
- Other
- CL = Del Mar Mesa sand aster
- CN = San Diego sand aster

NORTH

0 300600 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jursidictions, SanGIS, SANDAG, CDFG, Imagery: DigitalGlobe March 2008

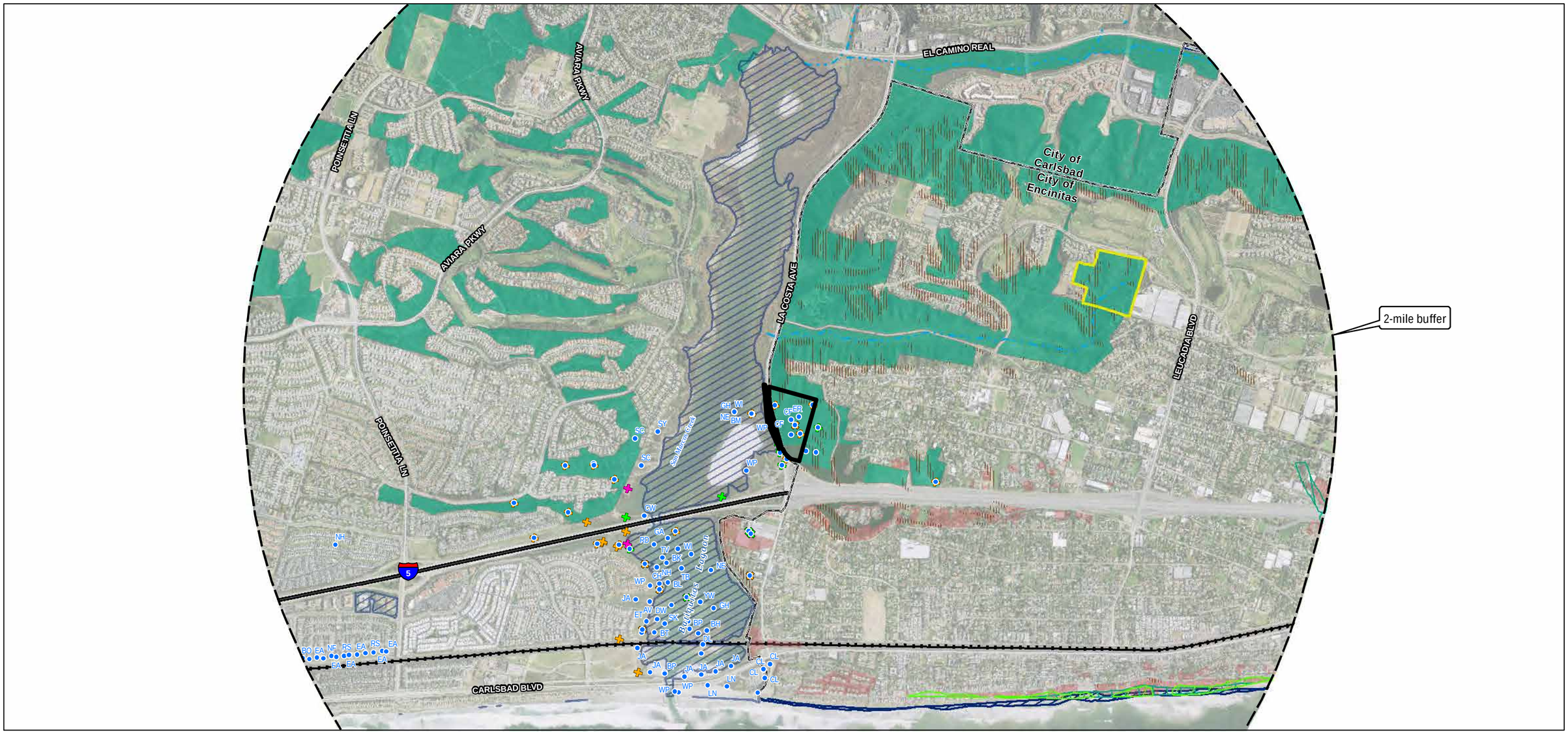
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FIGURE 4

La Costa Parcels Special Status Plant Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Stream/River

Coastal Commission Permit Jurisdiction

City of Encinitas LCP Data within 1,000ft of Project Area
Natural Sensitivity
Hillside and Inland Bluff Overlay Zone
Wetland Study Overlay Zone
Slopes 25% or Greater
North County MSCP Boundary

NORTH
0 500 1,000 1,500 Feet

US Fish and Wildlife Service
California Gnatcatcher Critical Habitat

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Belding's savannah sparrow
✚	✖	California gnatcatcher
✚		California least tern
	✖	Least Bell's vireo
✚		Least bittern

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Light-footed clapper rail
▲		NW San Diego pocket mouse
	▼	Orange-throated whiptail
	▼	Rufous-crowned sparrow

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

BE = Bald eagle
BH = Great blue heron
BL = Bank swallow
BP = California brown pelican
BW = Burrowing owl
CH = Cooper's hawk
DL = Double-crested cormorant
DW = Downy woodpecker
FA = Prarie falcon
FH = Ferruginous hawk

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

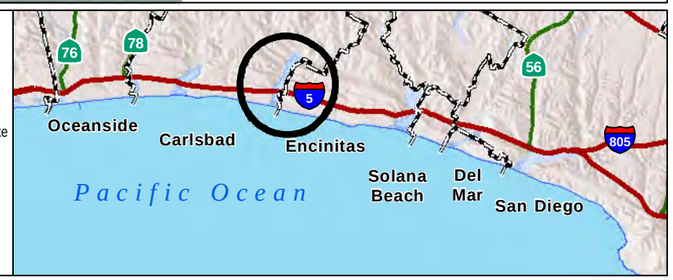
GE = Golden eagle
GH = Green Heron
LA = California horned lark
LH = Loggerhead shrike
LO = Long-eared owl
MB = Monarch butterfly
NE = Black-crowned night heron
NH = Northern harrier
PF = Peregrine falcon
PU = Purple martin

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

RE = Reddish egret
SW = Short-eared owl
TG = Two-striped garter snake
VF = Vermilion flycatcher
WB = Western bluebird
WH = White pelican
WS = Wood stork
YC = Yellow-breasted chat
YW = Yellow warbler



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 5

La Costa Parcel Special Status Wildlife Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Vegetation Communites

- I-5 NCC Project Overlay
- CHP = Chaparral
- CSS = Coastal Sage Scrub
- CSS-D = Disturbed Coastal Sage Scrub
- DH = Disturbed Habitat
- DEV = Developed

NORTH

0 100 200 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 6

La Costa Parcels Constraints Map

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Laser Preservation Parcels

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

AUGUST 2012

Printed on 30% post-consumer recycled material.

Site Location: The Laser Preservation Parcels (Laser parcels) are located west of Interstate 5 (I-5) and north and east of Manchester Avenue (see Figure 1). The parcels are situated across Manchester Avenue from San Elijo Lagoon.

Latitude/Longitude: 33.0878/-117.2896

APNs: 260-200-21-00 (1.88 acres) and 260-200-03-00 (3.1 acres)

Ownership: Caltrans has purchased these parcels

Correspondence with Resource Agencies: Resource agencies were made aware of the site purchase during NEPA 404 coordination meetings held in 2011 and 2012, and letters received on March 17, 2011 from USFWS and CDFG regarding consideration of the Laser parcels for mitigation.

Mitigation Goal

The San Diego Association of Governments (SANDAG) and California Department of Transportation (Caltrans) propose to mitigate impacts to sensitive upland habitats associated with the multi modal transportation projects permitted under the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by rehabilitating, preserving, and managing existing uplands habitat on the Laser parcels located immediately north of San Elijo Lagoon. The goal of the mitigation program on the Laser Parcel is to remove development potential of the parcels, preserve existing upland habitat through site protection (easements and fence), improve habitat value through the removal of non-native species in areas adjacent to the lagoon, and ensure management in perpetuity.

The proposed preservation and management of the native uplands vegetation communities will preserve:

- Occupied California gnatcatcher habitat (two territories);
- Coastal sage scrub and coastal bluff scrub habitat and ecosystem continuity through connectivity between coastal wetlands and native uplands;
- Sensitive plants onsite;
- Increased native upland buffer between I-5 and San Elijo Lagoon and surrounding native open space that connects to Encinitas Creek and other drainages into the lagoon and out to the Pacific coastline; and

- Natural topography adjacent to San Elijo Lagoon that is highly visible from the I-5 corridor and significantly contributes to scenic quality and landscape character.

The proposed rehabilitation of the ornamental adjacent to Manchester Avenue and the disturbed CSS communities throughout the Parcel will involve:

- The removal of nonnative species from areas mapped as ornamental adjacent to Manchester Avenue and areas mapped as disturbed coastal sage scrub (CSS).

- Replanting and/or hydroseeding ornamental planting and disturbed CSS areas with appropriate native species.

EXISTING CONDITIONS

Ecological Context

The Laser parcels were determined to support a range of habitat values (low to high) immediately adjacent to the Multiple Habitat Conservation Plan (MHCP) area for coastal northern San Diego County. The site is located within a Biological Core Linkage area. The parcels are located adjacent to the Coastal Zone and within critical habitat for California gnatcatcher (see Figure 2). California Natural Diversity Database (CNDDB) mapped resources for these adjacent uplands to San Elijo Lagoon includes nearby data points for northwestern San Diego pocket mouse (*Perognathus fallax fallax*), Palmer's grapplinghook (*Harpagonella palmeri*), and sand-loving wallflower (*Erysimum ammophilum*) (see Figure 3). Special status plant species observed onsite include California adolphia (*Adolphia californica*), sea dahlia (*Coreopsis maritima*), and Del Mar sand aster (*Lessingia filaginifolia var. linifolia*), while San Diego barrel cactus (*Ferocactus viridescens)* was observed nearby (see Figure 4). Numerous special status wildlife species are also identified within and adjacent San Elijo Lagoon (see Figure 5). Adjacent upland areas, including the subject parcels, are utilized by California gnatcatcher.

Soils

The acquired parcels consist of steep west-facing slopes. The soil on these parcels consists of terrace escarpment soils (NRCS, Web Soil Survey). The soil texture appears to be a sandy loam that is moderately erodible. There are areas where sandstone parent material is exposed.

Two areas of minor erosion that total 0.06 acre are present on the northern portion of the site. These erosion features are remnant off road vehicle and bike trails that predate the adjacent

residential development on the west. The residential development truncated these trails. Presently, there appears to be limited access to these trails by local residents. Although some native recruitment is present, the bare ground area does not appear to provide sufficient soil resources for natural recruitment to passively reclaim these areas. The severity of erosion features observed within these areas is low due to soil substrate texture.

Vegetation

Diegan coastal sage scrub, coastal bluff scrub, nonnative grassland, disturbed habitat, bare ground, and ornamental communities were identified on the two parcels. In addition, a small area of disturbed salt marsh and developed habitats were observed adjacent to Manchester Avenue. A general description of each community and a description of its occurrence within the parcels are provided below.

Diegan Coastal Sage Scrub. This vegetation type was once widespread in coastal southern California, and now it occurs in patches from Los Angeles into Baja California. Thisvegetation community is composed of a variety of low, soft aromatic shrubs dominated by drought-deciduous species such as California sagebrush (*Artemisia californica*), flat-topped buckwheat (*Eriogonum fasciculatum var. fasciculatum*), white sage (*Salvia apiana*), and black sage (*Salvia mellifera*). Coastal sage scrub onsite is dominated by California sagebrush and buckwheat with prickly pear (*Opuntia littoralis*), laurel sumac (*Malosma laurina*), lemonadeberry (*Rhus integrifolia*), black sage, and California sunflower (*Encelia californica*) (see Figure 2). The following sensitive plants occur in this community onsite, California adolphia (*Adolphia californica*), San Diego barrel cactus (*Ferocactus viridescens),* south coast saltscale (*Atriplex pacifica*), and Del Mar sand aster (*Lessingia filaginifolia var. linifolia*). There is approximately 2.6 acres of coastal sage scrub onsite (see Table 1).

Disturbed Coastal Sage Scrub. The upper portions of the parcels closer to I-5 and the utility access roads are dominated by disturbed coastal sage scrub. There is 1.32 acres of disturbed coastal sage scrub onsite (see Table 1).

Disturbed coastal sage scrub is dominated by the same native species with nonnative grass, mustard (*Brassica sp.*), fennel (*Foeniculum vulgare*), tobacco tree (*Nicotiana glauca*), and other nonnative species annuals.

In particular, non-native veldtgrass (*Ehrharta sp.*) appears to be spreading within the disturbed coastal sage scrub areas and on adjacent parcels. Veldtgrass is a perennial grass found along California's coastline. Veldtgrass is commonly found in disturbed areas, including riparian areas,

scrub, grassland, woodland, urban areas and turf. Veldtgrass causes more litter accumulation than native grasses and herbs do, which further inhibits native plant growth (CALIPC website; http://www.cal-ipc.org/ip/management/plant_profiles/Ehrharta_erecta.php).

Coastal Bluff Scrub. Coastal bluff scrub is a plant community made up primarily of low, prostrate plants that are wind pruned by sea breezes. Dominant plants in this community are primarily woody and/or succulent (Holland 1986). Species commonly found in this community include sea dahlia (*Coreopsis maritima*), live forevers (*Dudleya spp.*), lemonadeberry, and prickly pear. Coastal bluff scrub was identified in the southern portion of the smaller parcel. There is approximately 0.5 acres of coastal bluff scrub on the parcels. Sea dahlia and Orcutt's pincushion (*Chaenactis glabriuscula var. orcutiana*) are sensitive plant species that were found in this community onsite.

Non-native Grassland. Non-native grassland is generally dominated by annual non-native species of grass including wild oat (*Avena sp.*), ripgut grass, foxtail chess, and others. Non-native grassland occurs in two small patches onsite totaling 0.16 acres (see Table 1).

Other Communities. The remainders of the parcels are composed primarily of bare ground and ornamental landscaping. Bare ground areas are found on trails and near the edges of the roads. These areas have less than 10 percent cover and most of what does grow on these compacted soils are weedy species. The disturbed habitat is dominated by black mustard (*Brassica nigra*), ice plant (*Carpobrotus edulis*), tobacco tree, and yellow sweet clover (*Melilotus indica*). Ornamental landscaping is found near Manchester Avenue and is dominated by ice plant. There is also a small sliver of developed habitat on the shoulder of Manchester Avenue and a small remnant patch of disturbed salt marsh.

Table 1 includes the type and acreage of habitat to be preserved on the Laser parcels.

Table 1
Preservation Acreage by Habitat Type

Habitat Type	Mitigation Acreage
Coastal Sage Scrub	2.6 ac.
Disturbed (Coastal Sage Scrub Enhancement)	1.32 ac.
Coastal Bluff Scrub	0.5 ac.
Non-native Grassland	0.16 ac.

Habitat Type	Mitigation Acreage
Bare Ground	0.11 ac.
Developed	0.06 ac.
Disturbed Salt Marsh	0.02 ac.
Ornamental	0.21 ac.
Total	4.98 ac.

Wildlife

Two territories of threatened coastal California gnatcatcher (*Poliptila californica californica*) were observed, one on each parcel (see Figure 2). Other bird species that were observed onsite include California towhee (*Pipilo crissalis*), song sparrow (*Melospiza melodia*), Anna's hummingbird (*Calypte anna*), bushtit (*Psaltriparus minimus*), wrentit (*Chamaeafasciata*) and red-tailed hawk (*Buteo jamaicensis*). Other wildlife species detected onsite include coyote (*Canis latrans*), western fence lizard (*Sceloporus occidentalis*), desert cottontail (*Sylvilagus audubonii*), and California ground squirrel (*Spermophilus beecheyi*).

Prior and Current Land Use

Access to the Laser parcels is limited. Access to an existing pump station adjacent to I-5 may currently be used to access these parcels.

Some informal hiking trails are present on the parcel. These trails appear to be used to access high points that provide vistas of San Elijo Lagoon and the Pacific Ocean. Due to the lack of parking, these trails are likely used only by local residents and occasionally by motorists who make use of the nearby scenic viewpoint parking area associated with I-5. However, the viewpoint is fenced to discourage trespassing on this property.

Constraints/Existing Utilities/Infrastructure/Easements

There are access roads for the San Dieguito Water District pump station and reclamation plant crossing the northernmost portion of the site. In addition, due to proximity of residential land uses to the north and south of the Laser parcels, it is possible that a portion of the 100-foot fuel modification zone could extend into a small corner of the total site area available for habitat preservation and management, although it is currently high quality coastal sage scrub habitat (see Figure 6). If the 100-foot fuel modification zone does extend into a small corner of the total site area, these zone areas are not included in the restoration totals of the site. Treatment of the 100-

foot fuel modification zone will be consistent with fire protection standards for plant density, vegetation height, and reduced cover using appropriate fire resistant plantings.

A small area of the Laser Preservation Parcel could possibly be impacted by the eventual widening of Interstate 5. Any portion of the property affected by future widening of Interstate 5 is not included in the restoration totals of the site.

MITIGATION PROGRAM

The proposed mitigation for the entirety of the site will be for protected open space, habitat preservation and management. The goal of the preservation acquisition is to remove development potential of the parcels, preserve existing upland habitat through site protection (easements and fence), and ensure management in perpetuity.

Rehabilitation

Native species will be rehabilitated in areas that are currently mapped as ornamental and as disturbed CSS, but are not deed restricted or located within fire buffer areas, through the removal of the nonnative species and the replanting with appropriate native species. Adjacent native areas will be preserved, as outlined herein.

Removal of the ornamental plant species along Manchester Avenue and the replacement with native species will enhance the functions and services of the preserved upland and wetland buffer by preventing future encroachment of the ornamental species into the San Elijo Lagoon.

Target Plant Communities

The design and plant palette used to rehabilitate the ornamental and disturbed CSS areas will include native species found in adjacent native areas. To provide appropriate native species diversity that is comparable to adjacent high quality habitat, additional field surveys of the Laser Parcel, detailing native annual and perennial species will need to occur and the recorded species added to the plant palette in the NOID submittal, as appropriate.

SITE PROTECTION

Caltrans will deed the preservation parcels to an approved local land management agency that is acceptable to the resource agencies. A management endowment account will be established once the property acquisition is complete. The endowment funds will be used by the management entity to monitor and maintain site access restrictions and habitat quality.

Site restrictions might be required to fully protect existing biological resources from local residential land use and motorists at the viewpoint parking area. The viewpoint will be fenced and the fence would be maintained by Caltrans. Any additional fence installed will be maintained as part of the land management.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the functions and services of the preserved biological resources. A resource agency-approved management entity will assume long term management responsibilities. Funds for long term management will be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Endowment funds will be established using a Property Assessment Report that is based on the approved HMP.

Anticipated potential management issues related to this parcel include site access control, weed control, and trash accumulation control.

ADDITIONAL STUDIES

If some portion of the Laser Property may be affected by the future widening of Interstate 5, mitigation acreages available on the property would be adjusted to remove impact areas. This acreage change will be clearly documented in the text and figures of the Conceptual Mitigation Plan for the Laser Parcel.

Enhancement of ornamental planting and disturbed CSS areas may occur as a portion of the proposed mitigation program for the Laser Parcel. Additional field surveys of the Laser Parcel will need to occur to determine appropriate plant palettes to be used in the enhancement efforts onsite.

REQUIRED PERMITS

No permits are anticipated to be required to implement proposed site protection and long-term management actions.

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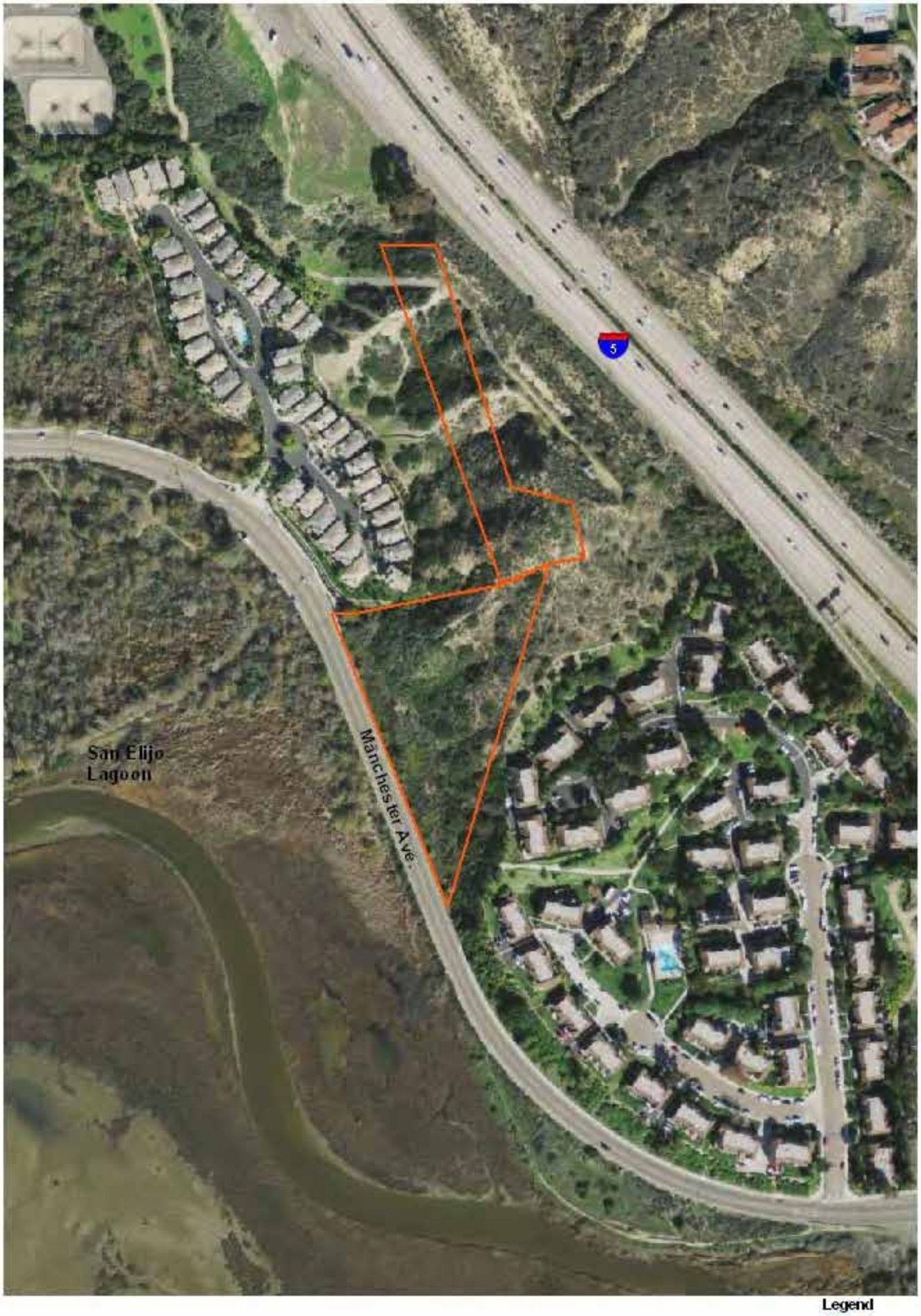
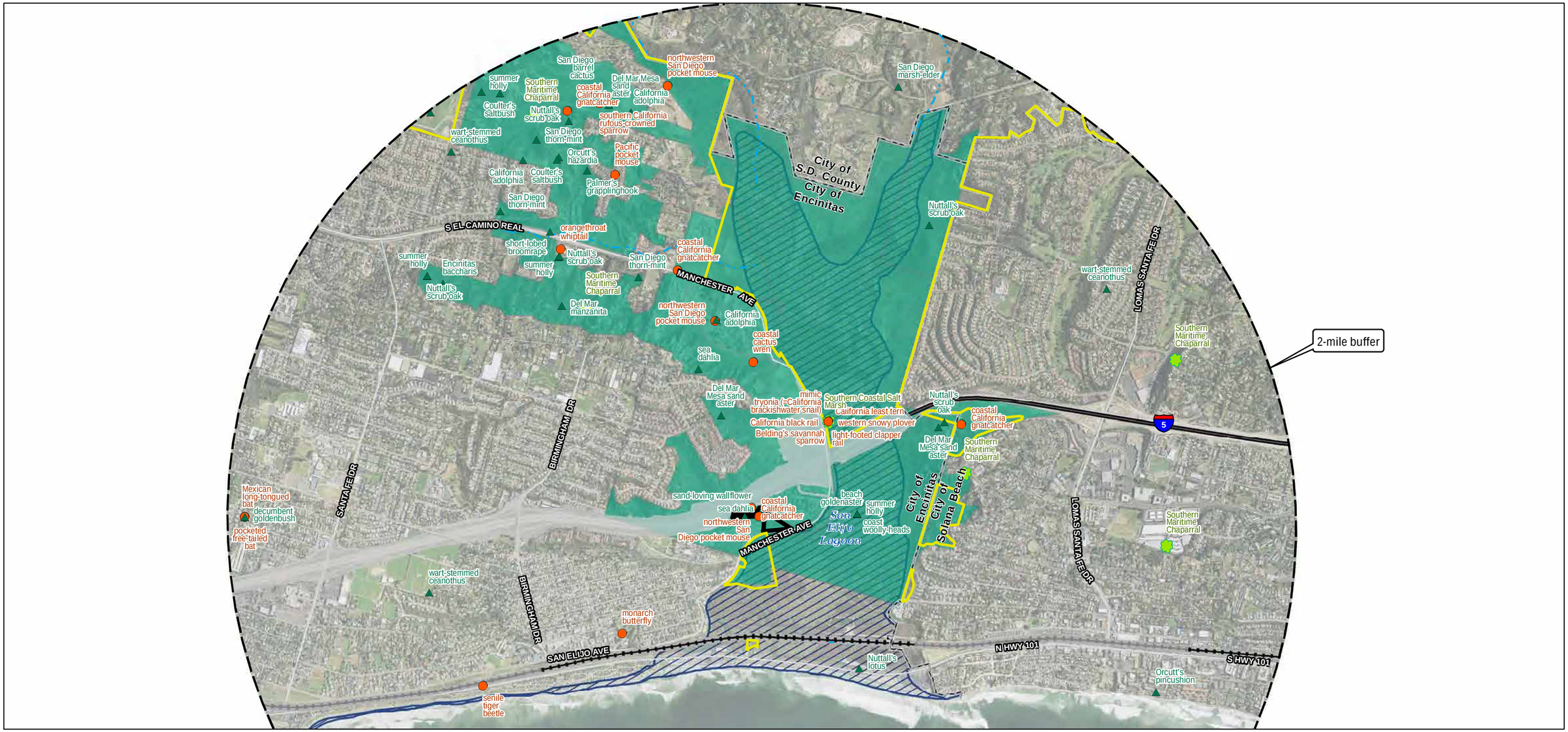


Figure 1. Location of Laser Parcels



Figure 2. Vegetation Communities and California gnatcatcher locations on Laser Parcels



Laser Parcel
I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary

North County MSCP Boundary
Coastal Commission Permit Jurisdiction

US Fish and Wildlife Service
California Gnatcatcher Critical Habitat
CNDDB Resources
Plant
Animal
Terrestrial Comm
Aquatic Comm

NORTH
0 500 1,000 1,500 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

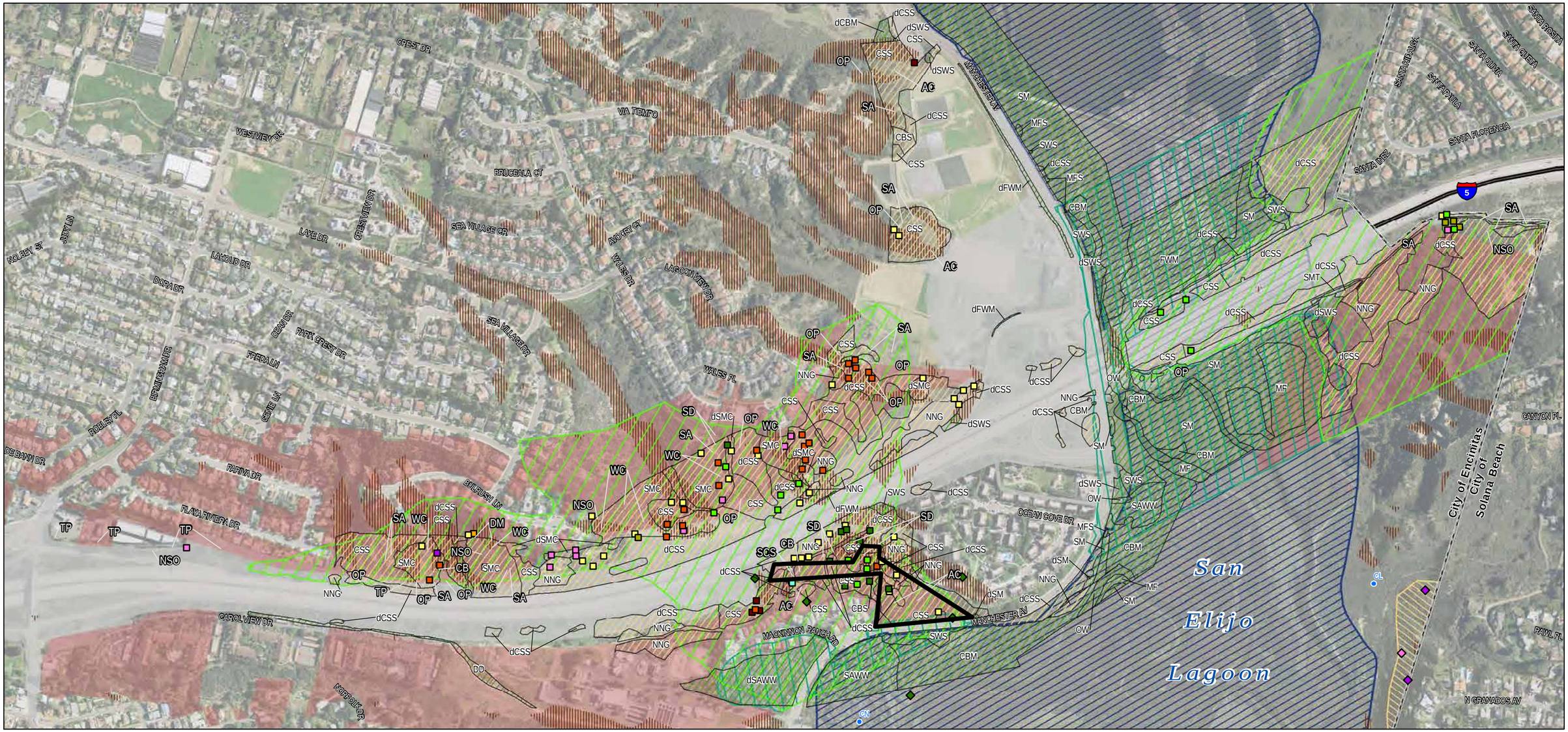
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FIGURE 3

Laser Parcel CNDDB Resources within 2 miles

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, Imagery: DigitalGlobe March 2008

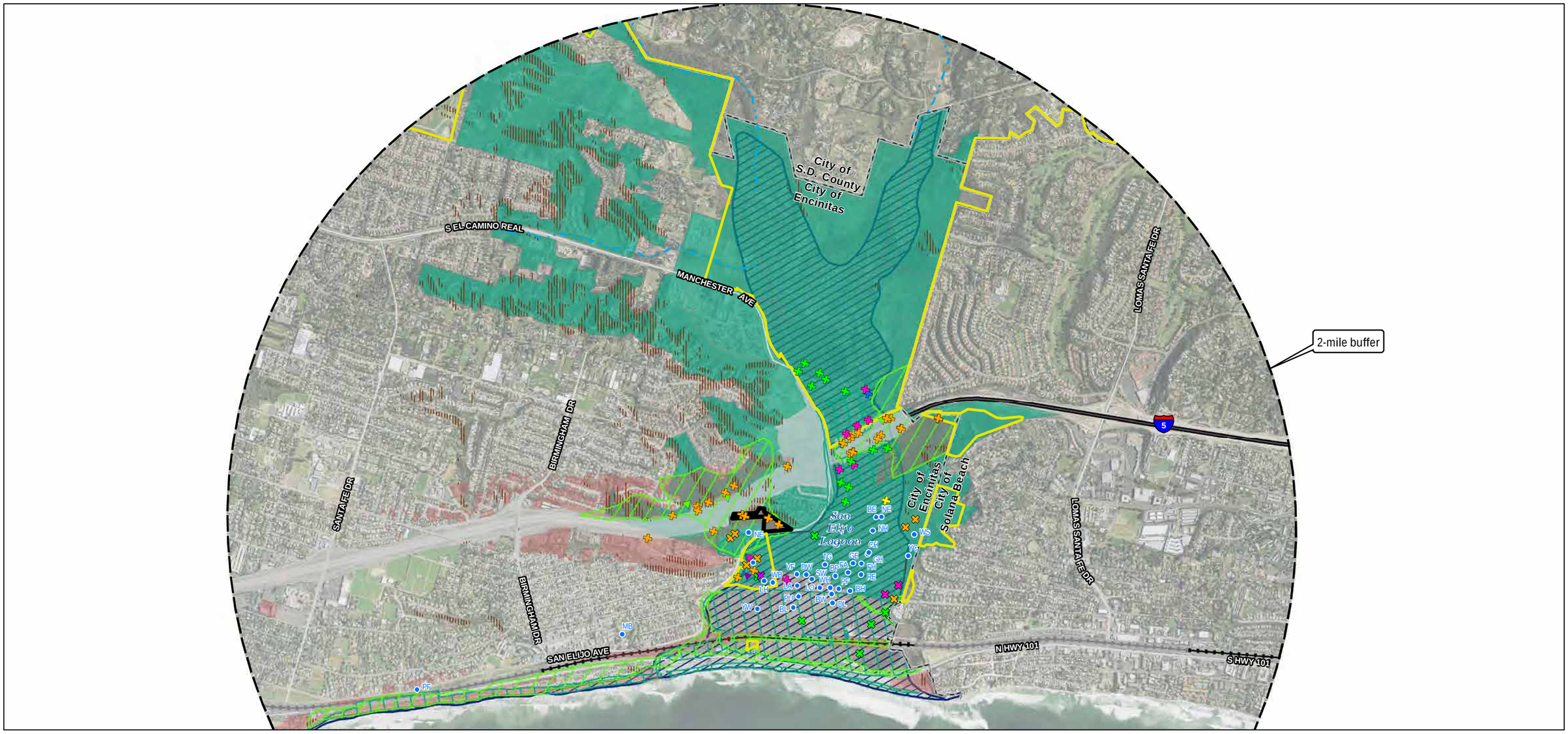
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FIGURE 4

Laser Parcel Special Status Plant Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



I-5 NCC Project Area
I-5 NCC Project Overlay
LOSSAN Proposed Track
LOSSAN Existing Track
City Boundary
Stream/River

NORTH

0 500 1,000 1,500 Feet

Coastal Commission Permit Jurisdiction

City of Encinitas LCP Data within 1,000ft of Project Area

Natural Sensitivity
Hillside and Inland Bluff Overlay Zone
Wetland Study Overlay Zone
Slopes 25% or Greater
North County MSCP Boundary

US Fish and Wildlife Service

California Gnatcatcher Critical Habitat

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Belding's savannah sparrow
✚	✖	California gnatcatcher
✚		California least tern
	✖	Least Bell's vireo
✚		Least bittern

Special Status Wildlife

Caltrans	Other Sources (CNDDB, SanGIS)	
✚	✖	Light-footed clapper rail
▲		NW San Diego pocket mouse
	▼	Orange-throated whiptail
	▼	Rufous-crowned sparrow

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

BE = Bald eagle
BH = Great blue heron
BL = Bank swallow
BP = California brown pelican
BW = Burrowing owl
CH = Cooper's hawk
DL = Double-crested cormorant
DW = Downy woodpecker
FA = Prarie falcon
FH = Ferruginous hawk

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

GE = Golden eagle
GH = Green Heron
LA = California horned lark
LH = Loggerhead shrike
LO = Long-eared owl
MB = Monarch butterfly
NE = Black-crowned night heron
NH = Northern harrier
PF = Peregrine falcon
PU = Purple martin

Special Status Wildlife

Other Sources (CNDDB, SanGIS)

● Other Species

RE = Reddish egret
SW = Short-eared owl
TG = Two-striped garter snake
VF = Vermilion flycatcher
WB = Western bluebird
WH = White pelican
WS = Wood stork
YC = Yellow-breasted chat
YW = Yellow warbler



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 5

Laser Parcel Special Status Wildlife Resources

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan



Laser Parcel
100-foot Fire Buffer Radius
I-5 NCC Project Overlay
Coastal Commission Permit Jurisdiction

NORTH

0 50 100 Feet



DATA SOURCES: Caltrans, California Coastal Commission, Local Jurisdictions, SanGIS, SANDAG, CDFG, USFWS, Imagery: DigitalGlobe March 2008

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FIGURE 6

Laser Parcel Constraints Map

North Coast Corridor Transportation and Resource Enhancement Program and Highway Public Works Plan

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North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the San Elijo Lagoon

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

OCTOBER 2012

Printed on 30% post-consumer recycled material.

Site Location: San Elijo Lagoon is located in the City of Encinitas just north of Solana Beach. The lagoon is part of the larger San Elijo Lagoon Ecological Reserve that includes approximately 1,000 acres of wetland and upl and habitat.

Latitude/Longitude: 33.007931/-117.272033

Ownership: State of California (CDFG), the County of San Diego, and the San Elijo Lagoon Conservancy (SELC). The reserve is mainly operated by the County of San Diego , however CDFG and the San Elijo Nature Conservancy Center are also involved in operations.

Correspondence with Resource Agencies: Stakeholders, including the Army Corps of Engineers (USACE), County of San Diego, SELC, San Diego Association of Governments (SANDAG), California Department of Transportation (Caltrans), and other state resource agencies are currently coordinating efforts to prepare a Draft EIR/EIS for the San Elijo Lagoon Restoration Project.

MITIGATION GOAL

SANDAG and Caltrans propose to mitigate impacts to USACE jurisdictional and State wetlands, as well as sensitive upland habitats associated with the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by funding the restoration of San Elijo Lagoon. The San Elijo Lagoon Restoration Project (SELRP) includes restoring the hydrological regime and the marsh habitat, and converting middle and high marsh habitat to mudflats and low marsh habitat within San Elijo Lagoon. Restoration alternatives under consideration include the following: 1) potential opening of the lagoon mouth and/or relocating the lagoon inlet at Coast Highway, 2) lengthening the I-5 bridge across San Elijo Lagoon to create wetland habitat within the existing bridge footprint and facilitate the restoration of marsh habitat through the improved hydrology, 3) dredging of channels and marsh habitat to create more mudflat and low marsh habitats, and 4) provide endowments for future lagoon maintenance.

The proposed SELRP will provide the following benefits (SELC 2012):

- Enlarge the tidal prism to increase area of tidal expansion within the lagoon.
- Improve water quality through restored tidal circulation, thereby reducing impacts to the public from beach closures due to high bacteria counts and the potential for mosquito-borne disease.
- Ensure no adverse change to current flood protection, specifically to existing infrastructure and adjacent development.

- Provide a natural gradient of habitats that considers climate change, anticipated sea level rise, heterogeneity of habitats, and tidal channels of various orders.

- Enhance habitats for native species, including rare and endangered species.

The provision of endowment funds for future lagoon maintenance will provide the following management benefits:

- A cost-effective management and maintenance plan for supporting the proposed habitat enhancements, curtailing growth and expansion of exotic species, and maintaining regular tidal flow.

- Design and implement a biological and hydrological monitoring program to assess the success of restoration efforts and facilitate adaptive management decisions.

- Maintain lagoon public access and educational opportunities consistent with resource protection needs and requirements.

San Elijo Lagoon

The San Elijo Lagoon consists of approximately 491 acres. The lagoon watershed encompasses all drainages that convey water into San Elijo Lagoon including Escondido Creek, San Elijo Creek, and their tributaries.

EXISTING CONDITIONS

San Elijo Lagoon Ecological Reserve is transitioning from open water and mudflat habitats to salt marsh and riparian habitat as a result of urban pressures. Transportation infrastructure contributes to restricted tidal flushing and degraded water quality in the reserve. As population expands in Southern California, the ecology of the wetland will continue to be impacted by both historical and future development. The future restoration project would thus restore the lagoon, a biodiversity hot spot and one of the few remaining wetland systems in Southern California to a more natural state.

Ecological Context

Habitats present in or within the vicinity of San Elijo Lagoon primarily include open water (estuarine and fresh), sand/mudflats, coastal salt marsh, fresh/brackish marsh, riparian, and Diegan coastal sage scrub upland. San Elijo Lagoon and its upland habitats support a number of special-status wildlife species including California least tern (*Sterna antillarum browni*), Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), California gnatcatcher

(*Polioptila californica californica*), and light-footed clapper rail (*Rallus longirostris levipes*). The lagoon is part of the SELC and its maintenance is coordinated by the SELC.

Drainage and Hydrology

San Elijo Lagoon is associated with the Carlsbad Hydrologic Unit (HU). The Carlsbad HU is comprised of 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 freeway and rail bisect four lagoons in this HU: San Elijo Lagoon, Batiquitos Lagoon, Agua Hedionda Lagoon, and Buena Vista Lagoon. All four of the lagoon crossings, including Loma Alta Creek, are on bridge structures. Development within the Carlsbad HU is projected to increase from 56% to 70% by the year 2015.

Beneficial uses within San Elijo Lagoon include contact recreation such as hiking, non-contact recreation such as wildlife viewing and nature tours, biological habitats of special significance, estuarine habitat, wildlife habitat, marine habitat, rare/threatened/endangered species habitat, migration corridors, and spawning/reproduction and/or early development habitat.

Soils

Upland and bank soils within the proposed mitigation areas are associated with marine terraces. The typical soils in the potential restoration areas include tidal flats; Corralitos loamy sand, 5 to 9 percent; Corralitos loamy sand, 9 to 15 percent; marina loamy coarse sand, 2 to 9 percent slopes; and terrace escarpments (NRCS 2012, soil survey maps).

Vegetation

The San Elijo Lagoon vegetated areas are composed primarily of sand/mudflats, coastal salt marsh, fresh/brackish marsh, southern riparian scrub, and coastal sage scrub vegetation community types.

Wildlife

San Elijo Lagoon and its upland habitats support special-status wildlife species such as California least tern, Belding's savannah sparrow, California gnatcatcher, and light-footed clapper rail. San Elijo Lagoon also provides important foraging and resting habitat for waterfowl and shorebirds along the Pacific flyway.

MITIGATION PROGRAM

The mitigation program for SELRP aims to provide comprehensive lagoon restoration through a suite of possible restoration alternatives, which may include infrastructure improvements where the facilities cross the Lagoon, hydrological improvements to the Lagoon mouth opening, and, where determined appropriate, through providing endowments for Lagoon planning, restoration, and maintenance in the future. These efforts would not only serve to substantially enhance and restore water quality in the corridor, but they would also serve to restore, enhance, and protect different habitat types within the Lagoon ecosystem.

Schedule

Detailed design of the mitigation program will begin upon selection of a preferred alternative by the resource agencies, and completion of environmental review. Currently, the City of Encinitas, USACE, USFWS, CDFG, County of San Diego, and the SELC are working to complete a Draft EIR/EIS for restoration of the lagoon. SANDAG/Caltrans have participated with the City of Encinitas, USACE, Coastal Commission, and other resource agencies in the feasibility analyses and modeling studies to determine optimal bridge openings at all major transportation crossings across the Lagoon for facilitating the mitigation program.

This REP mitigation opportunity includes funding large-scale lagoon restoration program at San Elijo Lagoon, in addition to funds already contributed to previous and ongoing planning and technical evaluation activities necessary to facilitate and implement this Lagoon restoration program. REP measures that contribute to large-scale Lagoon restoration opportunities (funding, critical transportation infrastructure improvements) shall be considered a substantial mitigation element for all PWP/TREP project impacts (including temporary impacts) given the resulting wide range of benefits to sensitive habitat for plant and wildlife species, water quality, flood control, groundwater recharge and recreation. For purposes of the PWP/TREP, detailed design of the selected alternative will be provided through the subsequent Coastal Development Permit and federal consistency review processes. The results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., USACE, U.S. Fish and Wildlife Service [USFWS], CDFG, Regional Water Quality Control Board [RWQCB], etc.), as well as all supporting documentation would be submitted with the Coastal Development Permit application.

Mitigation Goal and Purpose

The mitigation program will aim to preserve, protect and enhance the San Elijo Lagoon Ecological Reserve and, in turn, its watershed. The mitigation program would result in the restoration and enhancement of an integrated ecosystem, providing improved habitat for fish,

birds, and benthic organisms that would adequately compensate for the loss of wetland habitat occurring from the PWP/TREP rail and highway improvements. This large regional restoration project could ultimately facilitate the restoration of many hectares of wetlands, which would help to ensure the Lagoon's continued health and greatly enhance the coastal lagoon habitat.

To achieve the goals of the mitigation program, the EIR/EIS process, technical studies, and design work are currently being conducted to evaluate alternative actions to restore the habitat functions and services of the Lagoon. These studies and environmental review processes are being been used to evaluate the restoration opportunities available within the San Elijo Lagoon and will be used in the ultimate design of the proposed mitigation program.

Alternatives

Three build alternatives are being studied for the SELRP EIR/EIS, which are described below in greater detail, below.

Alternative 1A

Alternative 1A provides minimal physical changes to the site, with the exception of enlarging the main feeder channel throughout the site and redirecting its course just west of I-5. The main tidal channel is also extended farther into the East Basin and existing constricted channel connections are cleared and enlarged. Existing habitat areas will essentially remain intact. The tidal prism of Alternative 1A will slightly increase compared to existing conditions. A relatively small area of transitional habitat above tidal elevations will be placed in the northwest portion of the Central Basin.

Alternative 1B

Alternative 1B provides a more substantial change to the existing site to create a greater diversity of habitats than currently exists. The existing tidal inlet remains the source of seawater, and the main tidal channel extends throughout the Lagoon. A new subtidal basin off the main channel is created in the Central Basin. The main feeder channel is redirected just west of I-5, and extended farther into the East Basin. The channel in the East Basin is significantly enlarged in cross-sectional area to promote more tidal exchange east of I-5. The tidal prism of Alternative 1B will be significantly increased compared to Alternative 1A. Non-tidal habitat areas will still exist in the East Basin. Several areas of transitional habitat above tidal elevations will be placed in the western portion of the Central Basin.

Alternative 2A

Alternative 2A also provides changes to the existing site to create a greater diversity of habitats than presently exists. Seawater would enter the Lagoon via a new tidal inlet located south of the

existing inlet and a new subtidal basin would be created just landward of the new inlet in the West and Central Basins. A new railroad bridge would be built adjacent to the new inlet to provide a more direct connection to the rest of the lagoon. The main tidal channel would extend throughout the Lagoon and be redirected just west of I-5, and extend into the East Basin. The channel in the East Basin is identical to that for Alternative 1B. The tidal prism of Alternative 2A will increase compared to Alternative 1B. Non-tidal habitat areas remain in the East Basin. Transitional habitat areas above tidal elevations will also be included in the Central Basin.

Hydrology

San Elijo Lagoon sustains significant opportunity for hydrodynamic restoration. Restoring the hydrodynamics of the Lagoon, a vital coastal resource in the region, would provide a mechanism for conveyance and dissipation of floodwater, allow for deposition of flood-suspended sediments, assist with shoreline stabilization, and facilitate the recharge of groundwater and storage of surface waters. Improvements to the hydrology of San Elijo Lagoon would also serve to improve filtration of suspended sediments and toxic substances, and facilitate nutrient cycling, denitrification, and mineralization.

The San Elijo Lagoon Restoration Project that is currently underway is evaluating infrastructure factors that affect tidal circulation including the lagoon inlet, bridges for South Coast Highway 101, rail and highway facilities, and the existing tidal regime within the lagoon. Based on analysis conducted for the San Elijo Lagoon Restoration Project and the I-5 project, the I-5 bridge will be lengthened, thereby creating wetland habitat within the existing bridge footprint and facilitating the restoration of marsh habitat through improved hydraulic flows. Lengthening the I-5 bridge would ultimately enhance all lagoon functions and decrease tidal muting effects in the eastern basin. Other key findings from the optimization modeling study for all potential alternatives are summarized as follows:

- For alternatives which rely on the existing inlet channel (No Project, Alternative 1A, and Alternative 1B), the existing Hwy 101 Bridge structure and the Railroad Bridge structure have sufficient spans and are not limiting factors for tidal range or flood conveyance. The limiting factor for these alternatives is the long and narrow inlet channel between Hwy 101 and the Railroad Bridge. The main channel through the Central Basin is also narrow, shallow, and sinuous resulting in additional energy losses during normal tidal fluctuations and extreme flood events.

- There is no benefit to tidal flows and storm flow conveyance from increasing the existing I-5 Bridge channel dimension for No Project and Alternative 1A conditions. Regardless of the I-5 Bridge channel dimension, Manchester Avenue will experience flooding in the East Basin during a 100-year event. The existing I-5 Bridge channel dimension actually

helps prevent additional flooding of Manchester Avenue in the Central Basin by attenuating peak flows in the East Basin. This attenuation results in higher flood levels in the East Basin, but little or no flooding in the Central Basin. If the I-5 Bridge channel is widened, flood elevations are lowered in the East Basin, but raised in the Central Basin causing flooding of Manchester Avenue in both basins.

- Bridge optimization modeling of Alternative 1B suggested that increasing the I-5 Bridge channel width to 261 feet would relieve some flooding of Manchester Avenue in the East Basin. Portions of the roadway will still experience flooding, however, an increased bridge channel width would reduce flood levels below a significant length of roadway in the East Basin.

- For Alternative 2A, the optimization modeling study supported the recommended bridge channel dimensions identified in the SELRP Feasibility Studies. A Hwy 101 inlet channel width of 200 feet, a railroad channel width of 590 feet and an I-5 channel width of 261 feet were found to provide optimum tidal range and flood conveyance.

Performance Criteria

The California Rapid Assessment Method (CRAM), a performance criteria metric, has already been completed for the lagoon and will be used as a functional assessment to determine success in achieving the mitigation program goals. All the goals will be developed for the SELRP EIR/EIS and the HMMP (habitat mitigation and monitoring plan) documents. Interim target functional criteria scores will be used to inform maintenance decisions during the long-term monitoring and maintenance period with the intention of achieving the final target functional criteria assessment scores.

SITE PROTECTION

The San Elijo Lagoon is part of the San Elijo Lagoon Ecological Reserve. Areas that will be restored will remain part of the San Elijo Lagoon Ecological Reserve once the mitigation in those areas is in place and complete.

ADDITIONAL STUDIES

Stakeholders, including the SELC, SANDAG, and Caltrans are currently coordinating efforts to prepare a Draft EIR/EIS for the SELRP. Additional studies necessary for the design and implementation of the proposed mitigation project in San Elijo Lagoon will be evaluated once the environmental and preliminary planning processes are complete.

REQUIRED PERMITS

404, 401, 1602, ESA/CESA Permits, and a Coastal Development Permit would likely be required for the proposed mitigation efforts in San Elijo Lagoon.

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DRAFT

North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program
Mitigation Site Assessment for the Buena Vista Lagoon

Prepared by:

DUDEK

Prepared for:

Caltrans

SANDAG

SEPTEMBER 2012

Printed on 30% post-consumer recycled material.

Site Location: Buena Vista Lagoon is located in the cities of Carlsbad and Oceanside.

Latitude/Longitude: 33.173972/ -117.349208

Ownership: California Department of Fish and Game (CDFG), cities of Carlsbad and Oceanside, Buena Vista Lagoon Foundation, North County Transit District (NCTD), the California Department of Transportation (Caltrans), and private developments.

Correspondence with Resource Agencies: Stakeholders, including the Buena Vista Lagoon Foundation, San Diego Association of Governments (SANDAG), and Caltrans, are currently working on the EIR/EIS for the Buena Vista Lagoon restoration.

MITIGATION GOAL

SANDAG and Caltrans propose to mitigate impacts to U.S. Army Corps of Engineers (USACE) jurisdictional and State wetlands, as well as sensitive upland habitats associated with the North Coast Corridor Public Works Plan/Transportation and Resource Enhancement Program (PWP/TREP) by restoring the hydrological regime and the wetland habitat within Buena Vista Lagoon. Restoration alternatives presently under consideration include the following common components: 1) opening the lagoon inlet at the terminus of the watershed and adjacent to the Pacific Ocean, allowing passive restoration to a fresh water1 or a salt water system; 2) modify rail and highway bridge designs over the Buena Vista Lagoon, offsetting wetland fill impacts with the establishment of new wetland areas and improved flushing and stream flow; 3) restoring tidal/fluvial hydrology and maintaining hydrologic conditions through dredging; 4) improving flows through construction improvements to Coast Highway by opening up basins that have historically been separated; and 5) providing endowments for future lagoon maintenance and planning.

EXISTING CONDITIONS

Ecological Context

Buena Vista Lagoon area consists of approximately 203 acres. The lagoon watershed encompasses all drainages that convey water into Buena Vista Lagoon including Buena Vista Creek and its tributaries. Habitats present in or within the vicinity of Buena Vista Lagoon primarily include open water (estuarine and fresh), coastal brackish and freshwater marsh, southern riparian scrub, and Eucalyptus woodland. In addition, Buena Vista Lagoon and its

[1] Please note that resource agencies with jurisdictional oversight of the lagoon have indicated that a fresh water system restoration alternative would not meet the intent of providing in kind/similar mitigation to offset the types of impacts associated with the North Coast Corridor PWP/TREP. Accordingly, should that alternative be selected by the Stakeholders, it will not be included or funded through the REP.

wetland and upland habitats support a number of special-status wildlife species including California gnatcatcher (*Polioptila californica californica*), Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), and light-footed clapper rail (*Rallus longirostris levipes*).

The lagoon is part of the Buena Vista Lagoon Ecological Reserve that is maintained by CDFG. Buena Vista Lagoon is currently a freshwater lagoon that, for the most part, is not connected to the ocean except through a non-adjustable weir.

Drainage and Hydrology

Buena Vista Lagoon is associated with the Carlsbad Hydrologic Unit (HU) watershed that drains Buena Vista Creek. The Carlsbad HU is comprised of 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 freeway and railway bisect four lagoons in this HU: San Elijo Lagoon, Batiquitos Lagoon, Agua Hedionda Lagoon, and Buena Vista Lagoon. All four of the lagoon crossings, including Loma Alta Creek, are on bridge structures. Development within the Carlsbad HU is projected to increase from 56% to 70% by the year 2015.

Beneficial uses within Buena Vista Lagoon include the following: contact recreation such as fishing and hiking, non-contact recreation such as wildlife viewing and nature tours, biological habitats of special significance, estuarine habitat, wildlife habitat, marine habitat, and warm freshwater habitat.

Three existing transportation corridors cross the Lagoon (I-5, LOSSAN rail, and Coast Highway/Carlsbad Boulevard), which segments the Lagoon into four basins (Everest 2004). The ocean connection through a non-adjustable weir and LOSSAN rail bound the Weir Basin. The Railroad Basin is situated between the LOSSAN rail and Coast Highway. The Coast Highway Basin is located between Coast Highway and I-5. The I-5 Basin is located between I-5 and the mouth of Buena Vista Creek as it enters the Lagoon. The existing culvert under Coast Highway/Carlsbad Boulevard is inadequate to accommodate storm flows from moderate storm events, thereby limiting hydrologic exchange between the Coast Highway Basin and Railroad Basin. Sedimentation and vegetation in the vicinity of the crossings restricts flows between the four basins.

Soils

Upland soils in potential mitigation areas, located west of the potential I-5 area of effect, are largely associated with marine terraces. The typical soils in the potential restoration areas include marina loamy coarse sand, 2 to 9 percent slopes; terrace escarpments; and tujunga sand, 0 to 5

percent slopes (NRCS 2012, soil survey maps). Due to adjacent urban land use, most soils along the banks of the potential mitigation area are imported soils of sand to sandy loam.

Habitat and Vegetation Communities

Habitat and vegetation communities within Buena Vista Lagoon are comprised primarily of coastal brackish and freshwater marsh, southern riparian scrub, and Eucalyptus woodland. Open water habitat is the primary habitat type and found in all four basins.

The Lagoon is highly disturbed being surrounded by development and a non-adjustable weir at the Pacific Ocean outlet.

Wildlife

Bird and waterfowl nesting islands were created in the lagoon in 1983. The lagoon provides important habitat supporting special-status wildlife species such as Belding's savannah sparrow, California gnatcatcher, and light-footed clapper rail. Many species of waterfowl also use the lagoon for foraging and resting along the Pacific flyway.

Existing Utilities/Infrastructure/Easements

There are several utilities (e.g., gas lines, electric lines, communication lines, water pipes, storm drains, and sewer lines) on or near the Lagoon. The functional performance of these infrastructure components must be maintained, mitigated, or replaced as part of the restoration project. In addition, there are some existing easements and agreements between various agencies and utility companies that might pose constraints to restoration, enhancement, and the establishment of wetlands within the Lagoon.

MITIGATION PROGRAM

The mitigation program for the Buena Vista Lagoon, currently under development as part of the Buena Vista Lagoon Restoration Project planning process, aims to provide comprehensive lagoon restoration efforts through a suite of potential mitigation opportunities. The mitigation opportunities include opening the lagoon inlet at the terminus of the watershed and adjacent to the Pacific Ocean, modifying rail and highway bridge designs over the Buena Vista Lagoon, restoring tidal/fluvial hydrology and maintaining hydrologic conditions through dredging, improving flows through construction improvements to Coast Highway by opening up basins that have historically been separated, providing endowments for future lagoon maintenance and planning.

Numerous agencies and organizations have been working toward restoring the lagoon, including, but not limited to, the California Coastal Conservancy, U.S. Fish and Wildlife Service (USFWS),

Regional Water Quality Control Board (RWQCB), National Oceanic and Atmospheric Administration (NOAA), U.S. Army Corps of Engineers (USACE), the cities of Carlsbad and Oceanside, the Buena Vista Lagoon Foundation, The California Coastal Commission (CCC), and other local permitting agencies. The first phase of restoration planning, consisting of several studies assessing the feasibility of restoring function and habitat values by modifying the lagoon's hydrology was completed in 2010.

"Phase II" restoration planning is currently underway and consists of preparation of preliminary engineering and environmental documents requiring further development and evaluation of restoration alternatives for the lagoon. SANDAG/Caltrans have participated with the resource agencies as part of the NEPA 404 process for the I-5 project to determine the optimal bridge openings at all major transportation crossings to help facilitate (and not preclude) any future restoration plans for the lagoon.

Schedule

The Buena Vista Lagoon Foundation and its partners have completed a strategic plan and a restoration feasibility analysis that identifies proposed potential hydraulic regimes—saltwater, freshwater, or mixed water—and project alternatives. Restoration alternatives are being further examined as part of an ongoing lagoon restoration project EIR/EIS. Completion of this document is expected in 2013 with final engineering, permitting, and construction to follow as funding allows.

This REP mitigation opportunity includes funding large-scale lagoon restoration at Buena Vista Lagoon, in addition to funds already contributed to previous and ongoing planning and technical evaluation activities necessary to facilitate and implement this lagoon restoration program. REP measures that contribute to large-scale lagoon restoration opportunities (funding, critical transportation infrastructure improvements) shall be considered a substantial mitigation element for all PWP/TREP project impacts (including temporary impacts) given the resulting wide range of benefits to sensitive habitats for plant and wildlife species, water quality, flood control, groundwater recharge and recreation. For purposes of the PWP/TREP, detailed design of the Buena Vista Lagoon restoration/enhancement projects will begin upon selection of a preferred alternative by the resource agencies and be provided through subsequent Coastal Development Permit and federal consistency review processes. The results of the consultations with persons and agencies interested in, with jurisdiction over, and/or affected by the proposed development, including consultations with federal and state resource agencies (e.g., USACE, U.S. Fish and Wildlife Service [USFWS], CDFG, Regional Water Quality Control Board [RWQCB], etc.), as well as all supporting documentation would be submitted along with the Coastal Development Permit application.

Mitigation Goal and Purpose

The Buena Vista Lagoon Restoration Project seeks to preserve, protect and enhance the Buena Vista Lagoon Ecological Reserve. The Buena Vista Lagoon mitigation program would provide an opportunity to modify rail and highway bridge designs over the Buena Vista Lagoon, which could ultimately have a beneficial effect on water quality and marine resources by offsetting wetland fill impacts with the establishment of new wetland areas and providing for improved flushing and stream flow where feasible. Restoring hydrodynamic conditions in Buena Vista Lagoon would significantly improve water quality and the ecological value of the lagoon, riparian system, and adjacent upland areas to better support environmentally sensitive habitat areas (ESHAs), special-status species, and wildlife.

The two salt water and two freshwater alternatives, discussed below, have been determined to be the most viable restoration opportunities, as discussed in the *I-5/SR78 Interchange Preliminary Engineering I-5 Bridge Study at Buena Vista Lagoon* draft report (Everest 2012).

Alternatives

A number of restoration alternatives were developed over the past few years under the direction of several federal and state agencies including, the California State Coastal Conservancy (SCC), U.S. Fish and Wildlife Service (USFWS), and CDFG. Four of these alternatives were selected for further study because the proposed grading and outlet/inlet configurations represent a reasonable range of potential restoration conditions for Buena Vista Lagoon. These alternatives were analyzed to evaluate the ranges of dimensions for the hydraulic connections in order to provide design guidance for the bridge structures under consideration by Caltrans. These four alternatives are listed below and described in the following sections.

- Saltwater Alternative: Alt 2-1
- Saltwater Alternative: Alt SW2-A
- Freshwater Alternative: Alt 1
- Freshwater Alternative: Alt FW-A

Salt Water Alternatives

Alt 2-1

Alternative 2-1 represents the restoration configuration of a salt water hydrologic regime developed for the restoration project in 2008. This alternative achieved the restoration objectives primarily through elimination of the existing exotic vegetation, dredging to remove excess sediment, and establishment of continuous tidal exchange. The existing weir would be replaced with a tidal inlet to provide continuous tidal exchange between the Lagoon and Pacific Ocean. The tidal inlet would require stabilization with two jetties that would extend to the Mean Lower Low Water (MLLW) contour. The bottom elevation of the Railroad Basin and Weir Basin would be dredged to between -12 ft and -15 ft, NGVD to provide a sediment trap for sand entering the lagoon from the ocean. Prominent features of this alternative were described in the 2008 Hydraulic Study Report (Everest 2008).

Alt SW2-A

Alternative SW2-A is the latest salt water restoration alternative developed for the Lagoon. In this alternative, a channel would run along the center of the I-5 Basin and Coast Highway Basin at -3.3 ft , NGVD, with the two banks of the channel being graded with a slope not greater than 1:8 (vertical: horizontal). Downstream of the railroad bridge, the channel would widen and form a basin with a uniform depth of -3.3 ft NGVD at the Railroad Basin and Weir Basin. The tidal inlet channel would be constructed with an initial bottom elevation of -2.0' NGVD and no jetties would be constructed to stabilize the inlet channel. Prominent features of this alternative were described in the 2011 technical memo (Everest 2011a).

Fresh Water Alternatives

Alt 1

Alternative 1 represents the restoration configuration that was used to analyze the fresh water hydrologic regime as part of the Buena Vista Lagoon Restoration Project Feasibility Study in 2004. This alternative would achieve the restoration objectives primarily through elimination of the existing exotic vegetation and dredging to remove excess sediment. It was assumed that the existing ocean outlet weir would be replaced with an 80-foot (ft) wide ocean outlet weir in accordance with the weir widening project that was proposed by the City of Oceanside. The invert elevation of the weir would be kept at the invert elevation of the existing weir, which is 5.6 ft, NGVD. The bottom elevation of the Railroad Basin and Weir Basin would be dredged to between -12 ft and -15 ft, NGVD. Prominent features of this alternative were described in the 2008 fluvial hydraulics report (Everest 2008). It should be noted that for the sea level rise

analysis presented in this report, it was assumed that the invert elevation of the weir would be raised by the projected value of sea level rise (55 inches) in order to keep ocean water from entering the Lagoon. This assumption was necessary in order to preserve the fresh water condition of the Lagoon under this freshwater alternative.

Alt FW-A

Alternative FW-A is the latest freshwater alternative developed for the Lagoon. The central portions of each basin would be dredged to maintain a water depth of about six feet (bottom elevation of about 0 ft), NGVD) to minimize the future encroachment of cattails throughout the Lagoon. Similar to Alt 1, it was assumed that the existing ocean outlet weir would be replaced with an 80-ft wide ocean outlet weir in accordance with the weir widening project that was proposed by the City of Oceanside. The invert elevation of the weir would be kept at the invert elevation of the existing weir, which is 5.6 ft, NGVD. Prominent features of this alternative were described in the 2011 technical memo (Everest 2011a). It should be noted that for the sea level rise analysis presented in this report, it was assumed that the invert elevation of the weir would be raised by the projected value of sea level rise (55 inches) in order to keep ocean water from entering the Lagoon. This assumption was necessary in order to preserve the fresh water condition of the Lagoon under this freshwater alternative.

Hydrology

A fluvial hydraulics analysis was conducted to provide guidance for the three bridge/culvert structures (Interstate 5 Bridge, Coast Highway Culvert/Bridge, and Railroad Bridge) located within the Buena Vista Lagoon. The purpose of the analysis was to establish the minimum channel width and minimum channel depth that would need to be accommodated by the three bridge/culvert structures such that future implementation of a salt water or fresh water restoration alternative will not be restricted by the existing and future bridges/culverts.

The HEC-RAS one-dimensional fluvial hydraulics model developed by the U.S. Army Corps of Engineers (USACE 2006) was used to conduct the fluvial hydraulics analysis in the present study. HEC-RAS is capable of simulating unsteady flow through a network of open channels and can account for hydraulic structures such as bridges, culverts, and weirs. The model is approved by the Federal Emergency Management Agency (FEMA) for flood studies and is commonly used by the USACE and Caltrans for fluvial hydraulics analyses.

The fluvial hydraulics analysis was conducted under the current mean sea level and the projected mean sea level in the Year 2100 based on the current guidance provided by the California Ocean Protection Council (COCP 2011). Based on the results of the analysis, the conclusions presented below were drawn for each of the three bridge channels.

1. The channel under the existing Interstate 5 Bridge is not sufficient to accommodate a near full tide range nor is it sufficient to convey the fluvial flows analyzed in this study. The new Interstate 5 Bridge should be designed to accommodate a channel with a bottom width of 105 feet (at -6 ft, NGVD) and top width of 180 ft (at 14 ft, NGVD). The soffit of the existing Interstate 5 Bridge (23.1 ft, NGVD) is almost ten feet above the predicted flood water elevation for a 100-year flood event occurring with the projected mean sea level for Year 2100.

2. The channel under the existing Coast Highway Culvert/Bridge is not sufficient to accommodate a near full tide range nor is it sufficient to convey the fluvial flows analyzed in this study. The new Coast Highway Culvert/Bridge should be designed to accommodate a vertically-walled channel with a width of 110 feet and bottom elevation of -6 ft, NGVD. The soffit of the existing Coast Highway Culvert/Bridge (8.2 ft, NGVD) is about 1.5 feet (salt water alternative) to 5.5 feet (freshwater alternative) below the predicted flood water elevation for a 100-year flood event occurring with the projected mean sea level for Year 2100 thereby indicating that flooding of the structure would occur. This should be taken into account during design of the new Coast Highway Culvert/Bridge.

3. The channel under the existing Railroad Bridge is not sufficient to accommodate a near full tide range nor is it sufficient to convey the fluvial flows analyzed in this study. The width of the channel under the existing Railroad Bridge would be adequate to accommodate the fluvial flows analyzed in this study; however, the bottom elevation would need to be deepened from –2.5 ft, NGVD to -4 ft, NGVD. To accommodate a near full tide range the bridge would need to accommodate a channel with a bottom elevation of -6 ft, NGVD. If the existing bridge structure and foundation are capable of accommodating this increase in channel depth and the forces from higher flood levels, then the existing structural configuration would not need to be changed and would still convey the fluvial flows analyzed in this study and accommodate the implementation of a near full tidal salt water restoration project in the future (Everest 2008). This should be taken into account during design of a new Railroad Bridge when such work is undertaken. The soffit of the existing Railroad Bridge (11.1 ft, NGVD) is about 2.5 feet below the predicted flood water elevation for a 100-year flood event occurring with the projected mean sea level for Year 2100; therefore, flooding of that structure would occur under the fluvial flows analyzed in this study. This should be taken into account during design of a new Railroad Bridge when such work is undertaken.

4. The results of the fluvial modeling indicated that improvements to the Interstate 5 Bridge and Coast Highway Culvert/Bridge would result in higher flood levels within the Coast Highway Basin and Weir Basin because the flood flow is conveyed more efficiently to

these lower basins from the Interstate 5 Basin. While representing an improvement in the overall flood hydraulics, an increase in flood levels within these two basins under the two freshwater alternatives could result in impacts to private property and infrastructure, especially in the Weir Basin where the St. Malo community is located. Everest (Everest 2004 and 2008) reported a similar finding for existing conditions, which is a freshwater system controlled by the 50 ft wide weir. The proposed freshwater alternatives feature an 80 ft wide weir which does help to alleviate the problem compared to the existing 50 ft wide weir; however, the 80 ft weir is still not large enough to convey increased rate of flow resulting from the improvements in the Interstate 5 Bridge and Coast Highway Culvert/Bridge. Consequently, this issue should be addressed as part of the implementation process associated with the I-5 North Coast Corridor (NCC) Project and any future work associated with the Coast Highway Culvert/Bridge. It is envisioned that this would include further analysis to determine if flooding of property and infrastructure would actually occur as well as the development of mitigation measures to reduce such flooding to levels of insignificance. For example, the weir could be widened to convey the increased rate of flow resulting from the improvements in the Interstate 5 Bridge and Coast Highway Culvert/Bridge. Alternatively, the berm surrounding the St. Malo community could be raised to reduce the risk to property from any increased flooding.

Topographic Modification

Additional topographic and hydrologic studies will need to occur following selection of a preferred restoration alternative to determine if and to what extent grading will be required to facilitate the proposed restoration activities.

Soils

Soil testing would be completed during the design process to determine what soils and groundwater levels are expected onsite to help in designing restoration activities. Any soil deficiencies or issues will be examined to ensure that plans take into account soils found onsite.

Performance Criteria

Performance criteria will be developed in the restoration plan and included in the EIR/EIS for the Lagoon restoration.

SITE PROTECTION

The Lagoon is part of the Buena Vista Ecological Reserve. Areas that will be restored will remain part of the Buena Vista Ecological Reserve once the mitigation in those areas is in place and complete.

LONG TERM MANAGEMENT

A Habitat Management Plan (HMP) will be prepared to define the long term management responsibilities to maintain the biological resources that are established through the mitigation project. CDFG will assume long term management responsibilities in association with existing areas within the Buena Vista Ecological Reserve. Additionally, funds for long term management may be provided by SANDAG/Caltrans and placed into a non-wasting endowment. Any potential endowments funds will be established using a Property Assessment Report that is based on the approved HMP.

ADDITIONAL STUDIES

Further studies will be required to determine the extent and detail of the proposed restoration projects and will be conducted through the EIR/EIS process. These studies include a tidal hydrology study to establish target grade elevations that will create appropriate tidal inundations to support and sustain salt marsh habitat. Soil testing will need to occur to determine the appropriateness of existing soils for revegetation efforts. A topographic survey will be required to support construction grading design and construction plans. In addition, deed restricted, easement, and fuel / fire zone areas will also need to be quantified to determine boundaries and acreages that can be counted toward mitigation credit. The location of culverts, stormwater outfalls, or low areas where runoff from adjacent communities will also need to be mapped and analyzed to determine how flows onsite may affect restoration efforts. Field surveys will also need to occur to determine more accurately where and what type of mitigation opportunities exist.

REQUIRED PERMITS

404, 401, 1602, and a Coastal Development Permit would likely be required for the proposed mitigation efforts in Buena Vista Lagoon.

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