SR 37 Transportation and Sea Level Rise Corridor Improvement Plan

DRAFT

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September 2017

METROPOLITAN TRANSPORTATION COMMISSION

STA Solano Transportation Authority

TAM Transportation Authority of Marin

SCTA Sonoma County Transportation Authority

NVTA Napa Valley Transportation Authority

Caltrans

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ACRONYMS USED

CA: California

CESA: CA Endangered Species Act

CNDDB: California Natural Diversity Database

CSSC: California Species of Special Concern

DAA: Design Alternatives Assessment

ESA: Endangered Species Act

FE: Federally Endangered

FC: Federal Candidate for listing

I-80: Interstate 80

MHHW: Mean Higher High Water

MTC: Metropolitan Transportation Commission

NAVD: North American Vertical Datum

NVTA: Napa Valley Transportation Authority

PA/ED: Project Approval/Environmental Document

PS&E: Plans Specification and Estimates

SE: State Endangered

SCTA: Sonoma County Transportation Authority

SLR: Sea Level Rise

SR 37: California State Route 37

SR 121: California State Route 121

ST: State Threatened

STA: Solano Transportation Authority

STAA: Surface Transportation Assistance Act

TAM: Transportation Authority of Marin

US 101: United States Highway 101

GOALS AND OBJECTIVES

The SR 37 Corridor Plan (Corridor Plan) provides a comprehensive roadmap addressing current and anticipated issues on California State Route 37(SR 37). SR 37 (study corridor) currently experiences severe traffic congestion and temporary flooding during heavy storms. Furthermore, with anticipated Sea Level Rise (SLR), the frequency of flooding is expected to increase, to a point that the roadway becomes permanently inundated. At that point, vehicular traffic on the corridor would be forced to divert to other already congested routes and critical habitat for protected species would be lost.

The Metropolitan Transportation Commission (MTC) and its partners, the Solano Transportation Authority (STA), the Sonoma County Transportation Authority (SCTA), the Transportation Authority of Marin (TAM) and the Napa Valley Transportation Authority (NVTA) seek to perform a Design Alternative Assessment (DAA) to plan and expedite the delivery of improvements in the study corridor to address the threat of SLR and traffic congestion.

> Develop integrated transportation and ecosystem design solutions, both short- and long-term, to improve mobility for all modes of transportation, maintain public access, while developing resiliency to storms and sea level rise.

The Corridor Plan is part of the DAA process to identify near-term and long-term strategies for the corridor. Findings from several completed studies informed the Corridor Plan, including the Highway 37 Stewardship Study (completed 2012), the State Route 37 Integrated Traffic, Infrastructure, and Sea Level Rise Analysis (UC Davis Study, completed 2014-15) and the Transportation Concept Report (TCR, completed 2015). These studies along with corridor evaluation efforts as part of the DAA helped define the corridor context, identify critical issues, and explore alternative improvement strategies for the SR 37 Corridor Plan.

http://www.dot.ca.gov/dist4/systemplanning/docs/tcr/TCR-37-FINAL-SIGNED.pdf

http://www.dot.ca.gov/dist4/systemplanning/studies_sr37.htm

STUDY CORRIDOR

The study corridor extends from US 101 in Novato to I-80 in Vallejo as shown in Exhibit 1. SR 37 is an important regional connection linking the north, east and west San Francisco Bay Area sub-regions. It connects job markets and housing within Marin, Sonoma, Napa, and Solano Counties. It also provides access to the popular wine growing regions of Napa and Sonoma Counties, the Sonoma Raceway in Sonoma County as well as Six Flags Discovery and Mare Island in Solano County. SR 37 serves commute, freight and recreational traffic on weekdays and weekends. There is currently no transit or regular passenger rail service available and very little bicycle and pedestrian activity exists along the study corridor. There is an existing freight rail line that partially parallels the SR 37 corridor. Consistent with the Caltrans TCR, the Corridor Plan divides the study corridor into three segments reflecting a change in the number of lanes as well as in the designation of the facility. Exhibit 1 illustrates the study corridor and the three study segments:

Segment A: From US 101 to the signalized SR 121 intersection at Sears Point, SR 37 is a four-lane expressway with 3.4 miles in Marin County and 3.9 miles in Sonoma County. Segment A is relatively low-lying (2 to 6 feet NAVD88) for most of its length and protected by levees along Novato Creek, the

Petaluma River, and landward levees of the Sonoma Baylands. These levees range in elevation from approximately 10 to 13 feet. The lowest point of the corridor is just less than 2 feet in Sonoma County near Lakeville Road.

Segment B: East of Sears Point, SR 37 becomes a two-lane conventional highway with a median barrier as it crosses the Napa-Sonoma marshlands from SR 121 to Mare Island with 2.3 miles in Sonoma County and 7 miles in Solano County. The SR 37 road elevation is relatively high (8 to 9 feet. NAVD88) and is protected by levees between Tolay Creek and Sonoma Creek. There is no bayfront levee protecting SR 37 west of Sonoma Creek to Mare Island and the road is constructed to an elevation of approximately 11 feet except near Mare Island where the road elevation is much lower at approximately 7 to 8 feet NAVD88.

Segment C: SR 37 is a four-lane freeway starting at Mare Island and continuing eastward, mostly on elevated roadway and structures, 4.4 miles to its termination at I-80 in Solano County. This segment crosses SR 29 in the City of Vallejo.

Exhibit 1: Study Corridor

CORRIDOR ISSUES

The most critical issues for the study corridor are recurrent traffic congestion, vulnerability to flooding, which will likely grow more frequent with SLR, and potential impacts of SLR on highly sensitive environmental resources adjacent to the corridor.

Traffic Congestion

The primary cause of corridor congestion is vehicular demand exceeding the capacity of the 2-lane conventional highway segment, Segment B, between SR 121 and Mare Island. No transit opportunities are available along the study corridor to offset vehicular demand. The capacity of this segment is also unusually low, about 400 vehicles per hour per lane less than other similar facilities (about 1,200 versus

1,600), and is primarily due to the short merge distances approaching the lane drops east of SR 121 and Mare Island, high heavy vehicle usage, railroad crossing settlement east of SR 121 and grades at the Sonoma Creek Bridge. The high traffic demand combined with the low capacity results in severe congestion for both weekday peak period and weekend traffic. Westbound SR 37 traffic typically experiences congestion approaching the lane drop west of the Mare Island interchange for about 6 hours during the weekday AM peak period and throughout much of the day on weekends. Eastbound SR 37 congestion occurs approaching the lane drop east of SR 121 intersection for about 7 hours during the weekday PM peak period as well as much of the day on weekends. On typical weekdays, the maximum westbound delay in the morning peak period is about 27 minutes and the maximum eastbound delay in the afternoon peak period is about 80 minutes. The bottlenecks and queues Exhibit illustrates the bottleneck locations and the extent of associated queues along the study corridor.

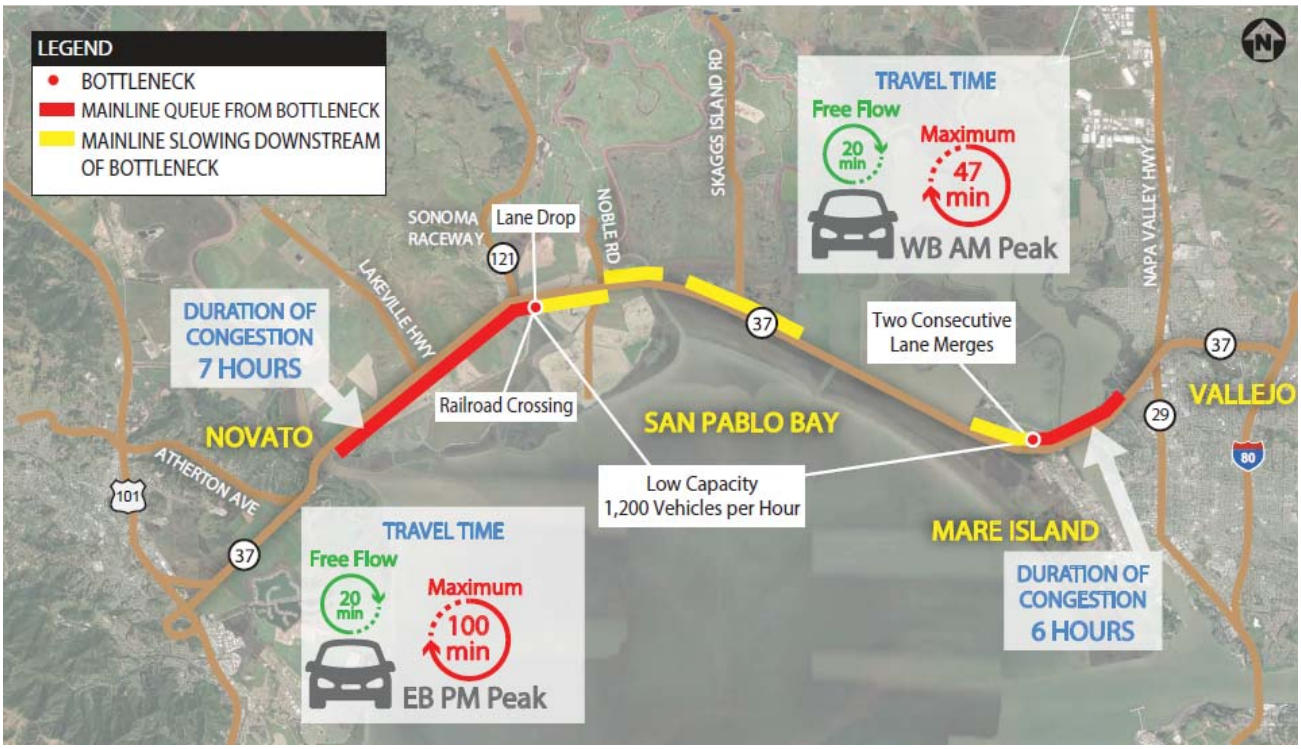


Exhibit 2: Bottlenecks and Queues

Sea Level Rise Vulnerability and Flood Risk

Rising sea levels due to climate change will critically impact both the study corridor and surrounding sensitive ecosystems. Currently, SR 37 is protected from flooding by a complex interconnected system of levees along Novato Creek, the Petaluma River, Tolay Creek, Sonoma Creek, the Napa River, and the San Francisco Bay. Exhibit 3 shows the relationship between the surrounding levee system and the roadway elevations along SR 37. Segments A and B are further sub-divided to present differences in the highway and levee elevations within the segments. Segment A and a portion of Segment B are protected by levees. Raised portions of Segments B and C act as levees. The UC Davis Stewardship Study identified Segment A as the most vulnerable to SLR – primarily due to its low elevation and reliance on levees to provide flood protection for the highway. Segment B was identified as the most at risk to SLR impacts when considering consequence factors such as capital improvement costs, economic impacts on commuters and goods movement, impacts to public recreational activities and impacts to alternate routes. Many of the levees are privately owned and were not constructed specifically for protecting SR 37 from flooding. Instead, protection of SR 37 is an ancillary benefit of the levees. Neither Caltrans, MTC nor any of the four North Bay Transportation Authorities has a role in managing or maintaining many of the levees responsible for protecting SR 37.

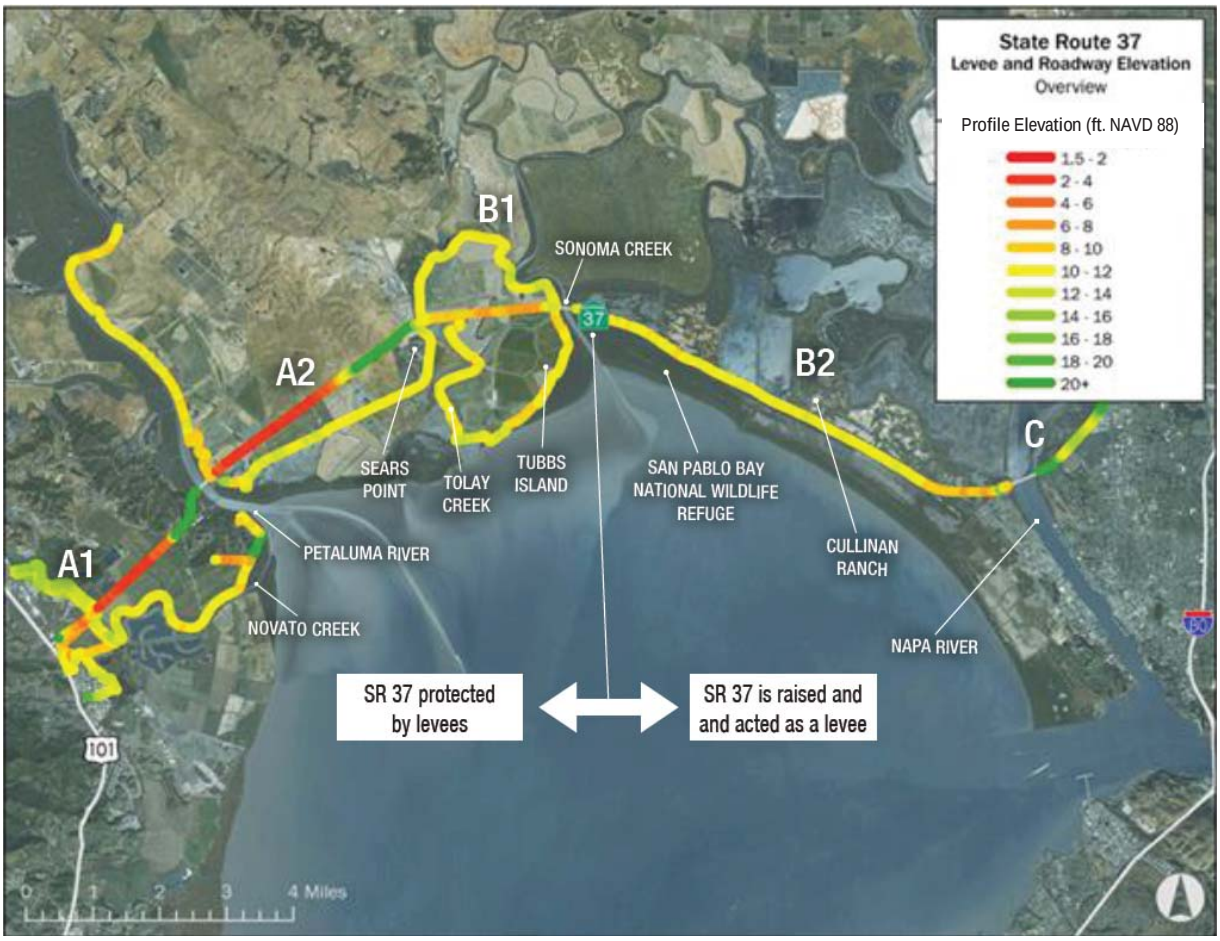
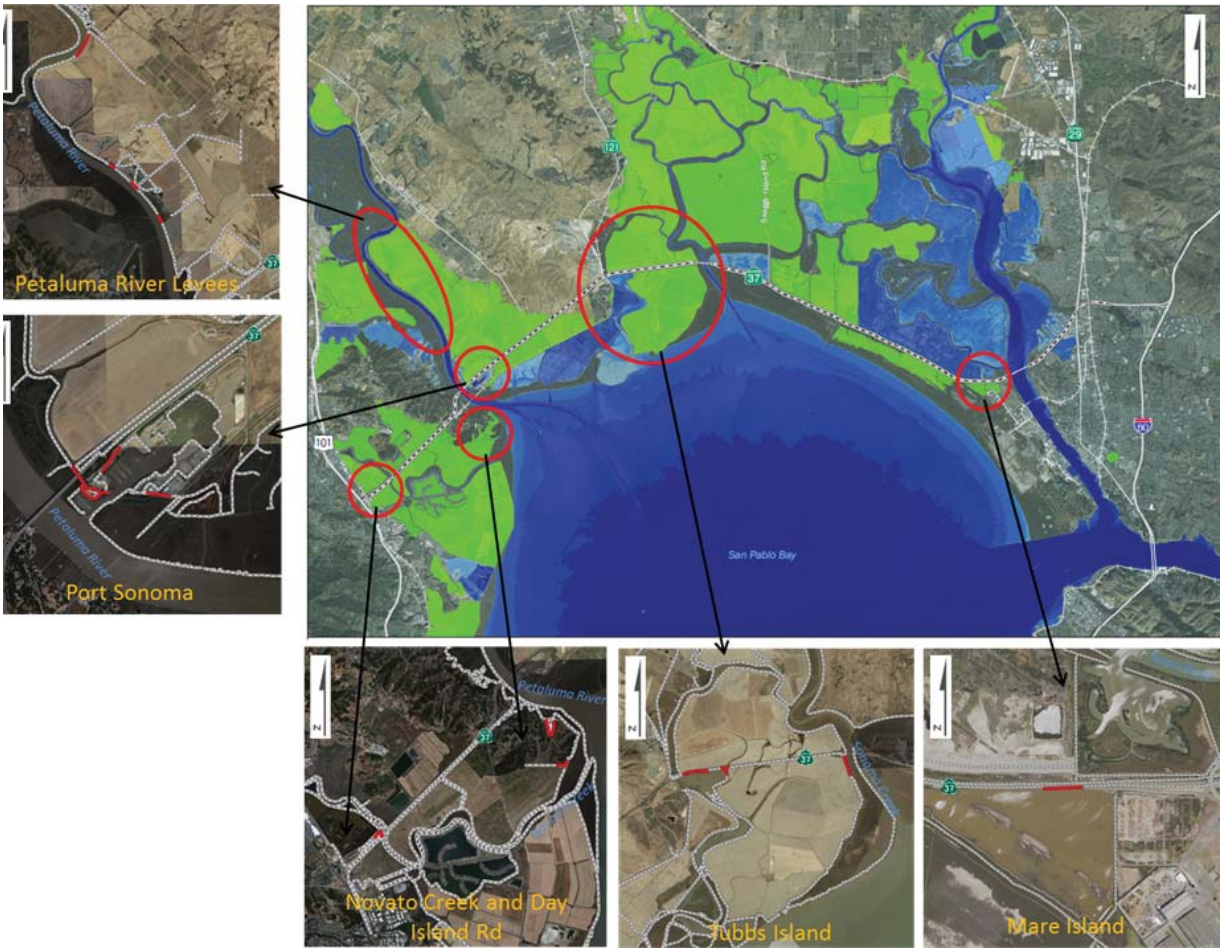


Exhibit 3: Levee and Roadway Elevation

Existing Conditions-Flood Risk

Exhibit 4: Novato Creek Flooding During Closure Prior To 2017 Repairs

The existing levees along Segment A and B protect the low-lying highway from daily tidal inundation and storm surge flooding. Flooding is, however, an issue along some portions of SR 37 such as Novato Creek, Tolay Lagoon, and Mare Island. The highway has, in the past, been closed due to flooding, most recently in January and February 2017 when both directions of the roadway were closed for 28 days at the Novato Creek crossing. The Mare Island Interchange eastbound off-ramp also experienced flooding during that period. Subsequently, Caltrans dedicated $8 million in emergency funds to address the flooding at Novato Creek, but the Mare Island Interchange was not addressed. The improvements at Novato Creek included raising the roadway elevation by two feet in both directions using lightweight material and replacing three cross-highway culverts. A review of the UC Davis study and subsequent field surveys confirmed six potential low spots in the existing levee system making them weak links in the system. These weak links make portions of Segments A, B, and C more vulnerable to short term flooding and eventual SLR. These locations are shown in the Exhibit 5.



Lowlying Areas > 1 Acre

Exhibit 5: Weak Links Assessment

Future Conditions-Flood Risk

The State Route 37 Integrated Traffic, Infrastructure and Sea Level Rise Analysis study evaluated the exposure of SR 37 to permanent inundation and temporary flooding using SLR inundation maps. The study found that, in general, all segments of the highway would be impacted by permanent inundation with 36 inches of SLR and could be exposed to storm surge flooding by a 25-year coastal storm event today and by a 5- to 10-year coastal storm event with 6 to 12 inches of SLR. The inundation map in Exhibit 6 shows that a majority of Segments A and B will be completely inundated during the MHHW plus 36" SLR scenario (corresponding to the likely SLR projection at 2100).

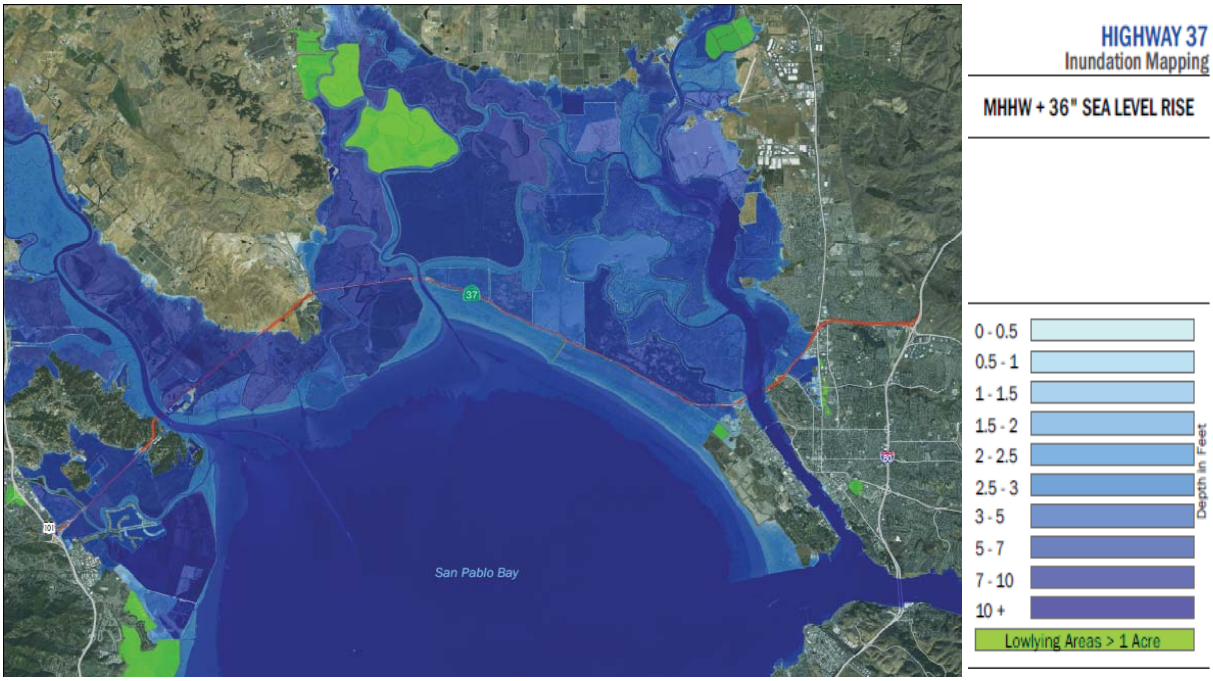


Exhibit 6: Inundation Map-MHHW+36" SLR Scenario

Table 1 shows SLR projections for the San Francisco Bay through 2100. The "Projections" represent a mid-range, likely, SLR amount at each planning horizon. The "Ranges" represent low- and high-range SLR amounts that are considered possible but unlikely to occur at each planning horizon. For example, it is considered likely that the SLR amount at 2100 will be between 26 and 46 inches (36 ± 10 inches); however, it is possible, but unlikely, that SLR could be as low as 17 inches or as high as 66 inches.

Table 1 Sea Level Rise Estimates for San Francisco Bay

Year	Projections	Ranges
2030	6 ± 2 in	2 to 12 in
2050	11 ± 4 in	5 to 24 in
2100	36 ± 10 in	17 to 66 in

Source: NRC 2012. Sea-Level Rise for the Coast of California, Oregon, and Washington: Past, Present and Future.

The State of California SLR Guidance Document (2013) recommends considering a range of SLR values and planning for the "worst case scenario" for critical infrastructure with long lifespans, thus, long-term alternatives would need to plan for the 100-year storm plus 66" SLR scenario.

The UC Davis study provided Inundation areas and depths for multiple scenarios and recommendations were provided based on the "most likely" year 2100 sea level rise scenario (36 inches SLR). Although the SLR study mapping did not account for rainfall-runoff events and water control structures such as culverts and tide gates, FEMA's bayside storm surge estimates include 30 years of historical data and the Flood Insurance Rate Maps account for combined riverine and coastal flooding (for existing but not future conditions). The inundation map in Exhibit 7 shows that a majority of Segments A and B will be completely inundated during the 100-year storm surge plus 36" SLR scenario (corresponding to the likely SLR projection at 2100).

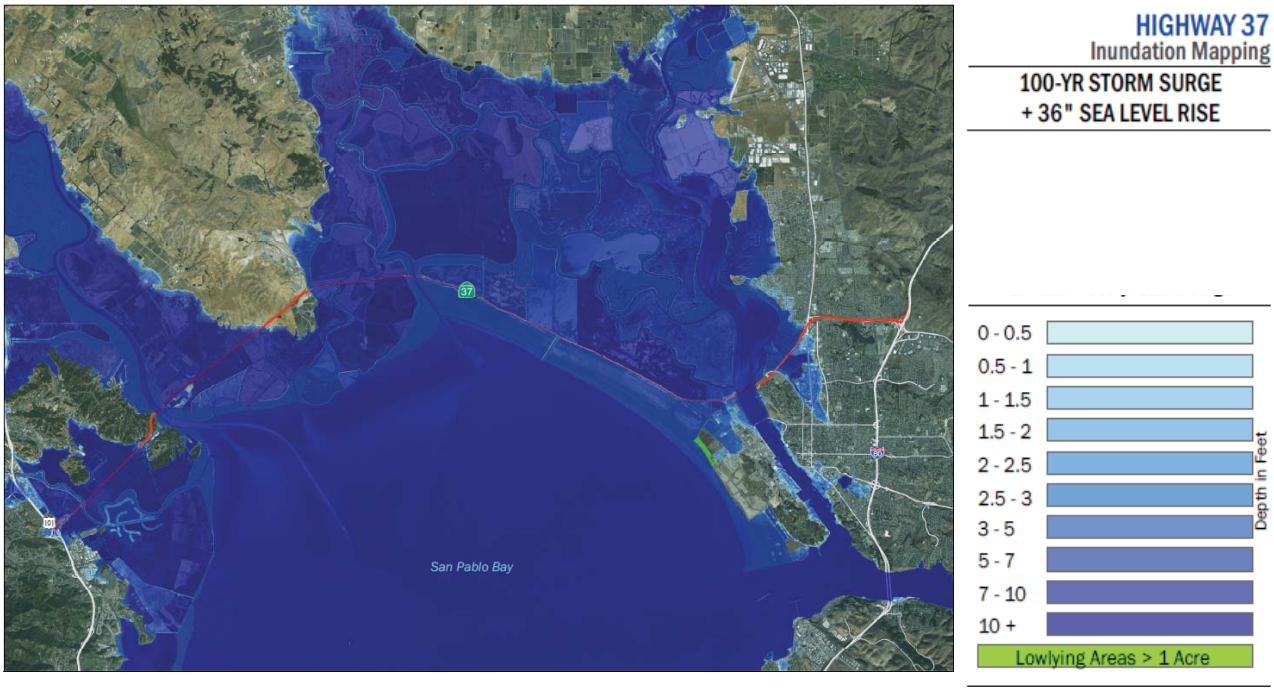
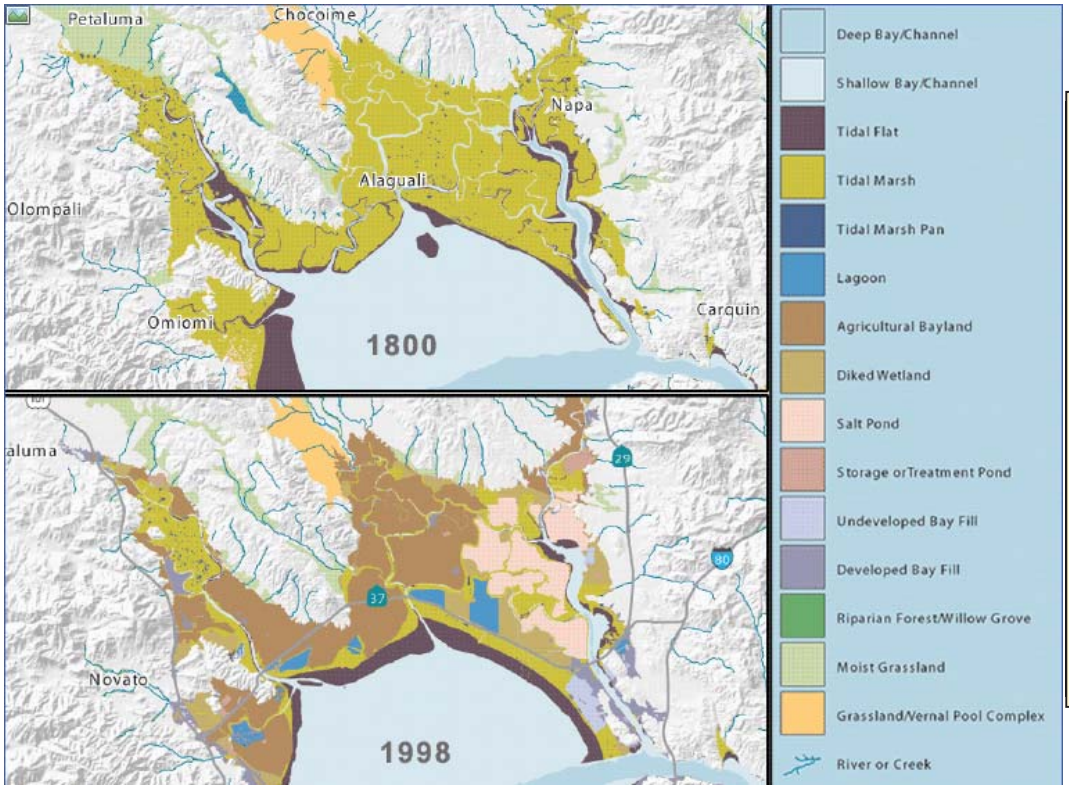


Exhibit 7: Inundation Map - 100-year Storm Surge+36" SLR Scenario

According to the projections, Segment A will flood during a 10-year storm surge event and will be permanently inundated around 2050 with roadway flooding depths ranging up to 5-feet. Segment B, from SR 121 to Sonoma Creek (area of Tubbs Island) will flood between the 25-year and 50-year storm surge events and will be permanently inundated around 2050 with roadway flooding depths up to 2-feet. The remainder of Segment B will be permanently inundated around 2100 with the majority of roadway depths around 0.5-feet. The low-lying area in Segment C, near Mare Island, will flood during a 10-year surge event and will be permanently inundated around 2050 with roadway flooding depths ranging up to 2-feet.

Environmental Sensitivity

The study corridor lies within an ecologically sensitive area containing wetlands and baylands, which provide habitat for several special-status species. Exhibit 8 from the San Francisco Estuary Institute shows the historical evolution of the marshlands in the North Bay. Human activities have significantly altered this area such as hydraulic mining in the Sierras, which increased the sediment supply to San Pablo Bay and led to a buildup of marshland, salt production, draining, filling, agriculture, and development. Current levee systems, built for agriculture throughout the project corridor, further complicate this dynamic system.



The upper map to the left shows pre-1850 historic marshlands and tidal areas.

The map below portrays a radically changed environment.

The most damaging period was between 1850 and 1900, when 85 percent of the marshlands were drained to create farmland, primarily to grow livestock feed.

Exhibit 8: San Francisco Estuary Institute - North Bay marshlands

Wetlands and baylands are present throughout the SR 37 corridor. Segment B west of the Sonoma Creek Bridge has wetlands and waterways present, however, it is largely upland habitat. From the Sonoma Creek Bridge, eastward to Vallejo (segments B and C), the study corridor is largely dominated by wetland and bayland habitats that are along the edge of SR 37. Wetland habitat types in the study corridor include freshwater wetlands such as drainages, springs and seeps and tidal wetlands, such as bayland mudflats, open water, and tidal ditches.

Exhibit 9: Wetlands along SR 37

The Napa Sonoma Marsh represents a large marshland expanse. Restoration opportunities through stakeholder collaboration may be present within the study corridor. Ongoing restoration of historic wetlands, the preservation of existing open space and further efforts are in various planning and implementation stages. Various local, state, and federal agencies as well as private and non-profit groups are involved and investing considerable resources in marshlands and habitat restoration and endangered species recovery efforts. Present day wetland locations are presented in Exhibit 12, along with sea level rise inundation estimates under the 2050 scenario.

SR 37 crosses the San Pablo Bay National Wildlife Refuge. The wetlands, waterways and uplands surrounding the corridor provide habitat for a wide variety of native fauna and flora. Exhibit 13 shows species within the projected SLR inundation area. The inundation area shown in the Exhibit 13 corresponds to MHHW+66" SLR scenario. Some of the state and federally-protected species, include:

- Salt marsh harvest mouse (FE, SE, CDFW FP)
- California Ridgway's rail (FE, SE, CDFW FP)
- California Black rail (ST, CDFW FP)
- Steelhead (FE)
- Green sturgeon (FE, CSSC)
- Longfin smelt (FC, ST, CSSC)
- Red Legged Frog (FE, SE, CDFW FP)

These species are largely found in areas associated with wetlands and waterways in all segments of the corridor.

Exhibit 10: All About Birds-Ridgway's Rail

Exhibit 11: USFWS-Salt Marsh Harvest Mouse

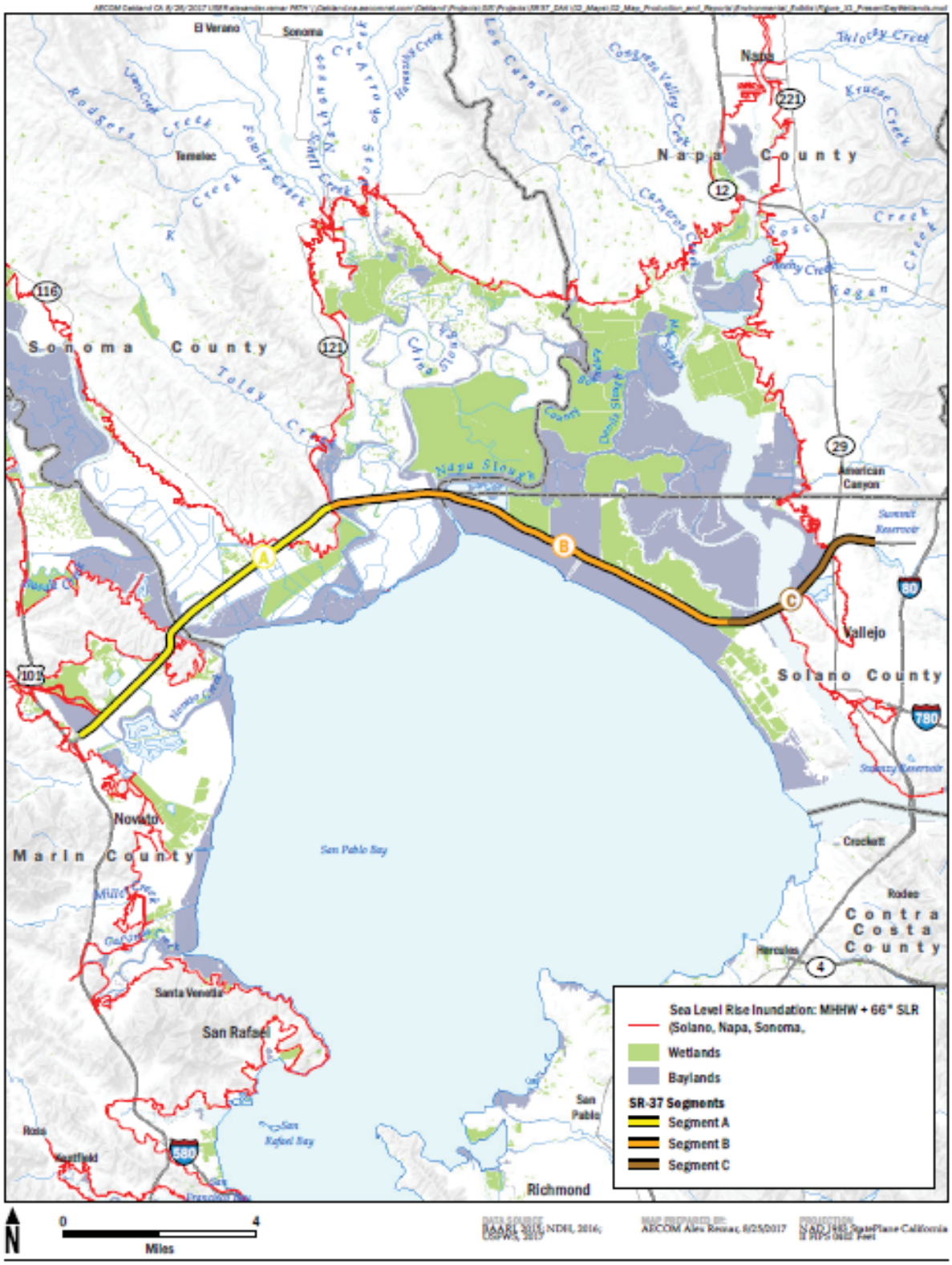


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Exhibit 12: **Environmental Resources**
Wetlands

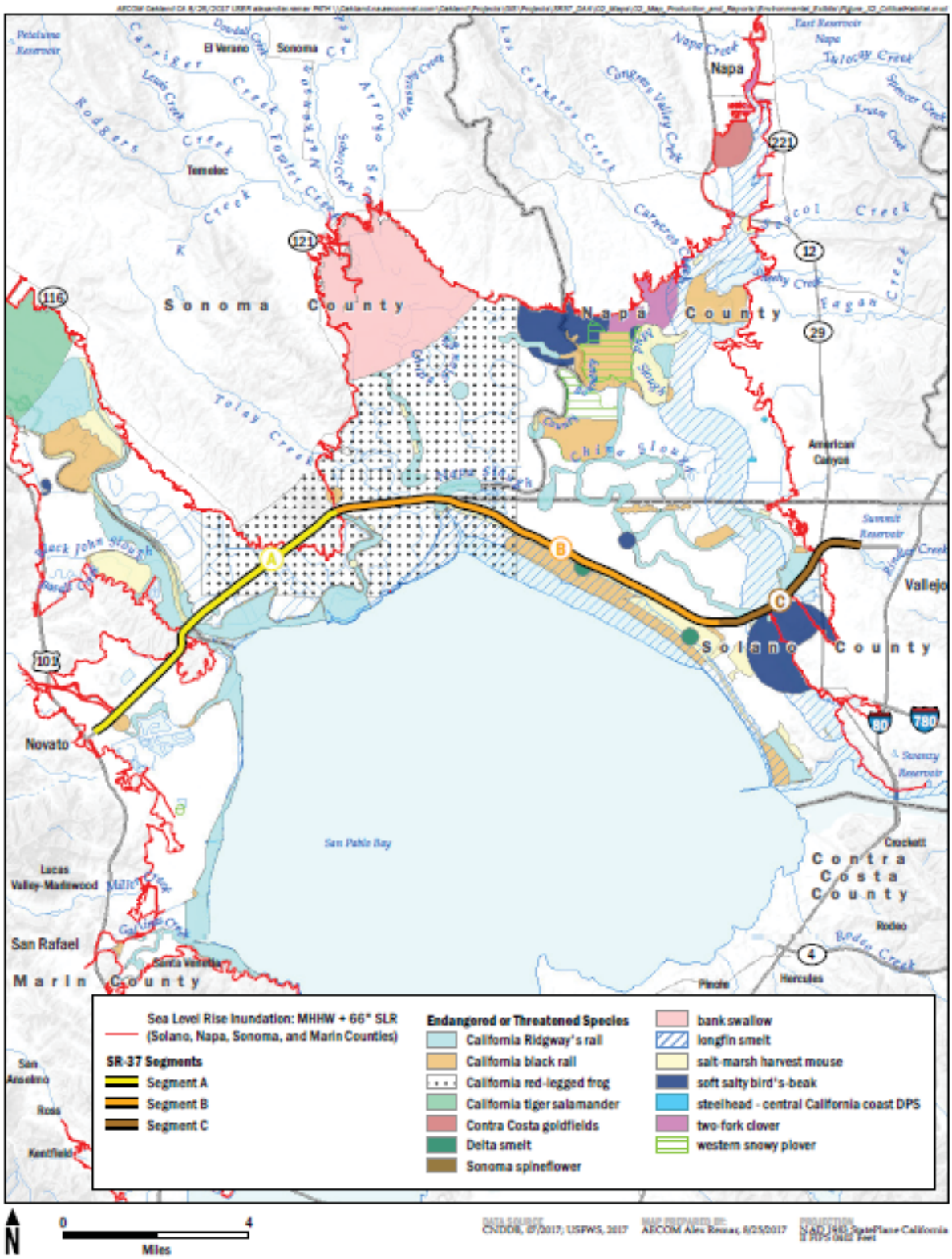

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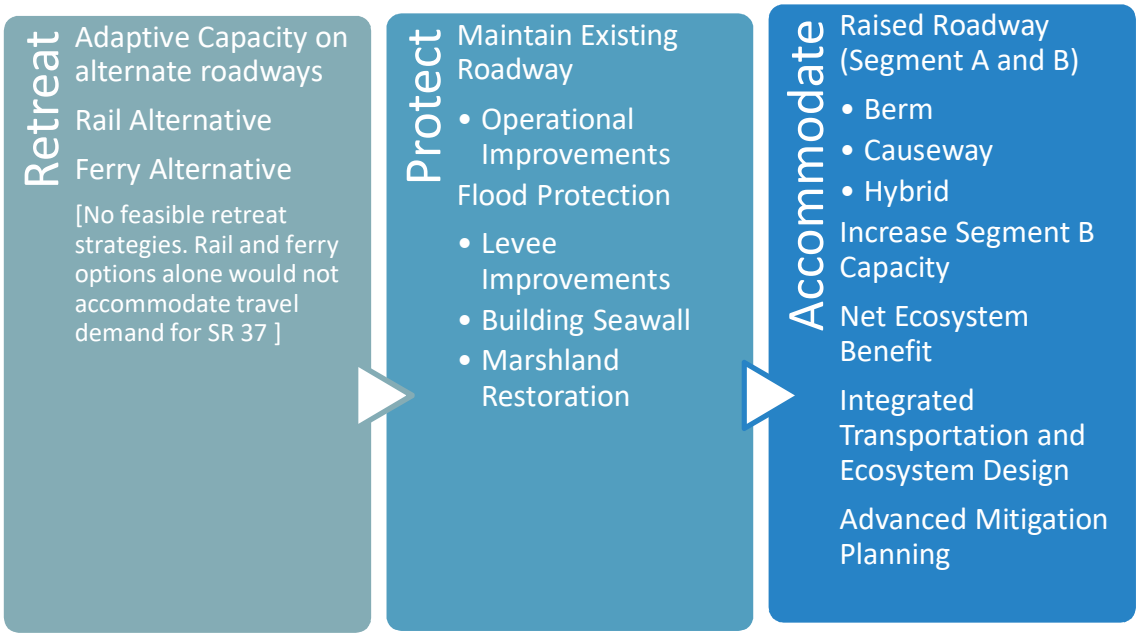
Exhibit 13: **Environmental Resources**
Endangered or Threatened Species

POTENTIAL STRATEGIES

SR 37 serves as a commute and recreational route and experiences traffic congestion both on weekdays and weekends. SR 37 acts as a secondary and reliever route to the interstates and state highways it parallels and is a recovery route for the Richmond-San Rafael Bridge in the event of an emergency closure. The existing congestion on SR 37 is projected to increase in the future thereby reducing its ability to serve commute and recreational traffic and act as a reliever route. The projected SLR in the next 90 years poses a potential threat to the highway. With the increased risk of flooding, there is a chance that portions of SR 37 will be permanently inundated or temporarily flooded in the future. Reduction or elimination of traffic on SR 37 would displace traffic to SR 29, SR 12, and SR 121 to the north and I 580 to the south. The SLR vulnerability and risk assessment study completed by UC Davis identified little available capacity on these routes in the event of a permanent SR 37 closure due to flooding. Hence, potential strategies have been developed to maintain this critical highway in the context of the existing corridor and identify adaptive mitigation strategies that will address the key corridor issues and develop resiliency to SLR.

The potential strategies were developed for key corridor issues of traffic congestion and SLR following a review of previous studies completed by UC Davis and Caltrans and coordinated with current stakeholders through TAC meetings. These strategies are consistent with adaptation strategies in the State of California SLR Guidance Document.



Strategies to Retreat

The following strategies (alternate roadways, rail transit, ferry alternatives) were evaluated as possible strategies to retreat and it was determined that none of these are feasible standalone strategies as explained below.

1. *Available Capacity of Alternate Roadways:* MTC's travel model was run to determine the traffic diversion on alternate roadways if Segment A and Segment B are closed in the event of temporary flooding or complete inundation. The model runs determined that on the closure of SR 37 would displace traffic to alternative routes I-80, I-580, US 101, SR 12, SR 116 and SR 121 shown in Exhibit 14. Most these roadways are already experience severe traffic congestion, and the performance of these alternate routes is projected to be deteriorate with the additional traffic displaced from SR 37 closure, and hence this was not considered a viable option.

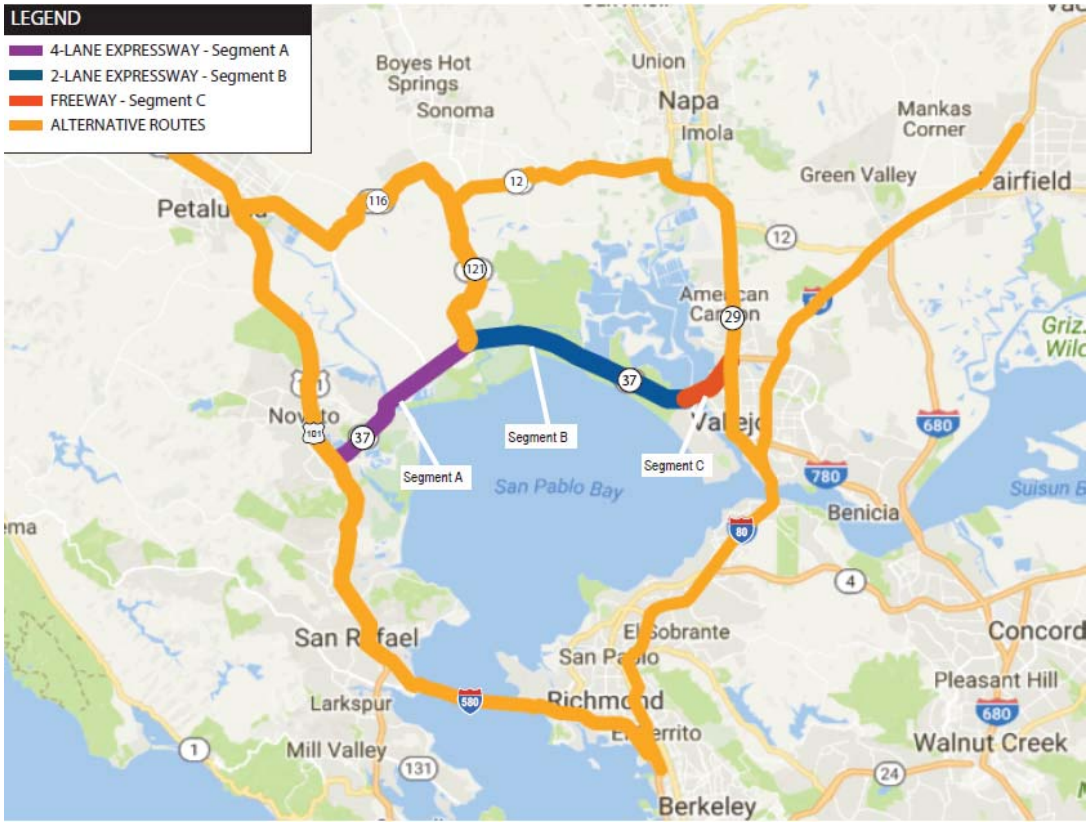


Exhibit 14: Alternate Routes

2. *Rail Alternative:* The rail alternative in the event of SR 37 closure due to inundation or flooding was considered but is not recommended for further analysis as part of SR 37 DAA due to the following reasons:
    a. Rail has a longer and more circuitous route than SR 37 as shown in Exhibit 15, and the travel time would be high when compared to vehicular travel by road on SR 37.
    b. The cost of needed rail improvements is significant as shown in the Table 2. The frequency of the rail service would also need to be high to accommodate the SR 37

traffic demand. The Napa/Solano Passenger /Freight Rail Study indicated relatively modest ridership projections in this corridor. However, it should be noted that the Napa/Solano study did not take a complete closure of SR 37 into account for ridership projections. Only peak hour and recreational passenger volumes were considered in the ridership projections. Detailed ridership projections are needed to truly compare road user cost and rail user costs. The additional cost of transit stations and ongoing rail maintenance and operating costs are not included in the assessment.

c. Portions of the rail alignment, particularly in Segment A, have SLR and flooding vulnerabilities similar to the highway. Additionally, there is no real advantage of a rail alternative over roadway improvements in this segment in terms of environmental impacts.

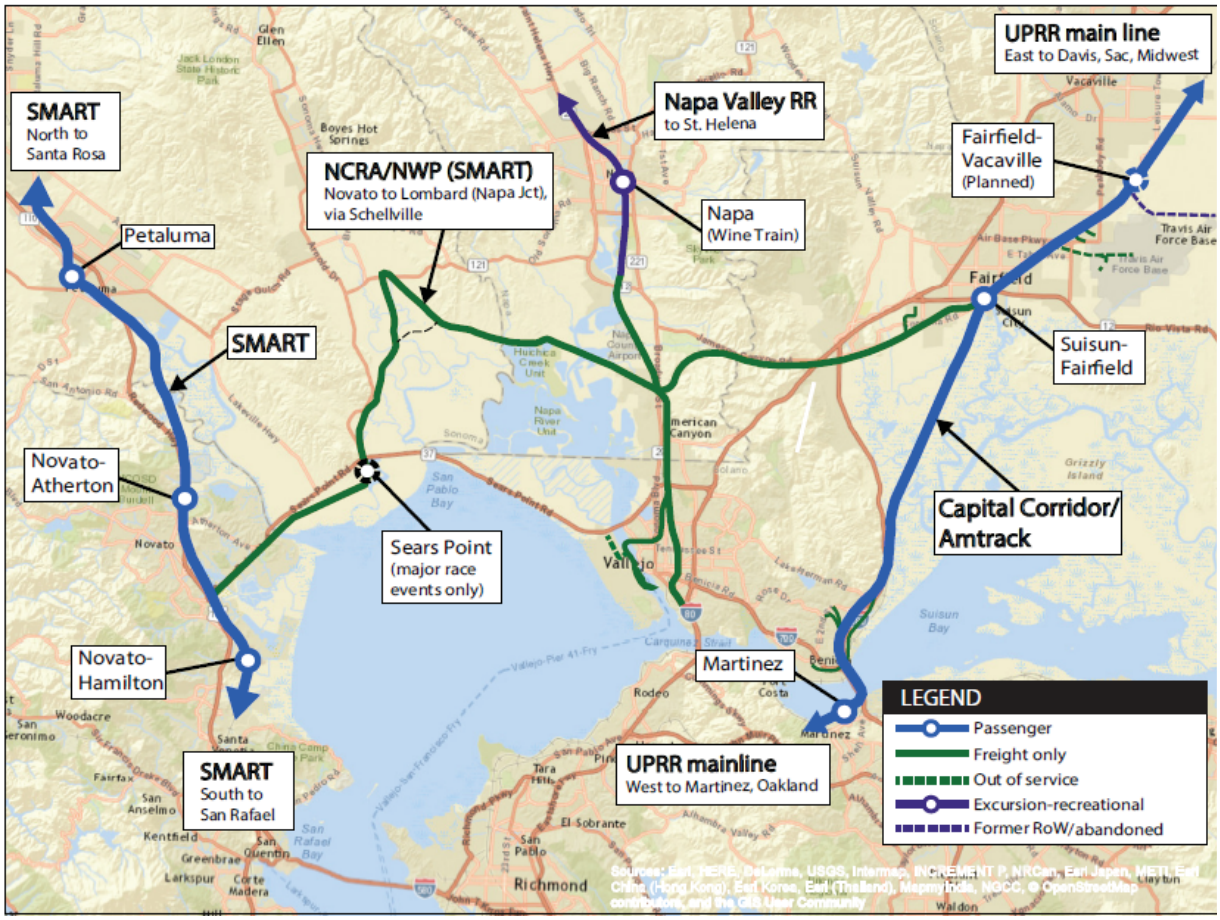


Exhibit 15: Existing Rail Facilities

Table 2 Rail Road Alternative Probable Construction Costs

Segment	Capital Costs *
Novato to Sears Point	$1.1 B
Sears Point to Napa Junction	$0.2 B
Napa Junction to Vallejo	$0.2 B
Total	$1.5 B

*2018 Dollars
Source: Kimley-Horn 2017

3. *Ferry Alternative:* A ferry alternative is not viable as it is not possible to accommodate the traffic demand on SR 37.

Strategies to Protect

1. *Maintain Existing Roadway:* Traffic congestion on SR 37 can be attributed to the inefficient merging conditions approaching the lane drops and the lack of capacity in the two-lane section of the highway between SR 121 and Mare Island. Operational improvements, as shown, would improve merge conditions and help alleviate traffic congestion issues in the short-term.

Existing Conditions | **Potential Improvements**

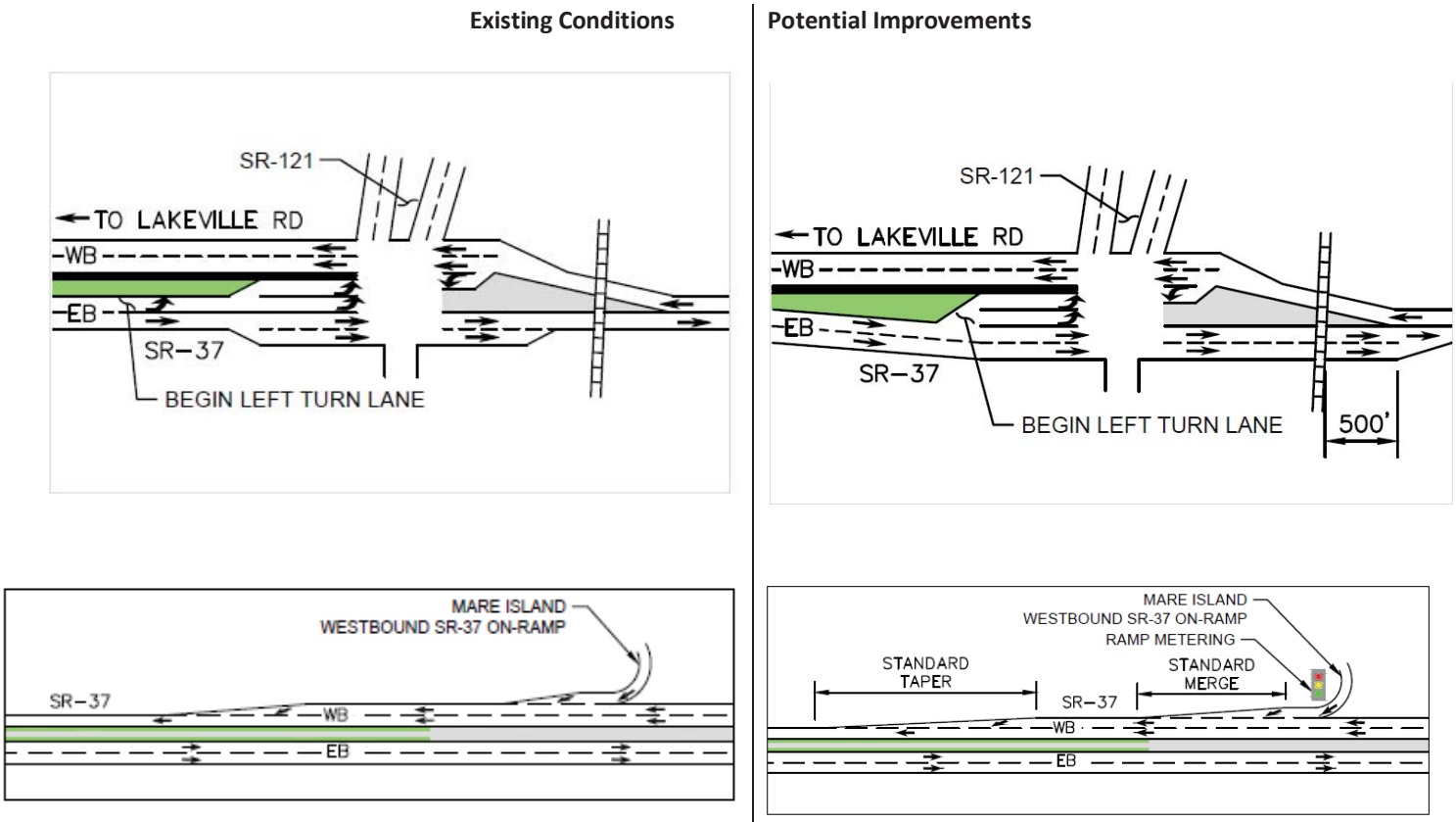


Exhibit 16: Schematics of representative Intersection operation improvements and lane merge improvements

2. *Flood Protection:* Shoreline features such as levees, berms and other topographic features currently protect SR 37 from inundation and flooding. Some of the shoreline protection strategies include raising levee crests with fill, installing sheet pile walls in the levees, installing flood barriers along the roadway and raising of some small sections of roadway at low spots.

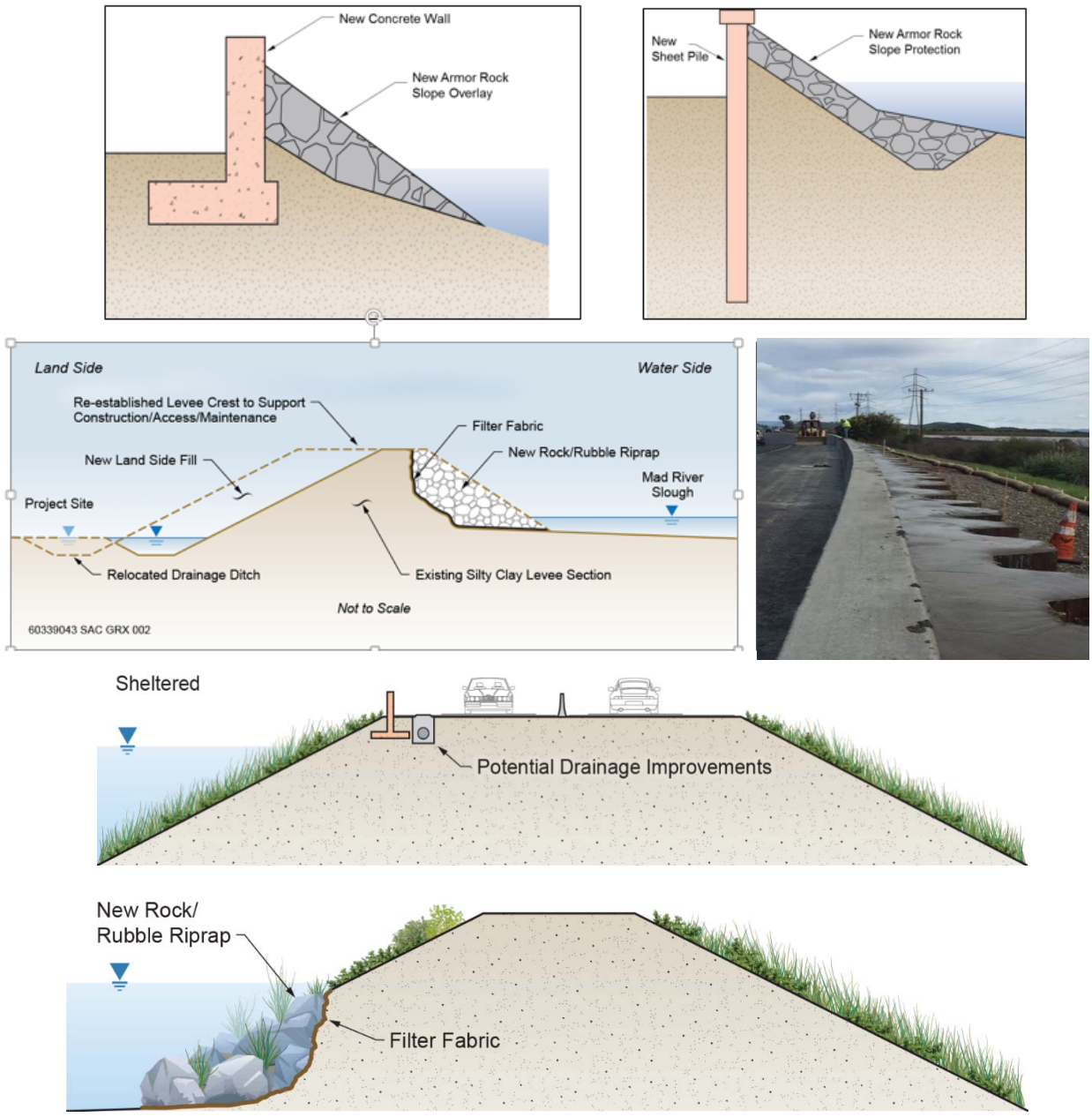


Exhibit 17: Schematics of representative shoreline protection features

Strategies to Accommodate

1. *Raised Roadway*: These strategies would elevate the roadway above the future projected limit of high tides, storm surge, and waves. State of California SLR Guidance Document recommends considering a range of SLR scenarios and planning for the "worst case scenario" for critical infrastructure, thus, long-term alternatives would need to plan for the 100-year storm+66" SLR scenario (approximately 17ft NAVD88 in sheltered areas and 20 ft. NAVD88 in areas exposed to waves).

Improvements to accommodate would address traffic congestion issues and offer SLR resiliency, as well as provide higher benefit to cost ratios and longer useful life. There are various options to constructing a raised Segment B that accommodate multi-modal transportation operations and SLR resiliency while minimizing environmental impacts and construction costs.

- An option of providing a 12' barrier separated Class IV bicycle facility on the roadway connecting to the Class I bicycle facility on Bay Trail
- Pavement section options, along with construction staging for the permanent roadway section include:
    - Roadway elevated on an embankment
    - Roadway elevated on a box-girder causeway/box culvert
    - Roadway elevated on a slab-pier causeway/box culvert
    - Hybrid of embankment and causeway/box culvert
    - Roadway on geofoam lightweight material
- Options for constructing the roadway on north or south side of the existing SR 37 to minimize construction impacts on traffic and the environment.
- Managed lane options for any of the proposed roadway improvements in Segment B.

All the new structures will consider species migration. Center barriers on embankment sections will have openings for animal crossings and/or additional culverts to improve species migration.

Exhibit 18: Conceptual Rendering of Embankment and Causeway Alternatives

2. *Net-Zero Wetland Loss and Mitigation Integration*: Approaches to a goal of no-net loss of wetlands habitat to mitigate for project widening involve considering how to create opportunities for wetland restoration built into project design.
3. *Advanced Mitigation Planning:* Advanced Mitigation Planning process-ready and Early Stakeholder Coordination are key components of project success in this ecologically diverse and environmentally sensitive landscape.

Applying a Regional Advanced Mitigation Planning (RAMP) process-ready approach, is one potential approach to successful project implementation. While still in the development phase, RAMP allows natural resources protection/ restoration as compensatory mitigation before infrastructure project construction. RAMP is a voluntary, non-regulatory regional planning process resulting in higher-quality conservation outcomes. New legislation AB 2087 grants CDFW authority to approve RAMP mitigation credit agreements, which can be implemented following creation of a Regional Conservation Assessment (RCA).

IMPLEMENTATION PLAN

Consideration of existing environmental habitat and enhancement opportunities are important to create a multifunctional project solution that goes beyond traditional roadway corridor planning, particularly in the face of climate change and surrounding sensitive ecosystem. The implementation of any improvements along the study corridor will employ integrated transportation and environmental mitigation strategies.

Near-term Solutions

While the mid- to long-term solutions will accommodate resiliency to SLR and ease traffic congestion, the Corridor Plan recognizes that there needs to be near-term strategies to improve existing traffic congestion and address flooding issues in the corridor.

Near-term improvements are estimated to take one to five years to implement, have minimal to no impact on the environment and provide cost-effective solutions to addressing immediate needs of the corridor. These potential improvements focused on corridor wide operational improvements and short-term flood protection. Exhibit 19 illustrates potential near-term improvements along the study corridor.

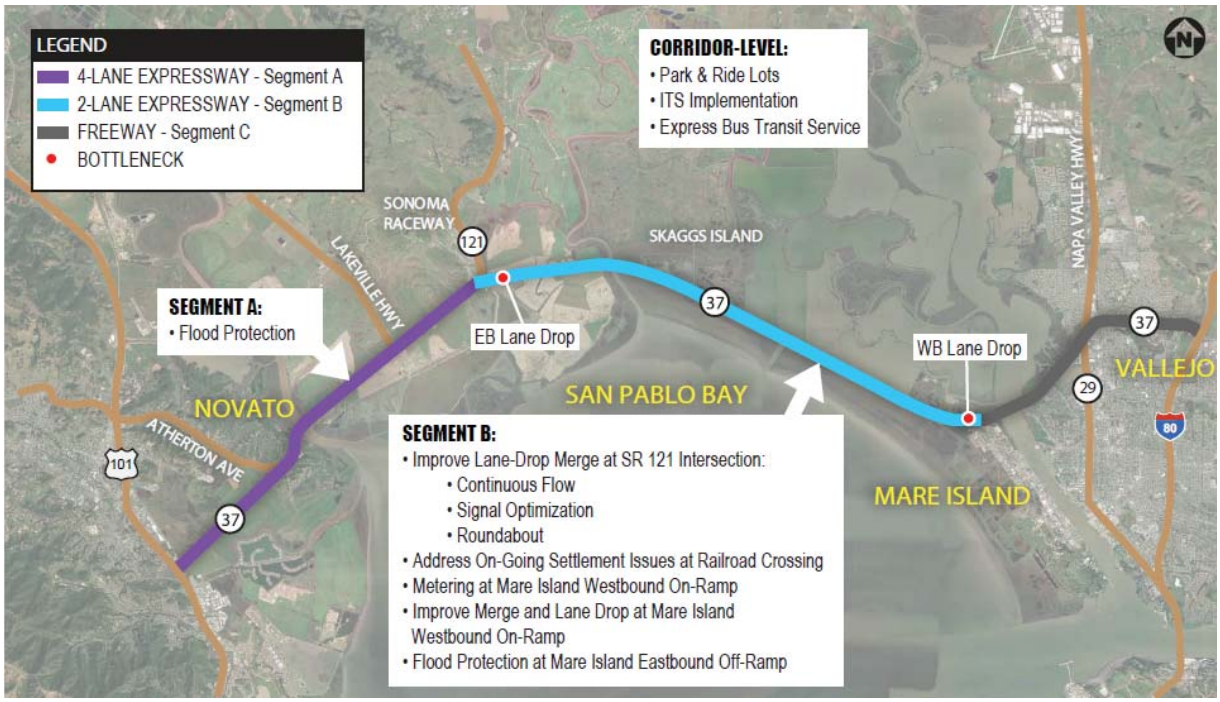


Exhibit 19: Near-Term Improvements

Flood Protection Improvements: Flood protection improvements will address weak links in Segment A (A1 and A2), B1, and C. Exhibit 20 shows the limits of individual reach within the segments. Existing roadway elevations, relative to existing and proposed future levee elevations, are shown in Table 3.

The extent of levee improvements to protect Segment A will be dependent on the design storm and planning horizon. Levee improvements to protect against the 100-year storm event would be costlier, require a longer implementation timeline, and have greater environmental impacts. The DAA will identify near-term roadway and levee improvements to address existing flood vulnerabilities and protect SR 37 to year 2050. Beyond 2050, the roadway will likely need to be raised as the scale of levee and shoreline improvements required would likely not be feasible – particularly for Segment A.

Table 3 Road and Levee Characteristics

Reach	A1	A2	B1	B2	C
Roadway Elevation (ft. NAVD 88)	4 to 6	2 to 4	8 to 9	7 to 11	>13
Existing Levee Elevation (ft. NAVD 88)	10 to 13	9 to 10	9 to 12	N/A	N/A
2050 Levee Elevation (ft. NAVD 88) Segment A	12.5 to 12.9 (100-yr flood protection) 11.4 to 11.6 (10-yr flood protection)				
2050 Levee Elevation (ft. NAVD 88) Segment B	14.8 to 15.2 (100-yr flood protection) 13.7 to 13.9 (10-yr flood protection)				

Exhibit 20: Study Corridor Segments

The near-term traffic improvements focus on improving operations with minimal environmental impact and include the implementation of ITS elements.

Improve Lane-Drop Merge at SR 121 Intersection: Currently, the lane configuration on EB approach of the intersection is two left turn only lanes and two through lanes through the intersection. The through lane drops from two lanes to one lane prior to the railroad crossing. During weekday PM peak periods, the EB approach becomes congested and motorists experience long queues and significant delays approaching the lane drop. Shifting the lane drop to east of the railroad crossing by about 500 feet and improving lane drop transition helps alleviate the traffic congestion approaching this location. In conjunction with this improvement, the following three options for the SR 37/SR 121 intersection are recommended to improve flows approaching and through the intersection.

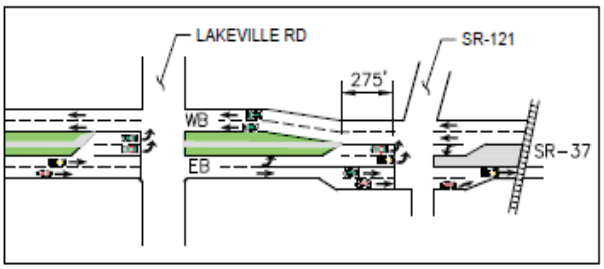


Exhibit 21: Existing Condition

- Signal optimization and roadway widening
- Continuous T intersection
- Roundabout with two EB by-pass lanes

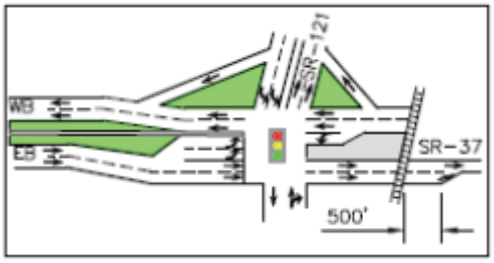


Exhibit 22: Signal Optimization

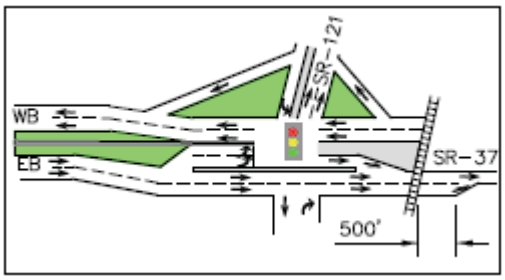


Exhibit 23: Continuous T Intersection

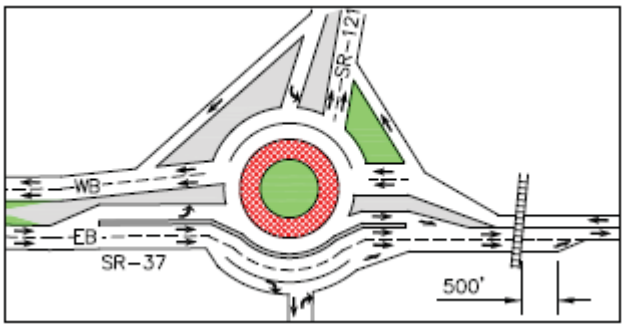


Exhibit 24: Roundabout Intersection

Settlement Issues at Railroad Crossing: The railroad crossing settlement east of SR 121 also slows down trucks and vehicles and reduces eastbound throughput of SR 121/SR 37 intersection. Northwestern Pacific Railroad is currently working on addressing the current settlement. Early coordination with the railroad will be critical if the settlement continues. This improvement is included in the corridor plan.

Metering at Mare Island WB On-Ramp: Improvements include ramp metering at the westbound SR 37 on ramp to smooth traffic flows and limiting the SB approach from the vista parking lot to right turn only movement.

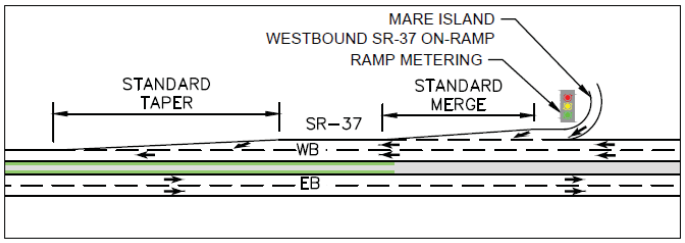


Exhibit 25: Improvements at Mare Island

Improve Merge and Lane Drop at Mare Island WB On-Ramp: Improvements include modifying the lane drop and merge west of Mare Island on-ramp to provide a standard merge and taper. This will increase existing WB bottleneck throughput west of Mare Island.

Park and Ride Lots: STA is studying potential locations for park and ride lots along the SR 37 corridor. These park and ride lots could provide opportunities for vanpool/carpool services and transit connections.

Express Bus Transit Service: There is currently no transit along the study corridor. With the implementation of near-term operational improvements on SR 37, the transit travel time reliability on the corridor should improve, providing opportunities for Express Bus Transit service. Express Bus Transit service connecting City of Vallejo transit hub with other transit hubs in the Cities of Novato and San Rafael during commute hours could be considered. Bus Transit between City of Vallejo and San Rafael

with a connection to Infineon raceway could address traffic issues related to raceway events. This corridor plan did not study opportunities for Express Bus Transit Service in detail. It is suggested that potential for Express Bus Transit Services be studied in more detail as part of a separate study.

ITS Implementation: The improvements include the installation of changeable message signs on SR 37 to give real time traveler information and better inform decisions.

Mid- to Long-term Solutions

The long-term solutions are based on accommodation strategies addressing future SLR impacts to the highway and include opportunities for multi-modal operations and wetland restoration built into project design. For critical infrastructure such as SR 37, the lifespan of long term solutions is assumed to be beyond 2100. Mid- to long-term improvements are estimated to take more than five years to implement with moderate to high environmental impact, requiring intensive agency coordination and requiring greater funding to complete. Exhibit 26 illustrates potential mid- to long-term strategies along the study corridor.

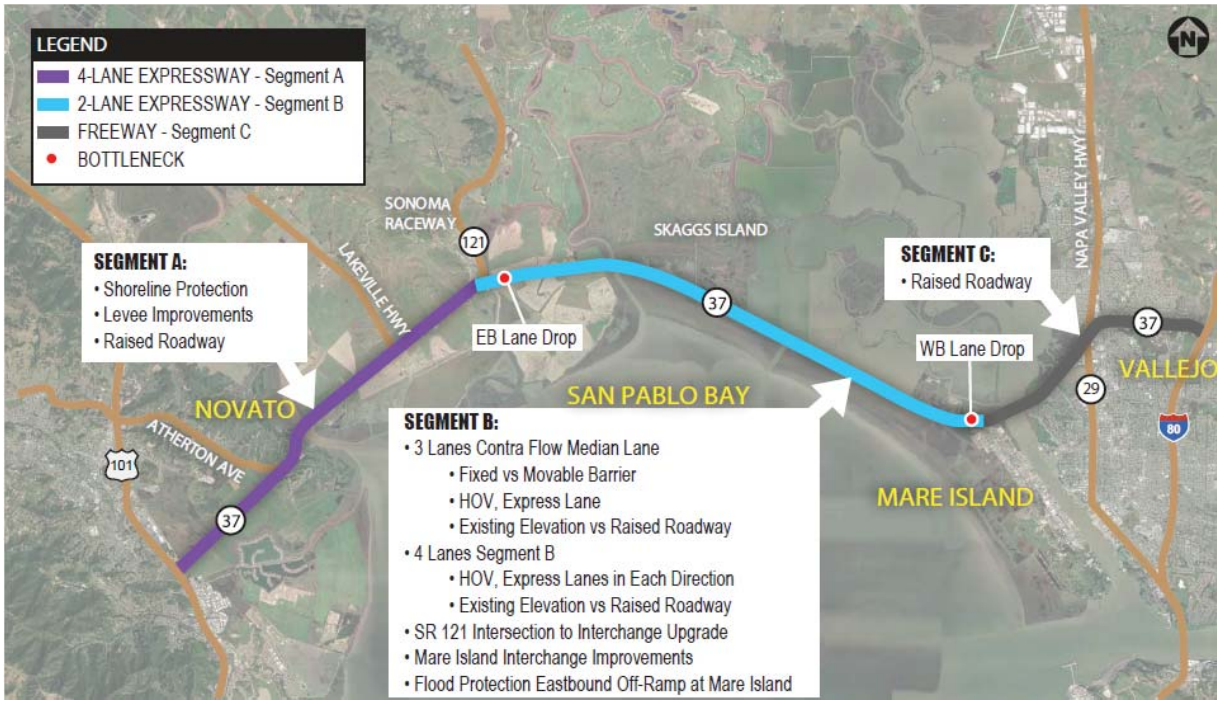


Exhibit 26: Potential Mid to Long-Term Improvements

Levee Improvements in Segment A: Improvements include continuing to raise levee crests at low spots along Segment A to protect the highway from flooding. This is expected to be a mid-term solution for flood protection until Segment A is raised.

Raised Roadway in Segment A: Elevate roadway on causeway or embankment as a long-term solution for SLR adaptation. This will provide opportunities for wetland restoration and reconnection of Bay hydrology. Improvements include adding a grade separated Lakeville Highway Interchange.

SR 121 Interchange Improvements: Improvements include reconfiguring the SR 121 intersection to have a grade separation with SR 37. This also includes a grade separation of the railroad crossing east of SR 121.

Widen 2-lane segment from SR-121 to Mare Island: Currently, Segment B is a two-lane conventional highway segment between SR 121 and Mare Island and is the primary cause of corridor congestion due to vehicular demand exceeding capacity. The DAA will provide detailed traffic analyses quantifying the benefits of the widening and potential of latent demand, the potential for HOV/managed lane options, and bus transit service along the corridor. Conceptual improvements in Segment B would be integrated with the surrounding ecosystem and will need to be coordinated with the ongoing restoration efforts in the area and build resiliency to SLR. To increase the capacity of the Segment B, the following options for widening Segment B are proposed for detailed traffic operations analysis.

- 3-lane section
- 4- lane section

The typical sections for each of these alternatives are shown below. The three-lane contra-flow will include either a moveable barrier or a reversible median lane with fixed barriers. The fixed barrier reversible lane section will require a 12' lane with 2' left shoulder and a 10' right shoulder. Given the 2' width of each of the two permanent barriers, this option will not significantly reduce the roadway footprint compared to a 4-lane section with a median barrier. Both the 3 lane and 4 lane alternatives will provide for shared bicycle usage on 10' right shoulders. Current concrete barriers along the levee sections of SR 37 were designed with openings to allow small animals like the salt harvest mouse to cross the roadway. The proposed design, either fixed or movable barrier, will require same type of provision for any levee segments.

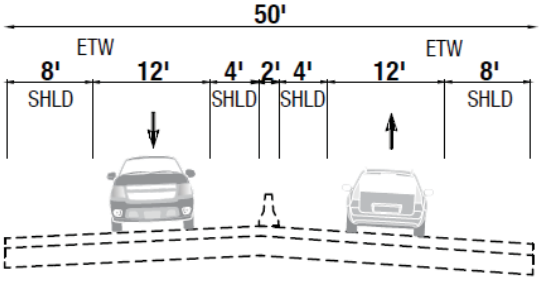


Exhibit 27: Existing Segment B

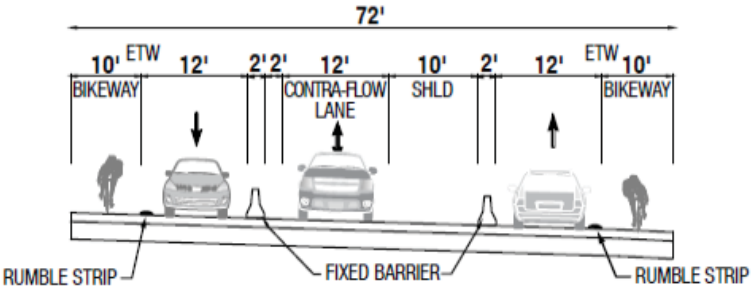


Exhibit 28: Three Lanes Section with Fixed Barrier

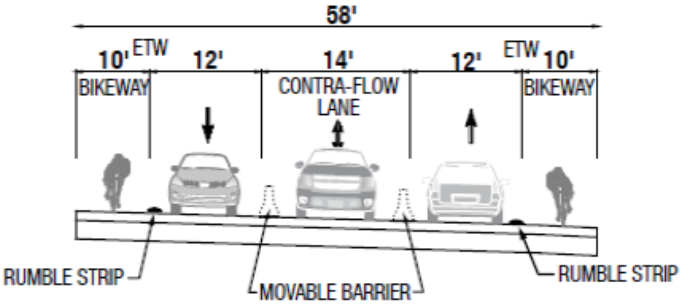


Exhibit 29: Three Lanes Contra-Flow Section with Movable Barrier and Bikeways

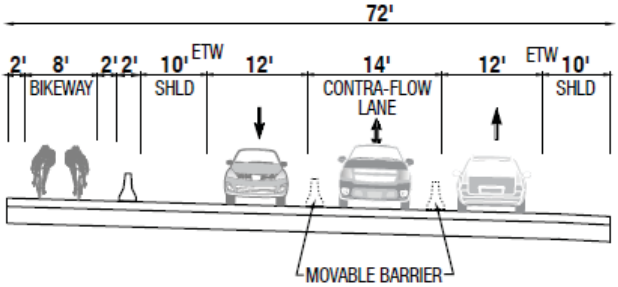


Exhibit 30: Three Lanes Contra-Flow Section with Movable Barrier and Bikeway

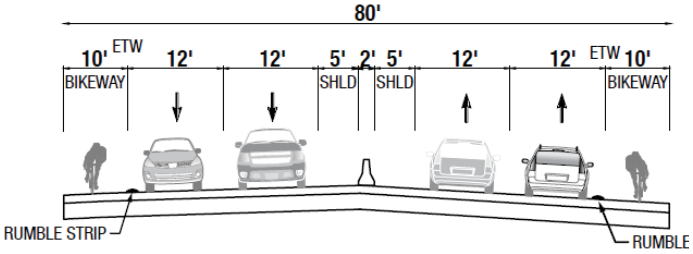


Exhibit 31: Four Lane Section with Bikeways

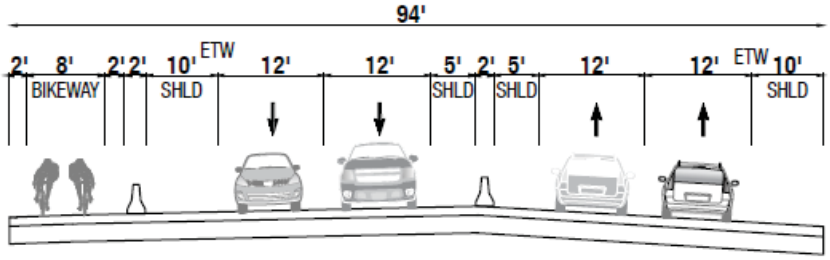


Exhibit 32: Four Lane Section with Bikeway

Highway modifications will integrate traffic improvements, environmental sensitivity and enhancement considerations, and flooding and SLR adaptation (as discussed in the Environmental Sensitivity section of this report). No-net loss mitigation for long-term SLR strategies could occur through:

1. Alternating fill embankment and causeway to raise road: The causeway would create wetland restoration opportunities by reconnecting the hydrologic and ecological landscape, providing a corridor for species to migrate upslope as sea level rises, and offsetting fill. Other alternatives to reconnect hydrology and habitat, such as culvert connections underneath the highway, could also be considered. Culvert connections could be a more economical alternative to reconnect dike areas to the bay compared to an open channel connection with bridge/causeway, however, the ecological benefits would be less and embankment fill impacts would be mitigated through other methods.

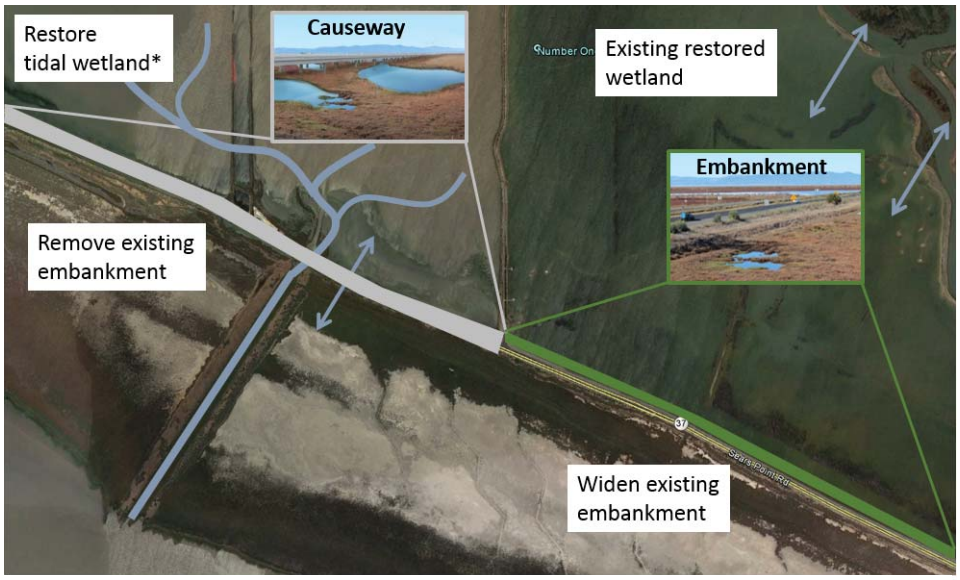


Exhibit 33: Hypothetical Illustration of Restoration Scenario

2. Large-scale offsite restoration: In this large-scale approach, large, contiguous parcels of land would be restored to wetland habitat, which would provide habitat of higher ecological value when compared to smaller parcels of land. A suitable site within San Francisco Bay (preferably within the San Pablo Bay) could be identified through stakeholder coordination.

3. Large-scale on-site restoration: Large-scale on-site restoration opportunities may be available, which would enhance the ecological value of landscape within the greater project corridor. Opportunity may exist for collaboration or contribution to on-going restoration projects in the area. A suitable site along the SR 37 corridor could be identified through stakeholder coordination.

Mare Island Interchange Improvements: Improvements include reconstruction of Mare Island Interchange to address traffic and flooding issues. Interchange improvements would need to align with widening and raising of the two-lane segment B.

Raised Roadway in Segment C: Improvement options include raising the highway between the Napa River Bridge and just west of SR29/SR37 Interchange for a length of approximately 1 mile, reconstructing the Sacramento Street Overcrossing, White Slough Bridge, the western approach of Napa River Bridge, and the westerly ramps at SR29/SR37 Interchange.

The DAA will develop near-term shoreline improvement scenarios based on different design storms and planning horizons to evaluate the cost-benefit of proposed improvements. The timeline of implementing traffic, flood control, and environmental improvements from near-term to long-term is shown in the implementation timeline Exhibit 34.

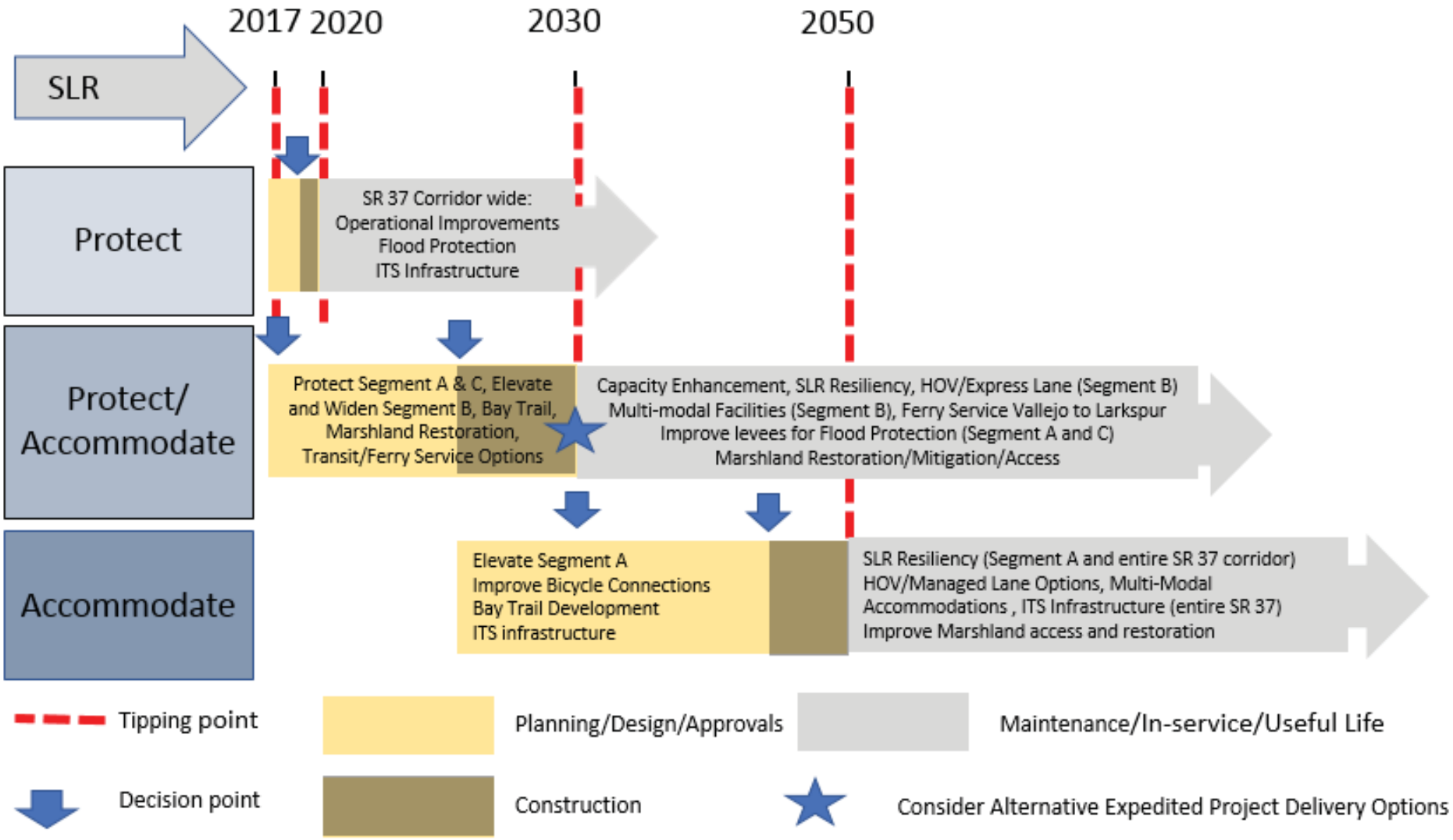


Exhibit 34: Implementation Timeline

POTENTIAL IMPROVEMENTS-SUMMARY

Table 4 summarizes near-term improvements with total project cost estimates and implementation time-frame.

Table 4 Near-Term Improvements Summary

Location	Improvement	Total Project Cost (2017 $)	Implementation Time Frame
Segment A	Flood Protection	$7.5 M	1-3 years
Segment B	SR 37/SR 121 Intersection Improvements		
	• Signal optimization and roadway widening	$5 M	1-3 years
	• Continuous T intersection	$7 M	1-3 years
	• Roundabout with two EB by-pass lane	$10 M	1-3 years
	Flood Protection		
	• Raise levee crest at low spots	$3.5 M	1-3 years
	• Shoreline protection at Tolay Lagoon	$3.5 M	1-3 years
	Fix Settlement Issues at Railroad Crossing (Work done by Northwestern Pacific)		1-2 years
	Metering at Mare Island WB on-ramp	$4 M	3-5 Years
	Westbound merge and lane drop improvements west of Mare Island on-ramp	$2.5 M	1-3 Years
	Flood protection-Raise road at Mare Island	$5 M	1-3 years
Corridorwide	Park and Ride Lots (STA is leading a planning study)	$2 M	1-2 Years
Corridorwide	Express Bus Transit Service (Suggested study by others)	TBD	1-2 Years
Corridorwide	ITS Improvements-Changeable Message Signs	$4 M	1-2 Years

Notes: Costs Include PA/ED Support, PS&E Support, Right of Way Support, and Construction Support Costs

Table 5 summarizes mid- to long term improvements with probable cost estimates and implementation time-frame. It is proposed that the near-term flood improvements be implemented immediately (1-3 years) and the mid-term improvements be implemented in 10-20 years that can protect the highway from flooding till 2050.

Table 5 Mid- to Long-term Improvements Summary

Location	Improvement	Total Project Cost (2030 $)	Implementation Time Frame
Segment A	Levee Improvements for flood protection	$7 M	10-20 years
	Raised Roadway and Lakeville Highway Interchange Improvements	$420 M - 1,600 M	20-30 years
Segment B	SR 121 Interchange Improvements including SR 37 and Rail Road grade separation	$100 M	10-20 years
	Widen 2-lane segment from SR-121 to Mare Island + Mitigation		
	• Roadway widening to 3 lanes at existing elevation	$210 M	7-10 years
	• Roadway widening to 4 lanes at existing elevation	$350 M	7-10 years
	• Roadway widening to 3 lanes, raised on berm/fill	$880 M	7-10 years
	• Roadway widening to 4 lanes, raised on berm/fill	$1,100 M	7-10 years
	• Roadway widening to 3 lanes, raised on causeway	$1,900 M	7-10 years
	• Roadway widening to 4 lanes, raised on causeway	$2,500 M	7-10 years
	Mare Island Interchange Improvements-Complete reconstruction of Interchange	$50 M	7-15 years
	Flood protection; Raise road at Mare Island to protect highway from future flooding (1 ft. SLR at 2050) (assumes short-term improvements were implemented previously)	$8 M	7-10 years
Segment C	Raised Roadway-From Napa River Bridge to just west of SR 29/SR 37 Interchange	$150 M-$370 M	10-20 years

Notes: Costs Include

- *3 to 1 Environmental Mitigation*
- *PA/ED Support, PS&E Support, Right of Way Support, and Construction Support Costs*
- *Escalation Costs*

PRIORITY SEGMENT

Segment B between SR 121 (Sears Point) and Mare Island (Vallejo) was identified as a priority segment for capacity enhancement to close the gap between the two four-lane segments on either end. The UC Davis Study performed vulnerability and risk assessments related to SLR for each study segment by estimating and aggregating impacts to costs of improvements, recovery time, public safety impacts, economic impact on commuters and goods transport, impacts on transit routes, proximity to Communities of Concern, and impacts on recreational activities. Based on the results of the risk assessment, Segments A and C were assigned moderate risk ratings, while Segment B was assigned a high-risk rating. The Corridor Plan reevaluated the risk and vulnerability assessment, with the addition of alternate routes impacts, which ultimately concurs with the UC Davis assessment. Consequently, it was concluded that Segment B would be considered as the priority segment in the study corridor.

NEXT STEPS

As next steps, detailed traffic operations analysis will be performed for the near-term and mid- to long-term improvements recommended in the Corridor Plan based on forecasted demand and growth in the corridor. Preliminary engineering design plans and cost estimates will also be developed for the Priority Segment B project.