I-80/Gilman Street Interchange Improvement Project

LOCATION HYDRAULIC STUDY REPORT

Caltrans District 04

04-ALA-80-PM 6.38/6.95

EA 04-0A7700/Project ID 0400020155

MAY 2018

I-80 GILMAN
INTERCHANGE IMPROVEMENT PROJECT

Caltrans

ALAMEDA County Transportation Commission

CITY OF BERKELEY

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May 2018

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Executive Summary

The I-80 Gilman Interchange Improvement Project (Project) is located in Alameda County at the Interstate 80 (I-80)/Gilman Street interchange in the cities of Berkeley and Albany (Post Miles [PM] 6.38 to 6.95). Within the limits of the proposed Project, I-80 is a conventional 10-lane freeway with 12-foot lanes and 11-foot shoulders. Gilman Street is a 4-lane major arterial with 11-foot lanes and 6-foot shoulders that passes underneath I-80. The I-80/Gilman Street interchange is a four-lane arterial roadway (Gilman Street), with two lanes in the east/west direction that are intersected with four I-80 on- and off-ramps, West Frontage Road, and the Eastshore Highway. The purpose of the Project is to simplify and improve navigation, mobility, and traffic operations; reduce congestion, vehicle queues, and conflicts; improve local and regional bicycle connections and pedestrian facilities; and improve safety at the I-80/Gilman Street interchange. Current conditions, along with an overall increase in vehicle traffic, have created poor, confusing, and unsafe operations in the interchange area for vehicles, pedestrians, and bicyclists.

The Project's Build Alternative proposes to reconfigure the I-80 ramps and intersections at Gilman Street. The I-80 ramps and frontage road intersections at each ramp intersection would be combined to form a single roundabout intersection on each side of I-80. Gilman Street would be reconstructed on the west from the parking lots at Tom Bates Regional Sports Complex along Gilman Street to the eastern side of the 4th Street intersection. Work would also include reconstruction of West Frontage Road and Eastshore Highway within the Project limits. Improvements associated with installation of the roundabouts would extend approximately 280 feet south on West Frontage Road from the Gilman Street interchange and approximately 250 feet north and 1,010 feet south on Eastshore Highway from the Gilman Street interchange. Work associated with reconfiguration of the eastbound I-80 off-ramp and on-ramp would extend approximately 820 feet south and 280 feet north of the interchange. Work associated with reconfiguration of the westbound I-80 off-ramp and on-ramp would extend approximately 370 feet north and 230 feet south of the interchange. There are no proposed improvements to the freeway mainline. The Project would also include a new bicycle/pedestrian overcrossing. The structure would be located south of Gilman Street with two staircases incorporated into the overcrossing, one on each side of I-80. There would also be retaining walls on the east and west side of the overcrossing; they would be approximately 6 feet tall at the highest point and taper down to zero. The Build Alternative includes a two-way cycle track on the south side of Gilman Street between the eastern I-80/Gilman Street ramps and 4th Street. The addition of the two-way cycle track would require installation of a traffic signal at the intersection of 4th Street and Gilman Street. Improvements would be made along 4th Street to Harrison Street to 5th Street to provide bicycle connectivity between the Codornices Creek Path and the two-way cycle track on Gilman Street. Additional pedestrian and bicycle improvements include upgrading the 3rd Street/UPRR crossing at Gilman Street to accommodate the cycle track.

West of the I-80/Gilman Street interchange, the existing San Francisco Bay Trail (Bay Trail) would be extended approximately 660 feet west along the south side of Gilman Street from its current terminus at the intersection of West Frontage Road and Gilman Street to just beyond Berkeley's city limits. Existing Pacific Gas & Electric (PG&E) overhead electric lines along Gilman Street, West Frontage Road, and Eastshore Highway would be relocated as part of the

Build Alternative. A separation device would be installed underground along Gilman Street to separate trash, mercury, and polychlorinated biphenyls (PCBs). An existing East Bay Municipal Utility District (EBMUD) recycled water transmission line would be relocated and extended as part of the Project. Approximately 1,100 feet of a new 12-inch recycled water transmission pipeline within Eastshore Highway from Page Street to Gilman Street and approximately 1,050 feet of pipeline within Gilman Street from 2nd Street to the Buchanan Street extension, are part of the Build Alternative. Approximately 1,100 feet of an existing 10-inch EBMUD recycled water pipeline located within California Department of Transportation (Caltrans) right-of-way (ROW) along the eastbound Gilman Street off-ramp shoulder, would be abandoned in place or removed. A new City of Berkeley sewer line would be installed underneath Gilman Street, beginning at a point east of the Interchange and ending on the west side I-80 at the approximate entrance to the Tom Bates Sports Complex parking lots. Construction of the roundabout would expand the ramp intersection to the north and would require relocation of the Golden Gate Fields entrance and exit gate to their stables. The Build Alternative would relocate the entrance and exit gate to the Gilman Street Extension.

The purpose of this study is to determine existing Federal Emergency Management Agency (FEMA) floodplains within the Project limits and determine whether the Project improvements will be affected by or will affect the base flood.

The Project limits are composed of FEMA Zone VE, Zone X (shaded and unshaded), and Zone AO floodplains. Zone VE floodplains are coastal floodplains subject to flooding and velocity hazard (wave action) by the 1% annual chance flood. The shaded Zone X area is east of I-80 and represents areas in the 0.2% annual chance floodplain. Areas west of I-80 and outside of Zone VE are in the unshaded portion of Zone X, representing areas outside the Special Flood Hazard Area (SFHA) and above the elevation of the 0.2% annual chance flood. The area along 5th Street north of Harrison Street is adjacent to Zone AO, which represents areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where flood depths are between 1 and 3 feet and where average depths have been determined. The Zone AO average flood depth is 2 feet. Sea level rise has the potential to impact some localized areas within the Project limits.

The Project would add under one acre of impervious area. The Project does not propose to change land use within the Project area. The amount of additional fill in the floodplain and change in the 100-year water surface elevation (WSE) will be minimal.

Proposed drainage systems would be designed to capture and convey runoff from the design storm in the Project area. Structures blocking coastal flood flows have been avoided in the design of the Project. Cut and fill volumes in the floodplain Zone VE have been balanced to minimize fill. Work done within Zone AO is limited to striping only, so it would not introduce additional fill inside the floodplain. Sea level rise has the potential to affect the Project area in the year 2050 and 2100 projections. A tidal flap gate would be installed at the existing headwall of the 60-inch reinforced concrete pipe at the west end terminus of Gilman Street to prevent backflow in the storm drain system. The tidal flap gate will prevent tidal backflow from entering into the Project area; however, the flap gate would not prevent impacts from sea level rise. Preventing impacts from sea level rise is beyond the scope of this Project. The Project is anticipated to have

minimal impact on floodplains in the Project area and therefore, no minimization measures are proposed as part of the Project.

Acronyms

ACFC&WCD	Alameda County Flood Control and Water Conservation District
ADT	average daily traffic
Bay Trail	San Francisco Bay Trail
BCDC	Bay Conservation and Development Commission
BFE	Base Flood Elevation
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CPUC	California Public Utilities Commission
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
I-	Interstate
ICM	Integrated Corridor Mobility
NAVD 88	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
PCBs	polychlorinated biphenyls
RCP	reinforced concrete pipe
ROW	right-of-way
SFHA	Special Flood Hazard Area
TCE	Temporary Construction Easement
TDM	Transportation Demand Management
TSM	Transportation System Management
UPRR	Union Pacific Railroad
WSE	water surface elevation

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY

Dist. 04 Co. ALA Rte. 80
P.M. 6.38/6.95 EA: 04-0A770 Bridge No. Not Applicable
Federal-Aid Project Number: Not Applicable

Floodplain Description:
Flood Insurance Rate Maps (FIRMs) No. 06001C0018G and No. 06001C0014G identify portions of the Project's Area of Potential Effect (APE) as being within a Special Flood Hazard Area (SFHA) subject to inundation by the 1% annual chance flood associated with San Francisco Bay. Within the Project's APE, areas of Gilman Street west of I-80 and the Golden Gate Fields north west parking lot encroach upon the SFHA designated as Zone VE, which represents a coastal flood zone with velocity hazard (wave action), and an area where base flood elevations have been determined. For the areas of Gilman Street west of I-80 and the Golden Gate Fields north west parking lot, the Zone VE base flood elevation are, respectively, 10 feet North American Vertical Datum of 1988 (NAVD 88) and 9 feet NAVD 88. FIRM No. 06001C0018G also identifies a portion of the Project's APE located at 5th Street north of Harrison Street as being within a SFHA. This area is designated as Zone AO, which represents areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where flood depths are between 1 and 3 feet and where average depths have been determined. The Zone AO average flood depth is 2 feet.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
There are no proposed walls or other physical barriers that would inhibit the existing floodplain characteristics. Improvements include replacement and potential increase of impervious surface, minimal fill to achieve the desired roadway grade, and installation of a tidal flap gate at the existing headwall of the 60-inch reinforced concrete pipe at the west end terminus of Gilman Street.

2. ADT: Current 19,064 (2015) Projected 27,312 (2040)

3. Hydraulic Data:

Base Flood:	Q_{100}= _____ cfs	WSE_{100}= 9, 10 feet NAVD 88
The flood of record, if greater than Q_{100}	Q= _____ cfs	WSE= _____
Overtopping flood	Q= _____ cfs	WSE= _____

Are NFIP maps and studies available? NO _____ YES X

4. Is the highway location alternative within a regulatory floodway? NO X YES _____

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A.	Residences?	NO X	YES _____
B.	Other Bldgs?	NO X	YES _____
C.	Crops?	NO X	YES _____
D.	Natural and beneficial Floodplain values?	NO X	YES _____

""Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO _____	YES X
B. Emergency vehicle access?	NO _____	YES X
C. Practicable detour available?	NO _____	YES X
D. School bus or mail route?	NO _____	YES X

7. Estimated duration of traffic interruption for 100-year event hours: 0.33

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$ _____
B	Property	$ _____
	Total	$ _____

9. Assessment of Level of Risk Low X
Moderate
High

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY cont.

Dist. 04 Co. ALA Rte. 80
P.M. 6.38/6.95 EA: 04-0A770 Bridge No. Not Applicable
Federal-Aid Project Number: Not Applicable

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

Amliff Aha *Date* 5/4/18
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO X YES

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

_____ *Date* _____
Local Agency/Consulting Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

_____ *Date* _____
District Project Manager *(capital and 'on' system projects)*

_____ *Date* _____
Local Agency Project Manager *(Local Assistance projects)*

_____ *Date* _____
District Local Assistance Engineer/District Hydraulic Branch
(District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

_____ *Date* _____
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

FLOODPLAIN EVALUATION REPORT SUMMARY

Dist. 04 Co. ALA Rte. 80
P.M. 6.38/6.95 EA: 04-0A770 Bridge No. Not Applicable
Federal-Aid Project Number: Not Applicable

Limits:

Project extends along I-80 from PM 6.38/6.95. Gilman Street would be reconstructed on the west from the parking lots at Tom Bates Regional Sports Complex along Gilman Street to the eastern side of the 4th Street intersection. Improvements associated with installation of the roundabouts would extend approximately 280 feet south on West Frontage Road from the Gilman Street interchange and approximately 250 feet north and 1,010 feet south on Eastshore Highway from the Gilman Street interchange. Work associated with reconfiguration of the eastbound I-80 off-ramp and on-ramp would extend approximately 820 feet south and 280 feet north of the interchange. Work associated with reconfiguration of the westbound I-80 off-ramp and on-ramp would extend approximately 370 feet north and 230 feet south of the interchange. West of the I-80/Gilman Street interchange, the existing Bay Trail would be extended approximately 660 feet west along the south side of Gilman Street from its current terminus at the intersection of West Frontage Road and Gilman Street to just beyond Berkeley's city limits. Improvements would be made along 4th Street to Harrison Street to 5th Street to provide bicycle connectivity between the Codornices Creek Path and the two-way cycle track on Gilman Street. The Golden Gate Fields north east parking lot, north west parking lot, internal access road, and the Gilman Street Extension are included in the Project limits.

Floodplain Description:

Flood Insurance Rate Maps (FIRMs) No. 06001C0018G and No. 06001C0014G identify portions of the Project's Area of Potential Effect (APE) as being within a Special Flood Hazard Area (SFHA) subject to inundation by the 1% annual chance flood associated with San Francisco Bay. Within the Project's APE, areas of Gilman Street west of I-80 and the Golden Gate Fields north west parking lot encroach upon the SFHA designated as Zone VE, which represents a coastal flood zone with velocity hazard (wave action), and an area where base flood elevations have been determined. For the areas of Gilman Street west of I-80 and the Golden Gate Fields north west parking lot, the Zone VE base flood elevation are, respectively, 10 feet North American Vertical Datum of 1988 (NAVD 88) and 9 feet NAVD 88. FIRM No. 06001C0018G also identifies a portion of the Project's APE located at 5th Street north of Harrison Street as being within a SFHA. This area is designated as Zone AO, which represents areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where flood depths are between 1 and 3 feet and where average depths have been determined. The Zone AO average flood depth is 2 feet.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	X	
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

FLOODPLAIN EVALUATION REPORT SUMMARY

Dist. 04 Co. ALA Rte. 80
P.M. 6.38/6.95 EA: 04-0A770 Bridge No. Not Applicable
Federal-Aid Project Number: Not Applicable

PREPARED BY:

_____ *Date* _____
Local Agency/Consulting Project Engineer *(capital and 'on' system projects)*

Andrette Ochoa *Date* 5/4/18
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

_____ *Date* _____
District Project Manager *(capital and 'on' system projects)*

_____ *Date* _____
District Local Assistance Engineer/District Hydraulic Branch
(District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

_____ *Date* _____
District Senior Environmental Planner *(or Designee)*
Note: a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding

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1 GENERAL DESCRIPTION

1.1 Project Description

The Project is located in Alameda County at the Interstate 80 (I-80)/Gilman Street interchange in the cities of Berkeley and Albany (Post Miles [PM] 6.38 to 6.95) (Figure 1 in the Vicinity Map and Figure 2. Location Map). Within the limits of the proposed Project, I-80 is a conventional 10-lane freeway with 12-foot-wide lanes and 11-foot-wide shoulders. Gilman Street is a 4-lane major arterial with 11-foot-wide lanes and 6-foot-wide shoulders that passes underneath I-80. The I-80/Gilman Street interchange is a four-lane arterial roadway (Gilman Street), with two lanes in the east/west direction that are intersected with four I-80 on- and off-ramps, West Frontage Road, and Eastshore Highway. The purpose of the Project is to simplify and improve navigation, mobility, and traffic operations; reduce congestion, vehicle queues, and conflicts; improve local and regional bicycle connections and pedestrian facilities; and improve safety at the I-80/Gilman Street interchange. Current conditions, along with an overall increase in vehicle traffic, have created poor, confusing, and unsafe operations in the interchange area for vehicles, pedestrians, and bicyclists.

1.1.1 Project Alternatives

This section describes the proposed action and the Project alternatives developed to meet the identified purpose and need of the Project, while avoiding or minimizing environmental impacts. The two alternatives include the Roundabout Alternative and the No Build Alternative. The general Project vicinity is shown in Figure 1 and the specific Project location is shown in Figure 2.

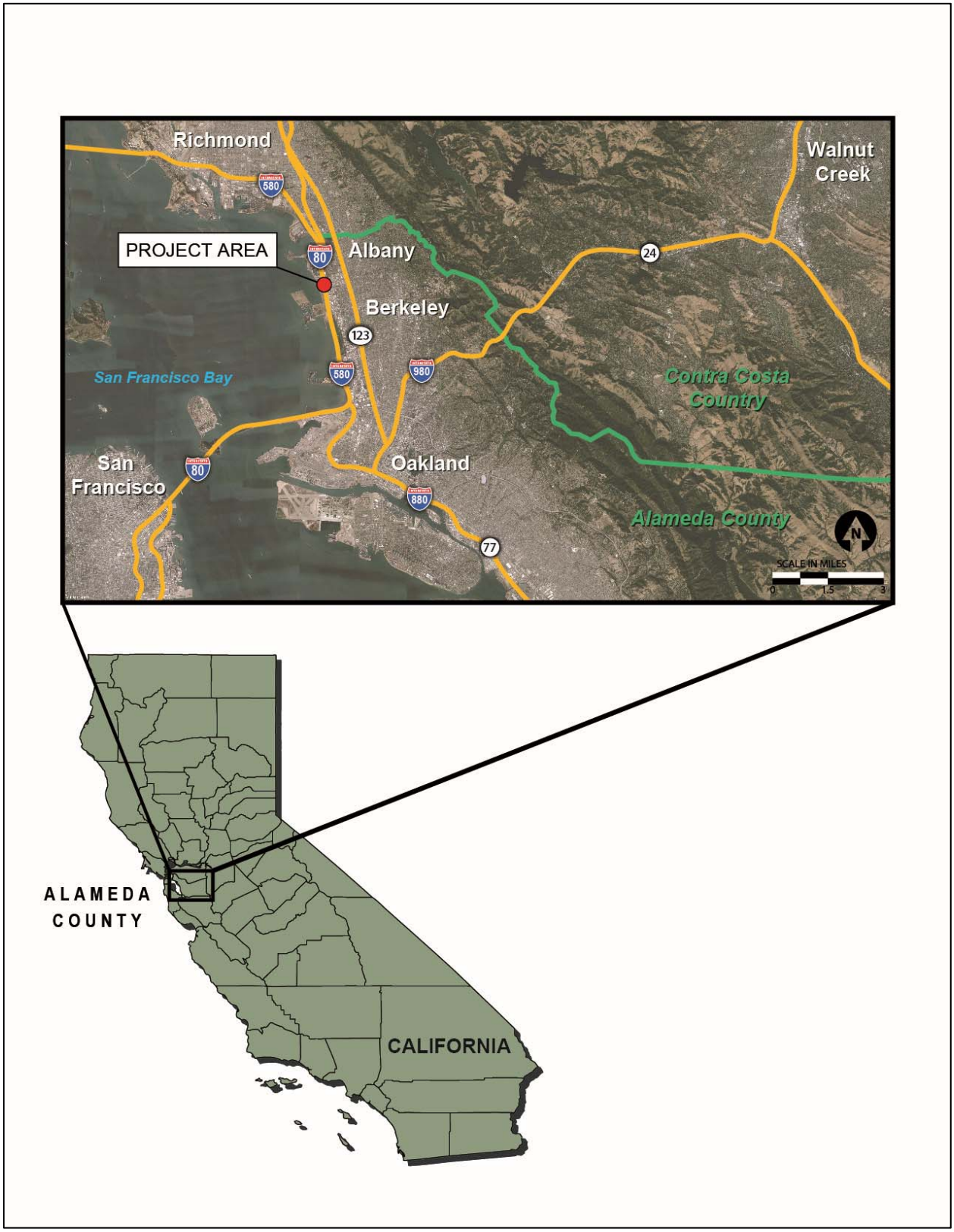

Figure 1. Vicinity Map

Source: Parsons

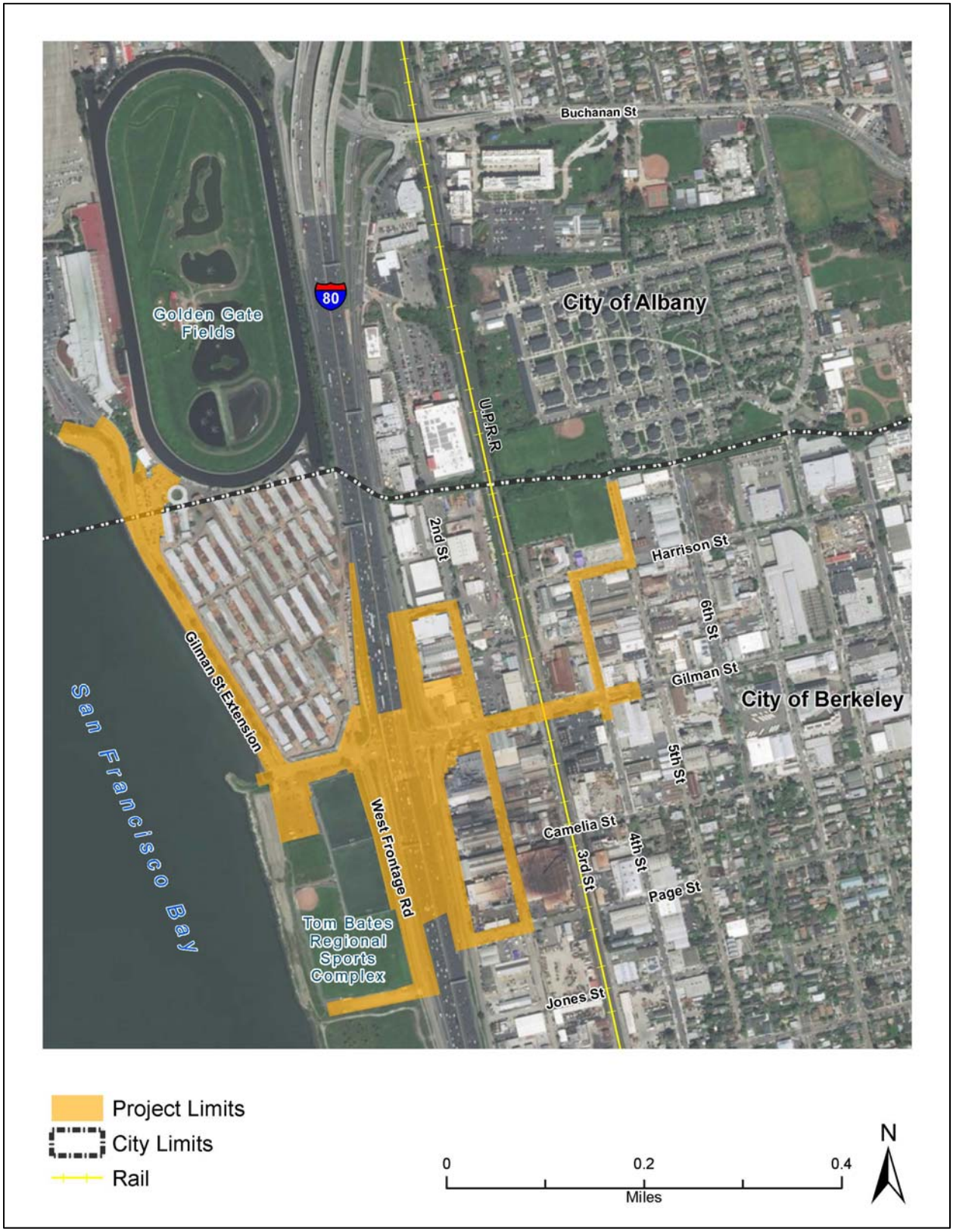

Figure 2. Location Map

Source: Parsons

1.2 Build Alternative

The Roundabout Alternative includes the reconfiguration of I-80 ramps and intersections at Gilman Street. The existing non-signalized intersection configuration with stop-controlled ramp termini would be replaced with two hybrid single-lane roundabouts with multilane portions on Gilman Street at the I-80 ramp terminals. The I-80 ramps and frontage road intersections at each ramp intersection would be combined to form a single roundabout intersection on each side of I-80. Gilman Street would be reconstructed on the west from the parking lots at Tom Bates Regional Sports Complex along Gilman Street to the eastern side of the 4th Street intersection. Work would also include reconstruction of West Frontage Road and Eastshore Highway within the Project limits. In addition, the northern and southern legs of the eastern roundabout would be reduced from two lanes to one lane entering the roundabout. The southbound and northbound movements onto Eastshore Highway would instead be made via 2nd Street to Page Street or 2nd Street to Harrison Street.

Improvements associated with installation of the roundabouts would extend approximately 280 feet south on West Frontage Road from the Gilman Street interchange and approximately 250 feet north and 1,010 feet south on Eastshore Highway from the Gilman Street interchange. Work associated with reconfiguration of the eastbound I-80 off-ramp and on-ramp would extend approximately 820 feet south and 280 feet north of the interchange. Work associated with reconfiguration of the westbound I-80 off-ramp and on-ramp would extend approximately 370 feet north and 230 feet south of the interchange. There are no proposed improvements to the freeway mainline. A metering light would be installed on West Frontage Road to regulate the volume of northbound traffic that enters the western roundabout.

The western roundabout intersection would consist of four approaching legs: eastbound and westbound Gilman Street, West Frontage Road, and I-80 westbound off-ramp. The eastern roundabout intersection would include five approaching legs: I-80 eastbound off-ramp, northbound and southbound Eastshore Highway, and eastbound and westbound Gilman Street. A left-turn pocket would be provided on Gilman Street for vehicles traveling eastbound turning onto northbound 2nd Street. Left turns will be restricted from westbound Gilman Street turning onto southbound 2nd Street.

Improvements on 2nd Street north of Gilman Street include reduced crossing distances, new striping, signing, new pavement, additional landscaping, and new light poles. South of Gilman Street, improvements on 2nd Street include a bulb-out on the southeast corner of the intersection and converting the road to one-lane southbound, while the other lane would be used as a designated parking/loading zone for businesses.

All modified roadways including ramps, frontage roads, and arterials would be improved. Improvements would include mill and overlay of pavement, striping, relocation of drainage inlets, lighting, and signage.

Several operational improvements would be incorporated in to the Project. A metering signal would be installed on the northbound leg of the western roundabout to limit the volume of traffic that is bypassing the freeway using West Frontage Road. A queue cutting signal will be placed

on the eastbound leg of the Union Pacific Railroad (UPRR) crossing at 3rd Street to prevent traffic from extending across the UPRR tracks.

The Roundabout Alternative is shown in Figure 3.

1.2.1 Pedestrian and Bicycle Facilities

A shared-use Class I path consisting of 10-foot-wide travel way with a 2-foot-wide shoulder for pedestrians and bicyclists would be constructed on the south side of Gilman Street from 2nd Street to the eastern roundabout. The shared-use path would extend south along Eastshore Highway, where it would then connect to a proposed bicycle/pedestrian overcrossing. The overcrossing would be constructed over I-80, merging into the existing San Francisco Bay Trail (Bay Trail) that runs parallel to West Frontage Road. The at-grade shared-use path would continue on the south side of Gilman Street under I-80 and terminate at the Bay Trail on the west side of the interchange.

The bicycle/pedestrian overcrossing would be similar to the existing bicycle/pedestrian overcrossing over I-80 at University Avenue. The structure would be located south of Gilman Street and have a minimum of three spans with a maximum span length of approximately 230 feet over I-80. The foundations for the pedestrian bridge would be located on 2-foot diameter Cast-In-Drilled-Hole piles 120 feet below the existing ground surface. There would be two staircases incorporated into the overcrossing, one on each side of I-80. The staircases would be approximately 45 feet long with a height of 25 feet to connect to the overcrossing. There would also be retaining walls on the east and west side of the overcrossing, approximately 6 feet tall at the highest point and taper down to zero. The maximum depth of the retaining wall piles are expected to be 50 feet below the ground surface.

Improvements would be made along 4th Street to Harrison Street to 5th Street to provide bicycle connectivity between the Codornices Creek Path and the two-way cycle track on Gilman Street. These improvements would consist of painted shared-lane markings, also known as sharrows, on the pavement throughout this corridor. Bicycle signage and pedestrian scale lighting would be constructed as part of the improvements.

Approximately 125 feet of new curb, gutter, and sidewalk beginning at the corner of Harrison Street and 4th Street and ending half-way down the block towards 5th Street, would be constructed. Parallel parking would be added along this new section of curb and sidewalk. The bus stop located at the corner of 4th Street and Gilman Street would be removed.

The Build Alternative includes a two-way cycle track on the south side of Gilman Street between the eastern I-80/Gilman Street ramps and 4th Street. The two-way cycle track is separated from vehicle traffic with a minimum 3-foot-wide striped buffer and a parking lane in some locations. The addition of the two-way cycle track would require installation of a traffic signal at the intersection of 4th Street and Gilman Street. The northern curb line on Gilman Street would also be shifted 2 to 5 feet north. Along Eastshore Highway, the sidewalk, curb, and gutter would be replaced between Page Street and Gilman Street.

West of the I-80/Gilman Street interchange, the existing Bay Trail would be extended approximately 660 feet west along the south side of Gilman Street from its current terminus at the intersection of West Frontage Road and Gilman Street to just beyond Berkeley's city limits. The proposed Bay Trail extension would be 10-feet-wide, unstriped, with 2-feet-wide unpaved shoulders on either side of the trail. On-street parking would be reduced by approximately 18 spaces at the end of Gilman Street as a result of the new trail extension.

Additional pedestrian and bicycle improvements include upgrading the 3rd Street/UPRR crossing at Gilman Street to accommodate the cycle track. Improvements would include relocating the gate, flashing beacons, addition of a bicycle signal, installation of medians, and improved striping and signage. All improvements will be approved by the UPRR and the California Public Utilities Commission (CPUC).

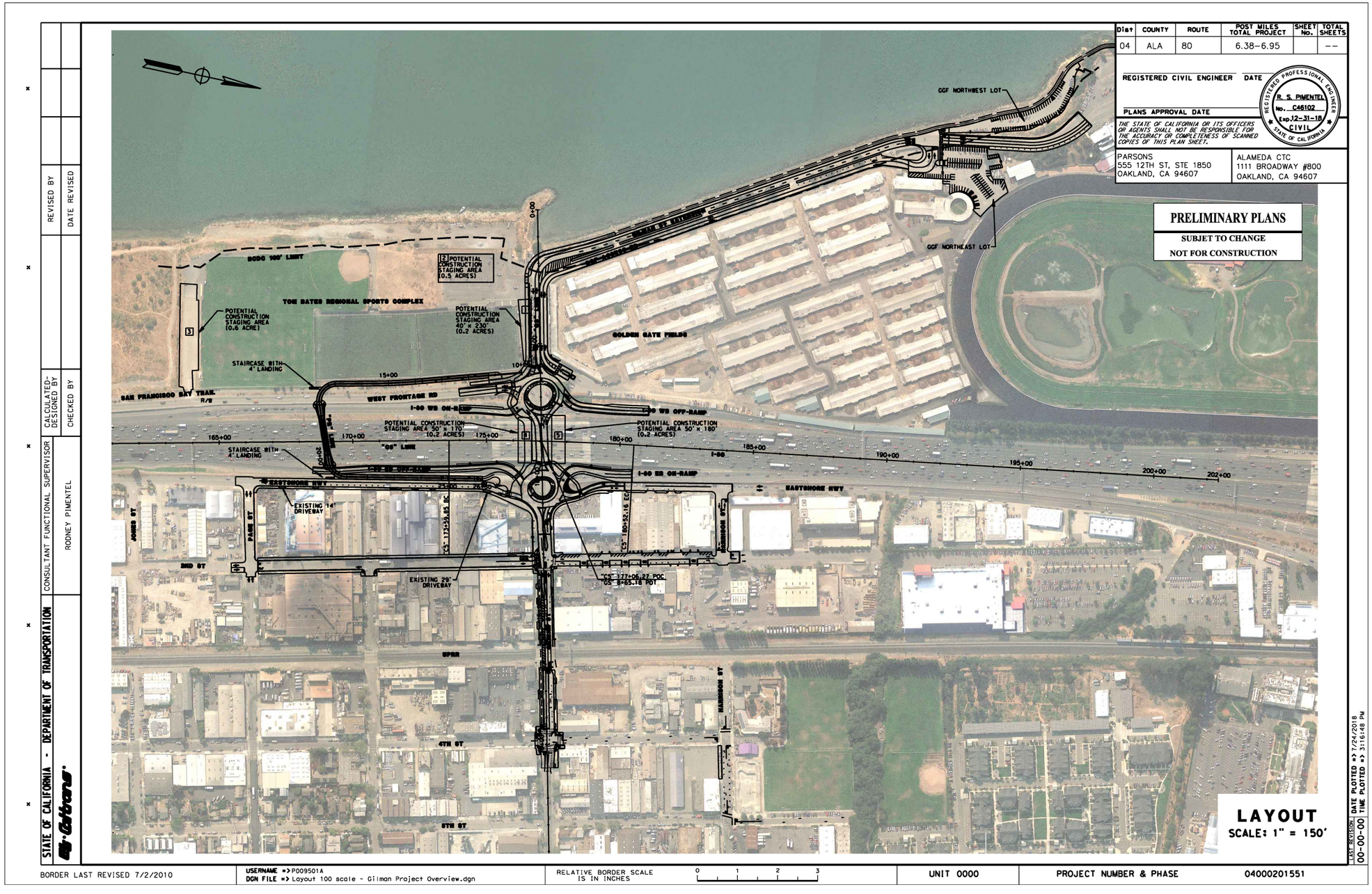

Figure 3. Roundabout Alternative

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1.2.2 Golden Gate Fields Access

The existing driveway entrance to Golden Gate Fields is located immediately adjacent to the westbound I-80 off-ramp at the end of the curb return on Gilman Street. Construction of the roundabout would expand the ramp intersection to the north and would require relocation of the Golden Gate Fields entrance and exit gate to their stables.

Alternate entrance and exit gate options for Golden Gate Fields were evaluated and discussed with Golden Gate Fields management in a series of meetings.

The Build Alternative would relocate the entrance and exit gate to the Gilman Street Extension. The existing gate would be connected to Golden Gate Fields Access Road, allowing for the existing security shed to remain in place. The intersection of Gilman Street Extension with Golden Gate Fields Access Road would be improved and Gilman Street would be widened to the south to provide space for two two-lane roads separated by a median. The Golden Gate Fields north east parking lot would be re-sized and restriped to allow room for the Gilman Street Extension/Golden Gate Fields Access Road intersection. The existing security shed leading to the north east and northwest parking lots would be moved north and reconstructed with new gates. The Golden Gate Fields north west parking lot would be restriped to maximize the parking spaces. Both parking lots would be repaved, restriped, and lighting and landscaping elements would be added. Golden Gate Fields internal access road and the Gilman Street Extension would be repaved and restriped between Gilman Street and the north east and north west parking lots. Fifteen new parallel parking spaces would be striped along the Gilman Street access road. There would be no net loss of parking for Golden Gate Fields.

1.2.3 Property Acquisitions

Partial acquisitions will be required for right-of-way (ROW) from Golden Gate Fields and EBRPD. Relocation of the driveway would be required from a property located on the south side of Gilman and 2nd Streets. Additionally, a permit to construct from Golden Gate Fields would be required to complete improvements on their property. Temporary Construction Easements (TCE) would be required for construction equipment storage, staging, and laydown from the East Bay Regional Park District (EBRPD) and various property owners along Gilman Street, 4th Street, Harrison Street, and 5th Street.

1.2.4 Utilities, Landscaping, and Drainage

Existing PG&E overhead electric lines along Gilman Street, West Frontage Road, and Eastshore Highway would be relocated as part of the Roundabout Alternative. Some of these overhead lines may be placed underground. Minor drainage modifications would also be required to conform to the new roundabout alignment and drainage improvements associated with the two-way cycle track along Gilman Street would also be required. Utility relocations and new drainage systems may require trenching to a depth of approximately 6 feet.
A separation device would be installed underground along Gilman Street to separate trash, mercury, and polychlorinated biphenyls (PCBs). A tidal flap gate would be installed at the existing headwall of the 60-inch reinforced concrete pipe at the west end terminus of Gilman Street. Replacement of the existing headwall and associated rip rap may include in-water work.

Work below the ordinary mean high water mark may be required. Dewatering or a coffer dam may also be required.

New light pole foundations and ramp metering poles would be 2 feet in diameter and would range from 5- to 13-feet-deep near the roundabout. An existing East Bay Municipal Utility District (EBMUD) recycled water transmission line would be relocated and extended as part of the Project. Approximately 1,100 feet of a new 12-inch recycled water transmission pipeline within Eastshore Highway from Page Street to Gilman Street and approximately 1,050 feet of pipeline within Gilman Street from 2nd Street to the Buchanan Street extension are part of the Roundabout Alternative. The maximum excavations for the pipe trench would be approximately 24 inches wide by 60 inches deep. Approximately 1,100 feet of an existing 10-inch EBMUD recycled water pipeline located within California Department of Transportation (Caltrans) ROW along the eastbound Gilman Street off-ramp shoulder would be abandoned in place or removed. A new City of Berkeley sewer line would be installed underneath Gilman Street beginning at a point east of the Interchange and ending on the west side I-80 at the approximate entrance to the Tom Bates Sports Complex parking lots.

Existing vegetation is sparse in the Project footprint and consists of ornamental plantings or ruderal vegetation. The Roundabout Alternative would remove existing landscaping and trees on the sidewalk along Eastshore Highway from Page Street to Gilman Street. In addition, trees and/or shrubs would be removed at the I-80 off-ramps, westbound I-80 on-ramp, and along the Bay Trail. Opportunities for new landscaping or artwork would be available in the center of each roundabout. Opportunities for tree replacements on site will be available.

1.2.5 Construction Activities

1.2.5.1 Construction Hours

Construction work for the Roundabout Alternative would be done primarily during daylight hours from 7:00 a.m. to 6:00 p.m.; however, there may be some work during night-time hours to avoid temporary roadway closures for tasks that could interfere with traffic or create safety hazards. Work hours along the internal access road in Golden Gate Field property will be limited to after 10:00 am to 5:00 pm. and night work will be restricted within or adjacent to Golden Gate Fields property. Examples of work activities include striping operations, traffic control setup, installation of storm drain crossings, and asphalt pavement mill and overlay.

1.2.5.2 Road Closures and Detours

Temporary lane and ramp closures and detours would occur. It is anticipated that temporary closure of existing bicycle or pedestrian facilities would occur at times and may require temporary rerouting of transit service due to intersection work. A Transportation Management Plan (TMP) would be developed and implemented as part of the Project construction planning phase. The TMP would address potential impacts to circulation of all modes of travel (i.e., transit, bicycles, pedestrians, and private vehicles). Roadway and/or pedestrian access to all occupied businesses and respective parking lots would be maintained during Project construction. The TMP would include an evaluation of potential impacts because of diverting traffic to alternate routes, and it would also include measures to minimize, avoid, and/or mitigate impacts to alternate routes such

as, agreements with local agencies to provide enhanced infrastructure on arterial roads or intersections to deal with detoured traffic. The TMP may provide for contracting with local agencies for traffic personnel, especially for special event traffic through or near the construction zone.

1.2.5.3 Staging Location

The anticipated construction staging areas available include areas within the existing roadway ROW construction limits. An additional staging area may be required west of the Project on Gilman Street in one or two parking lots owned by EBRPD. Staging areas are shown on Figure 3.

1.2.5.4 Construction Equipment

The following equipment is anticipated to be used during construction: auger drill rig, backhoe, compactor, concrete pump, crane, dozer, excavator, front end loader, grader, heavy duty dump trucks, jackhammer, vibratory roller, and pavement breaker.

1.3 Regulatory Setting

1.3.1 Executive Order 11988

Executive Order 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative (Federal Highway Administration [FHWA] 1994). Requirements for compliance are outlined in Title 23, Code of Federal Regulations (CFR), Part 650, Subpart A (23 CFR 650A) titled "Location and Hydraulic Design of Encroachment on Floodplains."

If the preferred alternative involves significant encroachment onto the floodplain, the final environmental document (final environmental impact statement or finding of no significant impact) must include:

- The reasons why the proposed action must be located in the floodplain;
- The alternatives considered and why they were not practicable; and
- A statement indicating whether the action conforms to applicable State or local floodplain protection standards.

1.3.2 California's National Flood Insurance Program

The Federal Emergency Management Agency (FEMA) is the nationwide administrator of the National Flood Insurance Program (NFIP), which was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation, and it offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP. FEMA is also

concerned with construction that would be within a 500-year floodplain for proposed projects that are considered "critical actions," which are defined as any activities where even a slight chance of flooding is too great. FEMA issues the Flood Insurance Rate Maps (FIRMs) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the State's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' Division of Flood Management. Under California's NFIP, communities have a mutual agreement with the State and Federal government to regulate floodplain development according to certain criteria and standards, which is further detailed in the NFIP.

1.4 Design Standards

1.4.1 FEMA Standards

FEMA standards are employed for design, construction, and regulation to reduce flood loss and to protect resources. Two types of standards are often employed: design criteria and performance standards.

A design criteria or specified standard dictates that a provision, practice, requirement, or limit be met; e.g., using the 1% flood and establishing floodway boundaries so as not to cause more than a 1-foot increase in flood stages (FEMA 2006).

A performance standard dictates that a goal is to be achieved, leaving it to the individual application as to how to achieve the goal; e.g., providing protection to the regulatory flood, keeping post-development stormwater runoff the same as pre-development, or maintaining the present quantity and quality of water in a wetland.

The 1% annual chance flood and floodplain have been adopted as a common design and regulatory standard in the United States. The NFIP adopted it in the early 1970s, and it was adopted as a standard for use by all federal agencies with the issuance of Executive Order 11988. States or local agencies are free to impose a more stringent standard within their jurisdiction.

2 AFFECTED ENVIRONMENT

2.1 Geographic Location

The Project is located in Alameda County at the Interstate 80 (I-80)/Gilman Street interchange in the cities of Berkeley and Albany (PM 6.38 to 6.95). The geographic coordinates shown on the FEMA FIRMs and used in the Flood Insurance Study (FIS) for Alameda County are referenced to the North American Datum of 1983.

2.2 Vertical Datum

The elevations shown in the FEMA FIRMs and FIS for Alameda County are referenced to the North American Vertical Datum of 1988 (NAVD 88).

2.3 Creek, Stream, and River Crossings

The Project receiving water bodies are the San Francisco Bay Central, Schoolhouse Creek, and Codornices Creek. Runoff from the Project is either collected or conveyed through a system of culverts or sheet flows directly into the San Francisco Bay Central**,** Schoolhouse Creek, or Codornices Creek**.** Schoolhouse Creek is located outside the Project limits and runs under Virginia Street, crossing I-80 at approximately Post Mile 6.15. Sheet flow from 5th Street would discharge into Codornices Creek. Codornices Creek is located at the border of the Project limits on 5th Street, crossing I-80 at approximately Post Mile 6.91. No work is proposed at this creek crossing.

2.4 Bridge Numbers

There are no bridges associated with a water body within the limits of the Project. The existing bridge over Gilman Street is identified as Bridge Number 33 0127 and is located at PM 6.62.

2.5 Watershed Description

The Alameda County Flood Control and Water Conservation District (ACFC&WCD) identifies the Project area as being within the Gilman Street, Schoolhouse Creek, and Codornices Creek watersheds; the watershed maps are included in Appendix A. The Gilman Street watershed drains the majority of the Project area to the west of the I-80 eastbound on- and off-ramps and most of the Project area on the north side of Gilman Street (ACFCWCD 2014a). The Schoolhouse Creek watershed drains the portion from the south side of Gilman Street between the Eastshore Highway and the UPRR tracks (ACFC&WCD 2014b). The Codornices Creek watershed drains the small remaining portion of the Project area along 5th Street north of Harrison Street (ACFC&WCD 2014a).

The Gilman Street watershed consists of the various networks of drainage facilities that connect to the 60-inch reinforced concrete pipe (RCP) that runs under Gilman Street and discharges to the San Francisco Bay. This storm drain outfall is low in elevation in relation to the FEMA Zone VE water surface elevation (WSE). There is the potential for storm drain system performance to be affected during high water as a result. The storm drain system will be analyzed in more detail in a Drainage Impact Report.

Based on the County watershed maps, the Project areas south of Gilman Street between Eastshore Highway and the UPRR tracks are part of the Schoolhouse Creek watershed. Within this area, collected runoff is conveyed to a culvert that runs under Second Street, which is a tributary of the main Schoolhouse Creek culvert under Virginia Street (ACFC&WCD 2014b).

The Codornices Creek Watershed is approximately 2.9 square miles of urbanized area from the Berkeley Hills to San Francisco Bay. The watershed's network of perennial streams flow through natural channels, culverts, and storm drains in Berkeley and Albany. It encompasses approximately 4.6 miles of open creek and engineered channels, including many sections that have been restored or daylighted. One can also find vibrant communities of aquatic life and multiple access points and walking paths, particularly along Codornices Creek, which is one of Berkeley's more natural and visible creeks. The watershed discharges through two outlets into San Francisco Bay, after traveling through three underground culverts beneath the I-580 near the Golden Gate Fields racetrack. Two of those culverted sections emerge as engineered channels that course through the mudflats of the Albany Bulb and a tidal slough, which is a fragment of the original slough (ACFC&WCD 2014a).

2.6 FEMA Floodplains

Typically, each county (or community) has an FIS, which is used to locally develop FIRMs and Base Flood Elevations (BFEs). Alameda County's effective FIS identifies Special Flood Hazard Areas (SFHA) and other flood areas within unincorporated and incorporated areas of the County. The majority of the Project is located within FIRM No. FM06001C0018G (FEMA 2009a) as shown in Figure 4. The remainder of the Project is located within FIRMs No. FM06001C0014G (FEMA 2009c) and No. FM06001C0056G (FEMA 2009d).

The FEMA FIRMs were researched for floodplain information. Figure 5 shows the Project layout with the associated FEMA Flood Zones. The Zone VE floodplain associated with San Francisco Bay extends into the Project area and covers Gilman Street west of I-80 and the Golden Gate Fields north west parking lot. Zone VE represents coastal flood zone areas with velocity hazard (wave action), and areas inundated by the 100-year base flood. FIRM No. FM06001C0018G referenced in Figure 4 shows the 100-year tide stage as 10 feet NAVD 88 for the area of Gilman Street west of I-80 (FEMA 2009a). FIRM No. 06001C0014G shows the 100-year tide stage as 9 feet NAVD 88 for the Golden Gate Fields north west parking lot (FEMA 2009c). These WSEs account for storm surge and wave run-up. The surface elevations in the Project area range from approximately 9.0 to 20.0 feet NAVD 88, which are just above the height of the water surface during the 100-year flood in Zone VE. A 100-year WSE in FEMA Zone VE has the potential to inundate the Gilman Street watershed storm drain system in the existing condition and reduce storm drain performance. This scenario could cause ponding of water in the low-lying areas until the water elevation recedes.

A majority of the Project area east of I-80 is identified as being within shaded Zone X, defined by FEMA's digital FIRM (ID No. NFHL_06001C) as areas in the 0.2% annual chance floodplain. The shaded Zone X area is likely attributed to Codornices Creek where, according to FEMA, shallow flooding occurs rather than typical valley floodways and floodplains.

Codornices Creek is located adjacent to the Project limits and runs under I-80 at approximately Post Mile 6.9. The Alameda County FIS states:

> "Because the City of Berkeley is fully urbanized and lies not in a valley but on a coastal plain bound by steep hills, stream flood flows may leave the channel and spread out through city streets towards the San Francisco Bay as shallow flooding. Floodways for Codornices, Schoolhouse…Creeks are not applicable." (FEMA 2009b).

As shown in Figure 5, the edge of the Project layout lies adjacent to the Zone AO—associated with Codornices Creek—with an average flood depth of 2 feet. According to FEMA, Zone AO is defined as "areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where flood depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply."

Project areas outside of Zones VE, AO, and shaded Zone X are in the unshaded Zone X, "representing areas outside the SFHA and above the elevation of the 0.2% annual chance flood" (FEMA 2016).

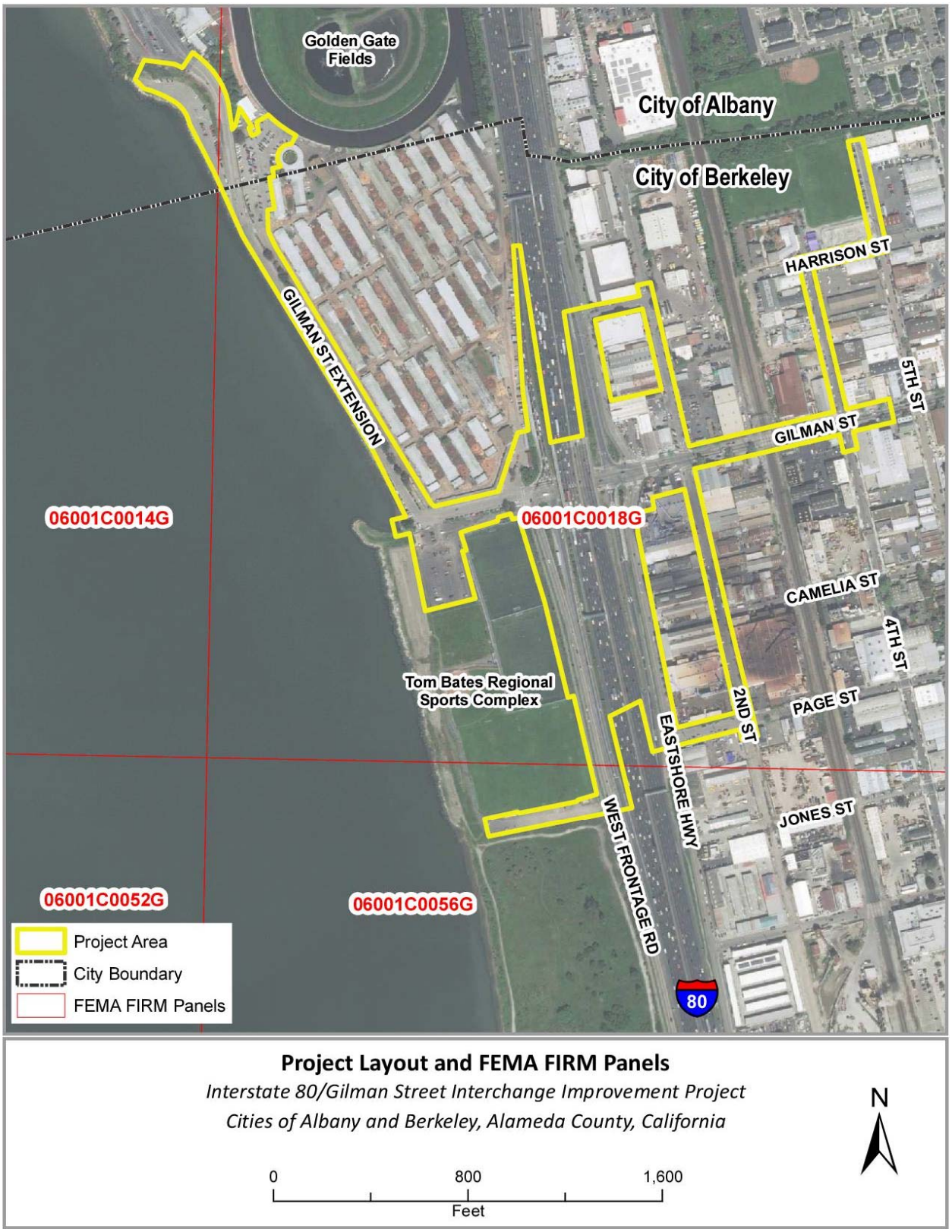

Figure 4. Project Area with FEMA FIRM Panel Numbers

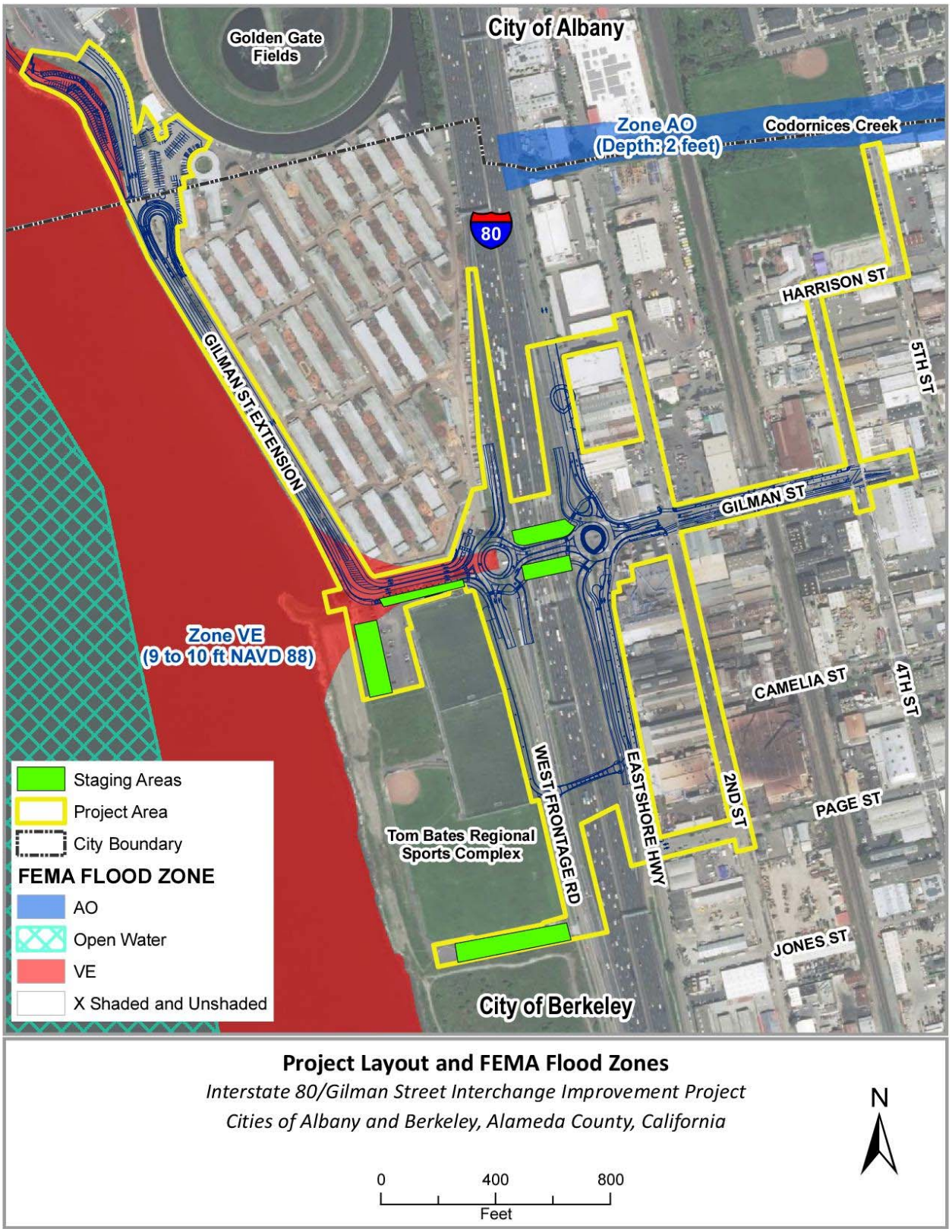

Figure 5. Project layout with FEMA Flood Zones

2.7 Traffic

I-80 is a major interstate used for emergency supply and evacuation, emergency vehicle access, school buses, and mail delivery. Current average daily traffic (ADT) within the Project area varies between approximately 15,000 and 20,000 vehicles (TJKM 2016). Practical detour routes are available for I-80 through the use of other intersections along I-80 and use of roads parallel to I-80 that would remain available during Project construction. Access to areas adjacent to Gilman Street can be made available through the use of other local streets in the area. The projected ADT in the year 2040 is 27,312. The Project would not result in increases to traffic interruptions from flooding.

3 PROJECT EVALUATION

Executive Order 11988 requires federal agencies to avoid to the maximum extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This section analyzes the impacts associated with this Project.

3.1 Risk Associated with the Proposed Action

As defined by FHWA, risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the bridge and roadway.

The potential risk associated with the implementation of the proposed action includes but is not limited to: 1) change in land use, 2) change in impervious surface area, 3) fill inside the floodplain, or 4) change in the 100-year WSE. The measures to minimize the potential floodplain impacts associated with the action are summarized in Section 4.

3.1.1 Change in Land Use

The Project does not propose to change land use in or around the Project area. The predominant land use within the Project limits is industrial. Partial acquisitions will be required for ROW from Golden Gate Fields and EBRPD. Relocation of the driveway would be required from a property located on the south side of Gilman and 2nd Streets. Additionally, a permit to construct from Golden Gate Fields would be required to complete improvements on their property. TCEs would be required for construction equipment storage, staging, and laydown from EBRPD and various property owners along Gilman Street, 4th Street, Harrison Street, and 5th Street. Partial acquisitions of the Tom Bates Regional Sports Complex and the Golden Gate Fields properties are necessary for Project completion; however, no businesses or residences will be displaced, and negligible land use change would result from the Project.

3.1.2 Change in Impervious Surface Area

The Project would add under one acre of impervious surface area. Because added impervious area is small in comparison to the San Francisco Bay watershed, and because Zone VE is a coastal floodplain where flooding is caused by tidal influence and storm surges rather than channelized runoff, the increase in impervious area is expected to have a negligible impact on flooding in the Project area. There is no change in impervious surface area in Zone AO.

3.1.3 Fill Inside the Floodplain

There would be minimal fill in the Project area. The Project proposes to balance cut and fill in the FEMA coastal floodplain, Zone VE. No fill is proposed in Zone AO.

3.1.4 Change in the 100-Year Water Surface Elevation

The Project does not propose any changes that will affect the 100-year WSE because the floodplain is a Zone VE coastal floodplain where flooding is caused by tidal influence and storm surges and because no additional fill is proposed in Zone AO where only roadway striping work will occur.

3.1.5 Summary of Risk Associated with the Proposed Action

The risk associated with Project implementation is anticipated to be low. Change in land use, impervious surface area, fill inside the floodplain, and change in the 100-year WSE as a result of the Project would be minimal and the impacts would be negligible. The increase in impervious surface has low risk and minimal impact because the Project is within a coastal floodplain where the flooding is not caused by surface runoff.

3.2 Summary of Potential Encroachments

FHWA defines a significant encroachment as a highway encroachment, and any direct support of likely base floodplain development, that would involve one or more of the following construction or flood-related impacts: 1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route, 2) a significant risk, or 3) a significant adverse impact on the natural and beneficial floodplain values (FHWA 1994). The following sections discuss the potential impacts to the floodplain that may result from the proposed action. The risk associated with implementation of the action is low as discussed in Section 3.1.

3.2.1 Potential Traffic Interruptions for the Base Flood

BFEs have the potential to cause traffic interruptions for exiting and entering traffic from and to I-80 and on Gilman Street for the existing and proposed conditions. The Project is not expected to cause any additional traffic interruptions during the base flood.

3.2.2 Potential Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values include, but are not limited to: fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge. Coastal floodplains within the Project limits, particularly those to the west of the rock slope protection that lines the eastern shoreline of San Francisco Bay, provides wildlife habitat for fish, waterfowl, and shorebirds. There are no biological beneficial floodplain values within the Project limits along Codornices Creek because floodplain areas along that waterway within the Project site consist of paved urban areas. Findings from the Natural Environment Study may conclude that the Project would have a minimal impact on these floodplain values (WRECO 2018).

3.2.3 Support of Probable Incompatible Floodplain Development

As defined by FHWA, the support of incompatible base floodplain development will encourage, allow, serve, or otherwise facilitate incompatible base floodplain development, such as commercial development or urban growth. The Project aims to improve the flow of traffic at the interchange, but the transportation design does not encourage incompatible floodplain development.

3.2.4 Longitudinal Encroachments

As defined by FHWA, a longitudinal encroachment is an action within the limits of the base floodplain that is longitudinal to the normal direction of the floodplain.

A longitudinal encroachment is "[a]n encroachment that is parallel to the direction of flow. Example: A highway that runs along the edge of a river is usually considered a longitudinal encroachment." The requirement for consideration of avoidance alternatives must be included in a Location Hydraulic Study by including an evaluation and a discussion of the practicability of alternatives to any significant encroachment or any support of incompatible floodplain development. The Project does not constitute a longitudinal encroachment into the floodplain.

3.3 Sea Level Rise

The elevation of the Project site (9.0-20.0 feet NAVD 88) is relatively low, and the site would be susceptible to inundation from future sea level rise. Sea level rise at the Project site was estimated using projections from the March 2013 update of the *State of California Sea-Level Rise Guidance Document* (Coastal and Ocean Working Group of the California Climate Action Team 2013). This document estimates upper projections for sea level rise to be 2.0 feet by the year 2050 and 5.48 feet by the year 2100 on the California coast south of Cape Mendocino. With this projection, the Zone VE elevation at the Project location would increase to approximately 11 feet to 12 feet NAVD 88 by the year 2050 and approximately 14.48 feet to15.48 feet NAVD 88 by the year 2100. It should be noted that although the Zone VE WSE accounts for storm surge and wave run-up, simply adding the projected sea level rise to the Zone VE WSE may not accurately predict the WSE with storm surge because water depth affects surge height. There is a local low point at a drain inlet on the southwestern edge of the westbound traffic circle with an approximate elevation of 10.4 feet (Figure 6), and another local low point at a drain inlet on Gilman Street Extension right before the ingress/egress point to Golden Gate Fields with an approximate elevation of 10.9 feet. The area around these low points would be especially susceptible to impacts from sea level rise, during the 100-year WSE, due to backflow through the drainage system or from overland tidal inundation. A tidal flap gate is proposed at the Gilman Street outfall to prevent tidal backflow from entering into the Project area. More information about the tidal flap gate is discussed in Section 4.2. In addition, the road surface elevations and the storm drain inlet elevations around the Second Street and Gilman Street intersection, the Gilman Street Extension, and the Golden Gate northwest and northeast parking lots range from 9.0 to 15.0 feet NAVD 88. These areas are susceptible to backflow through the storm drain system or overland tidal inundation when accounting for sea level rise.

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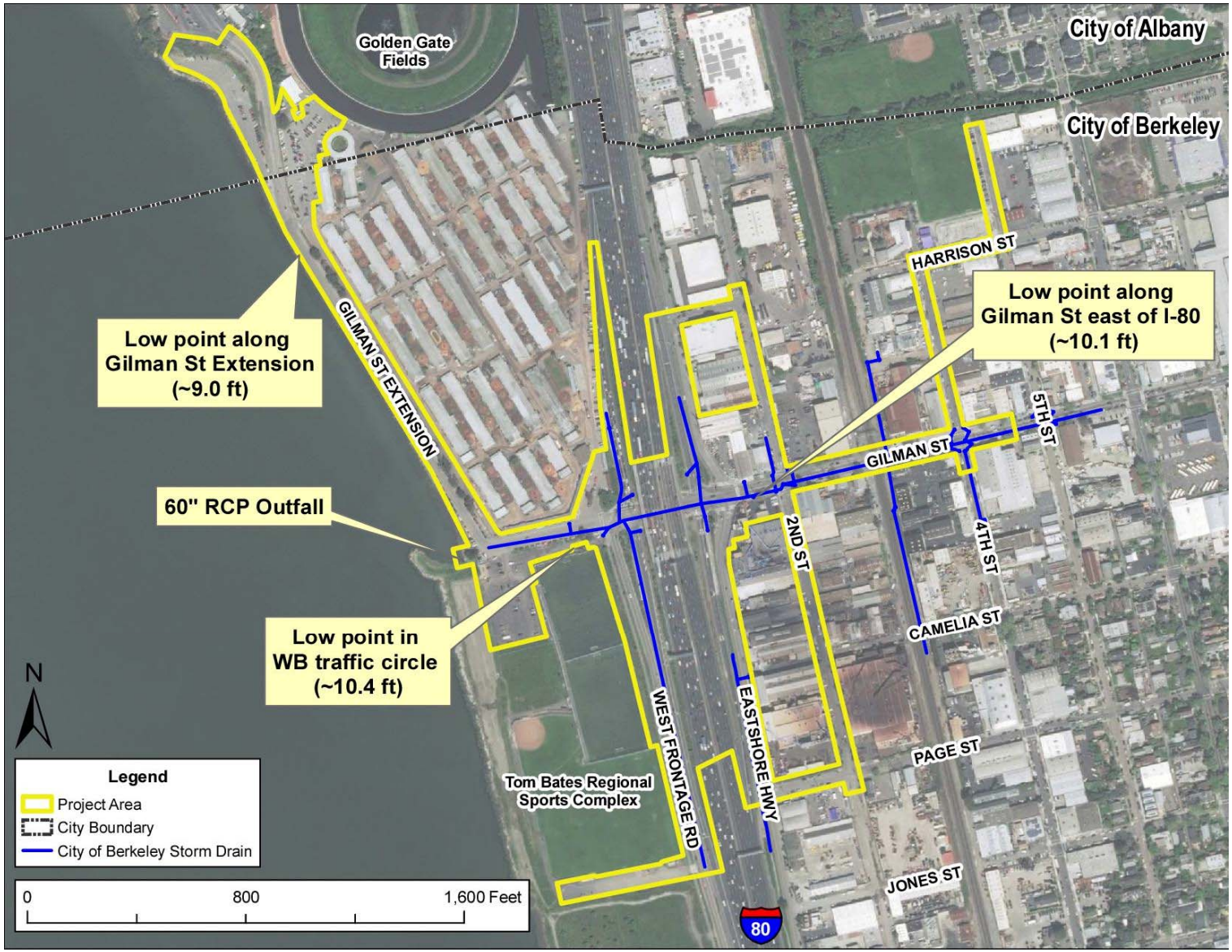

Figure 6. Project layout showing the low points susceptible to sea level rise

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4 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

The Project does not propose any adverse impacts to the floodplain and therefore, mitigation measures are not necessary for this Project. The Project proposes to avoid blocking coastal flood flows and to minimize fill in the floodplain by balancing the cut and fill work in the Zone VE floodplain. No additional fill is proposed in the Zone AO floodplain. The Project does not propose any structures with the potential to block flows within the SFHA Zone VE or Zone AO. Earthwork within Zone VE would be balanced, and the elevation of the original ground will be maintained. The Project is required to prevent flooding from runoff from the design storm, as defined by the *Highway Design Manual* (Caltrans 2015). In order to accomplish this, proposed drainage systems will be designed to capture and convey runoff from the design storm in the Project area.

4.1 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

No coordination is anticipated because the Project is expected to have a minimal impact on existing floodplains and there are no existing flood control channels within the Project limits.

4.2 Sea Level Rise

Sea level rise at the Project site was estimated using projections from the March 2013 update of the State of California Sea-Level Rise Guidance Document (Coastal and Ocean Working Group of the California Climate Action Team 2013). This document estimates upper projections for sea level rise to be 2.0 feet by the year 2050 and 5.48 feet by the year 2100 on the California coast south of Cape Mendocino. The water level of San Francisco Bay has the potential increase in elevation as a result of future sea level rise; however, the Project would not affect sea level rise. Sea level rise by the year 2100 has the potential to impact a significant portion of the Project site. High tide stages and storm surge in conjunction with sea level rise would cause backflow into the 60-inch RCP storm drain outlet near the bay jetty (Figure 6) and into the storm drain system draining Gilman Street and the surrounding area. Therefore, to prevent the effects of backflow due to sea level rise, a tidal flap gate is proposed to be installed at the existing headwall of the 60-inch reinforced concrete pipe at the west end terminus of Gilman Street. The flap gate will reduce backwater caused by high tides by preventing backflow from the bay into the storm drain system. Tides that are high enough to cause flooding will increase in frequency with sea level rise. The flap gate will not reduce flooding that is caused by stormwater runoff unable to drain to the bay due to a high tide. Therefore, the flap gate will reduce backwater due to tidal action but will not reduce flooding due to precipitation. Flap gates are recommended for this Project because they can be maintained from the outside and trash is not likely to cause frequent malfunctions. The gate will still need to be routinely inspected and maintained to prevent mussel accumulation or blockage from sediment. Resource agency permitting will be required due to the need for construction in the San Francisco Bay.

Because there are future scenarios where sea level at the 100-year WSE would be above the elevations of Gilman Street, Gilman Street Extension, and the Golden Gate Fields northwest and northeast parking lots, the roadways, storm drain system, and various improvements in the

Project area have the potential to be inundated. The low points on the westbound traffic circle and on Gilman Street Extension are locations in the Project area that would be impacted by the year 2050 projected sea level during a 100-year WSE. There are no feasible measures to prevent inundation in these locations because the area is in a floodplain and therefore, adding fill to this area is not advisable. Mitigation measures for other impacts from sea level rise to the Project area are beyond the scope of this Project. In addition, there is a current (as of the date of this report) Local Hazard Mitigation Plan forwarded to the Project team from the City of Berkeley, which states that there are no planned or existing measures to prevent inundation or backflow through the storm drain system caused by sea level rise (Appendix B).

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Appendix A Alameda County Flood Control and Water Conservation District Watershed Maps

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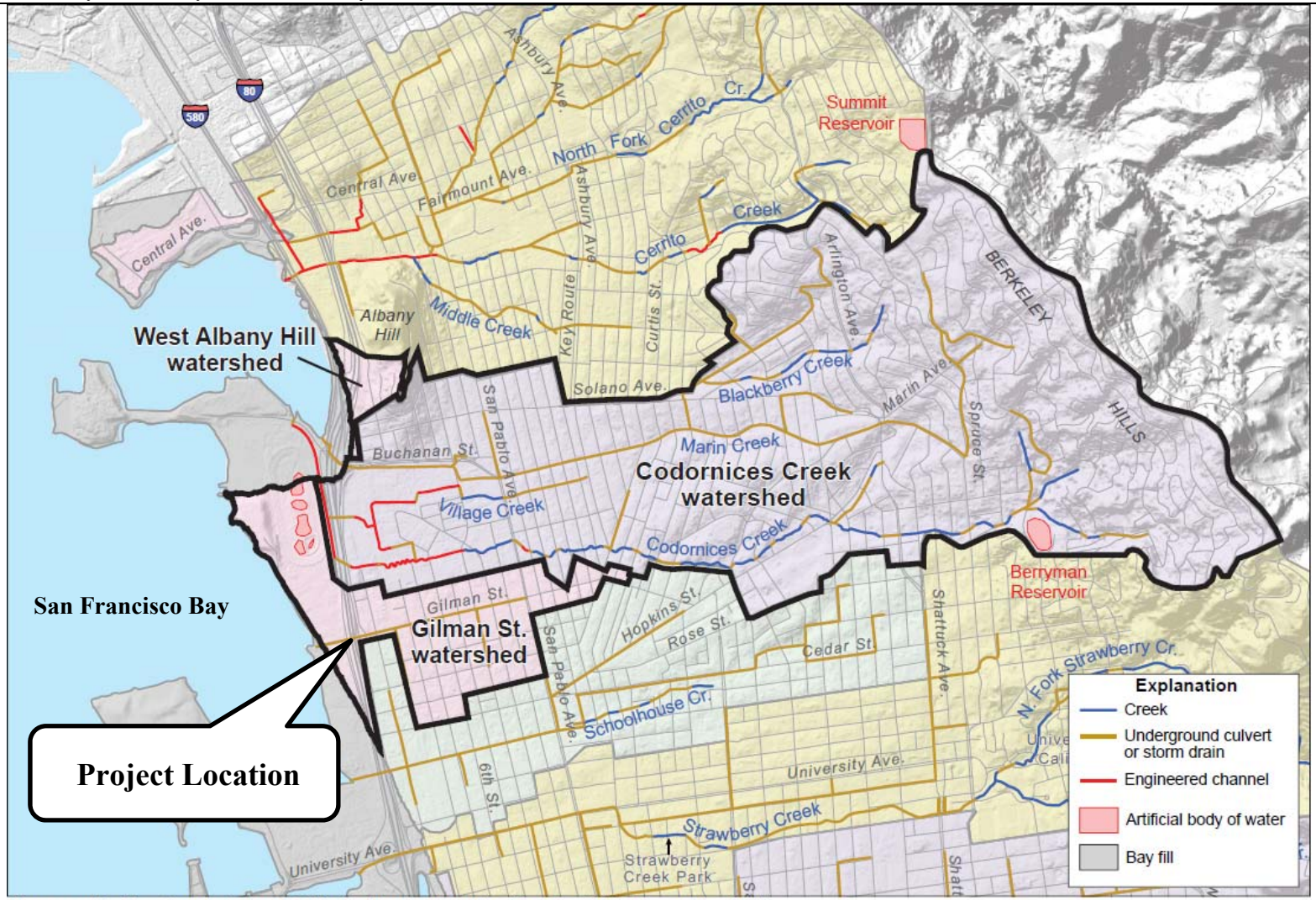

Map prepared by Fugro Consultants, Inc., 2014, for the Alameda County Flood Control and Water Conservation District.

Codornices Creek, West Albany Hill, and Gilman Street Watersheds

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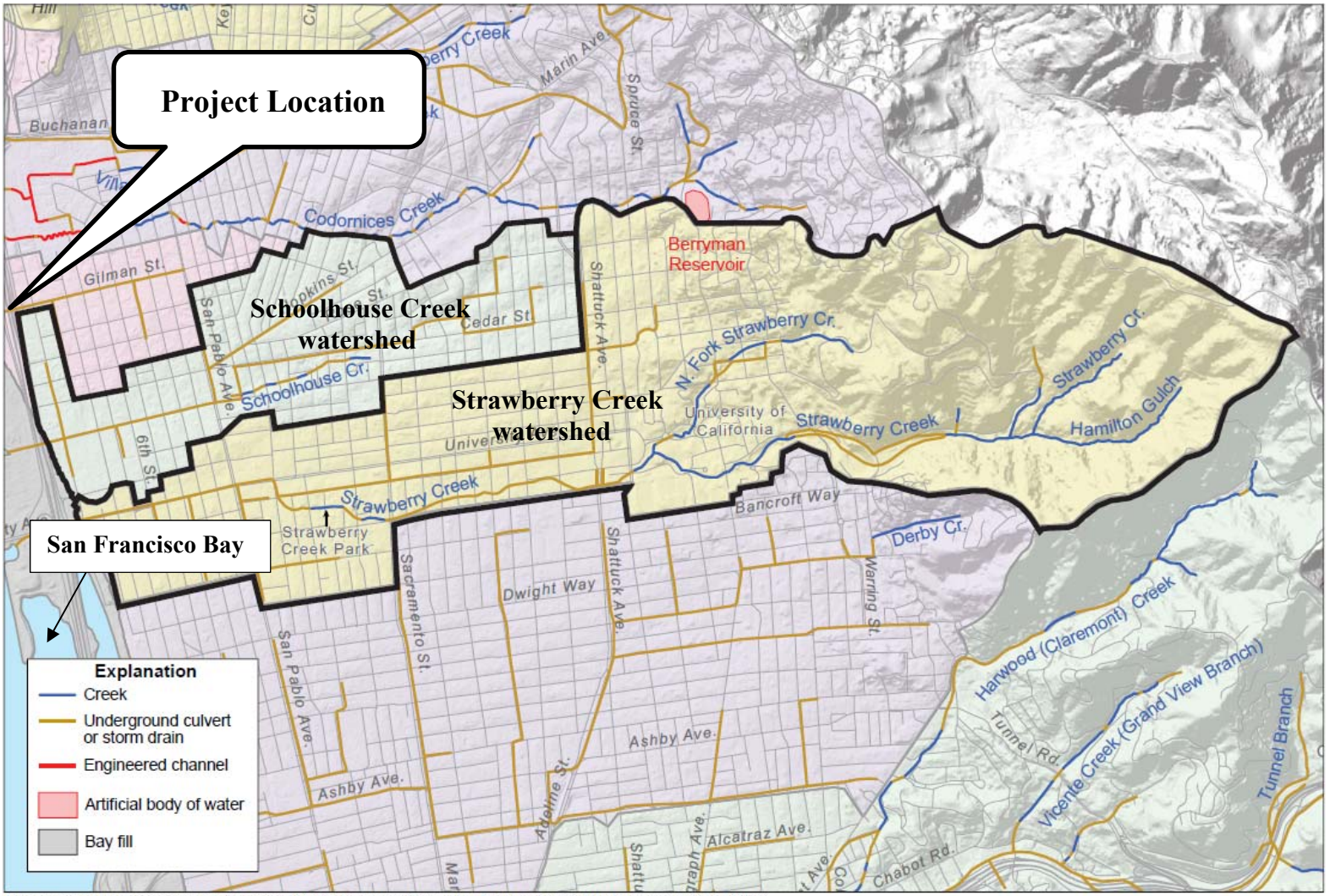

Map prepared by Fugro Consultants, Inc., 2014, for the Alameda County Flood Control and Water Conservation District.

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Strawberry Creek and Schoolhouse Creek Watersheds

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Appendix B City of Berkeley - 2014 Local Hazard Mitigation Plan

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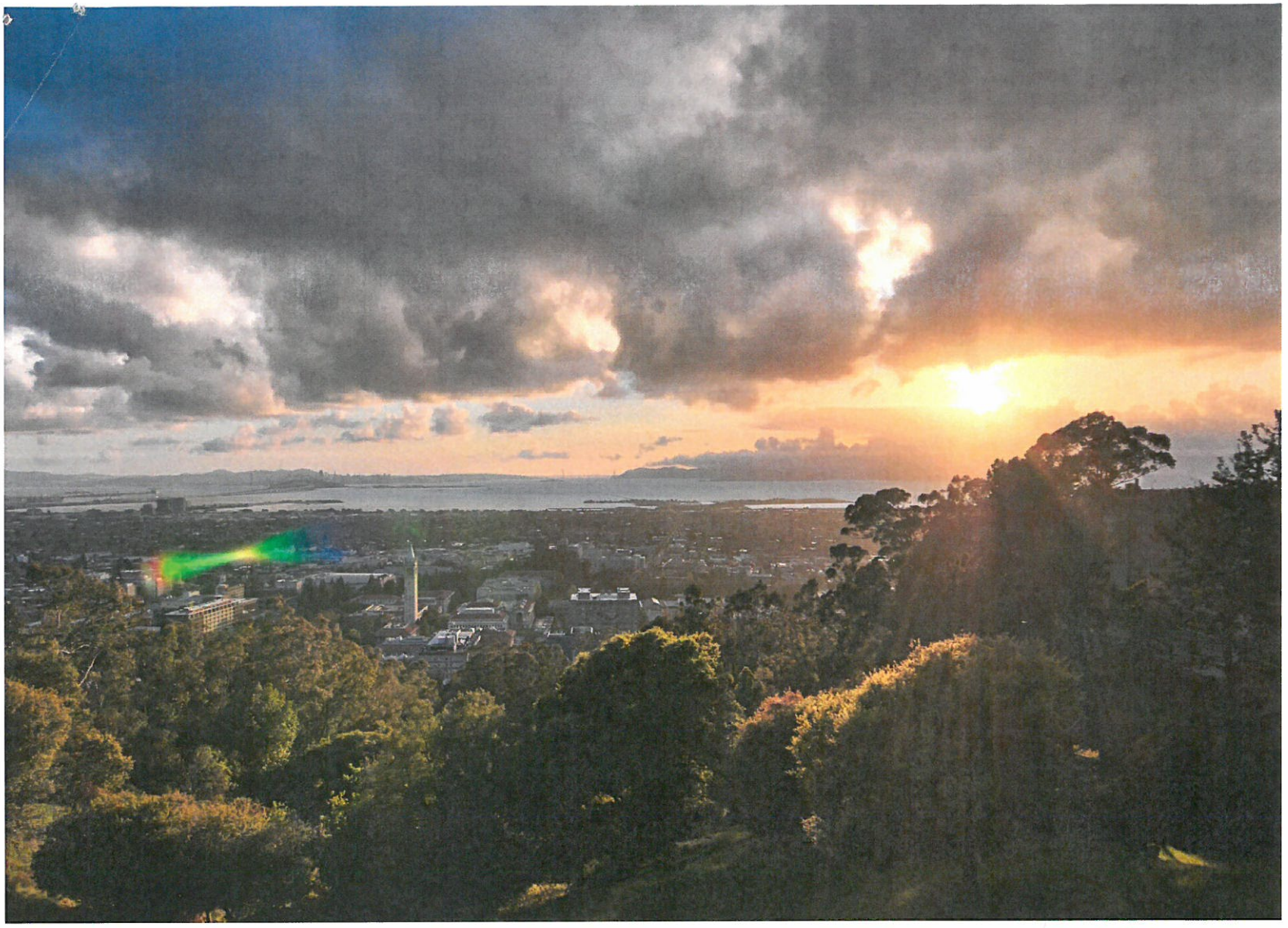

CITY OF BERKELEY

2014 LOCAL HAZARD MITIGATION PLAN

JUNE 1, 2014

Resources Required	
Potential Funding Sources	City General Fund Permit Service Center Enterprise Fund

1.2.4.3 Low-Priority Actions

2014 **Sea-Level Rise**	**Mitigate the impacts of sea-level rise in Berkeley.**
Proposed Activities	- Monitor and participate in regional and State-level research on projected sea-level rise in Berkeley and the region. - Develop guidelines, regulations, and development review procedures to protect new and existing public and private developments and infrastructure from floods due to expected sea-level rise.
Related Natural Hazard(s)	Climate Change
Associated LHMP Objective(s)	A. Reduce the potential for loss of life, injury and economic damage to Berkeley residents and businesses from earthquake, wildland-urban interface fire, landslide, flood, tsunami, climate change, and the cascading impacts of these hazards.
Related Policies from the General Plan or Climate Action Plan	Climate Action Plan, Adaptation Policies A and C General Plan Goal 6: Make Berkeley a disaster-resistant community that can survive, recover from, and thrive after a disaster – Utilize Disaster-Resistant Land Use Planning General Plan Policy S-27: New Development General Plan Policy S-14: Land Use Regulation, Action E
Special Environmental Concerns	Policy changes to development regulations in areas exposed to sea-level rise will take steps to minimize impacts to coastal habitat and historic resources.
Lead Organization and Staff Lead	Planning Department – Office of Energy and Sustainable Development (Monitor Research/Integrate Considerations) Staff Lead: Climate Action Coordinator Planning Department – Land Use Planning Division (Development Regulations) Staff Lead: Division Director
Priority	Low

3.8 *Climate Change*

Climate change is a global issue with local impacts. Like regions across the globe, the San Francisco Bay Area is experiencing and will continue to increasingly experience the impacts of the changing climate, including rising temperatures and sea-level rise. These impacts affect our natural environment, our built infrastructure, and the health and safety of the people in our community, especially people of color and the poor.[107] The impacts of climate change also exacerbate every one of this plan's natural hazards of concern, including flooding[108], wildland fire,[109] and landslides.[110]

This section identifies the main impacts of climate change, which Berkeley is experiencing or is projected to experience in the future. This section also describes how climate change exacerbates each of this plan's natural hazards of concern. Where possible, the information provided here is specific to Berkeley, the Bay Area, and/or the state of California. For each climate impact, associated historical events, hazard description, exposure and vulnerability analysis, and risk and loss estimates are presented as available.

A discussion of local climate impacts, and recommendations for mitigating those impacts, are also included in the Berkeley Climate Action Plan (CAP). The CAP was adopted by the Berkeley City Council in 2009, and is designed to guide community-wide efforts to achieve deep and sustained reductions in global warming emissions, and to help the community prepare for the impacts of the changing climate. Additional information on the CAP and its implementation is included at the end of this section. Ongoing updates on the CAP are available at www.CityofBerkeley.info/climate.

3.8.1 Direct and Secondary Climate Change Impacts

Human activities have and continue to release large quantities of GHG emissions into the atmosphere. The majority of the emissions come from burning fossil fuels to create energy, although other activities, such as deforestation and solid waste disposal, also play a role. GHG emissions trap heat in the atmosphere and cause the planet to warm. This is known as the greenhouse effect. The greenhouse effect is a natural phenomenon, but it is being exacerbated by a dangerous buildup of GHG emissions in the atmosphere. This dangerous buildup of emissions is changing the climate.

Temperature/Heat Events

Climate change is already happening. The earth is warming. Earth's average temperature has increased by over 1° F over the past century. Average temperatures in California increased 1.7°F between 1895 and 2011.[111] Because global emissions will likely continue to increase for some time, scientists predict under a range of scenarios that it is likely that average global surface temperature will rise between about 3.6° and 10.8° F by the end of the century.[112] For the Bay Area in particular, scientists estimate that average temperatures will increase between 3.5-11° F by century's end, compared to the average temperature during the historical period 1961 - 1990.[113]

The U.S. Environmental Protection Agency defines extreme heat events as "periods of summertime weather that are substantially hotter and/or more humid than typical for a

given location at that time of year."[114] As a result of increasing temperatures, scientists expect that by 2050, Berkeley will experience 1-2 more heat waves each year.[115] By 2100, scientists expect 6-10 additional heat waves per year.[116] Public health impacts associated with these heat events include premature death, cardiovascular stress and failure, and heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones.[117] The elderly and children under five are the most likely to suffer from heat-related illnesses and heat events.[118] Research indicates that communities of color and the poor also suffer more during extreme heat events because of lack of access to air conditioning, or to cars that allow them to escape the heat.[119] Across California, the highest risk of heat-related illness actually occurs in the usually cooler regions found in coastal counties. Because of a lack of acclimatization, the largest mortality rate increases in California are expected in coastal cities.[120]

In addition to public health impacts, heat events increase demands on infrastructure and lead to a need for additional infrastructure maintenance, particularly for roadways.[121]

Precipitation and Drought

In California, no consistent trend is detected to date in the overall amount of precipitation. For the Bay Area, a moderate decline in annual rainfall is projected: 1 to 3 inches by 2050 and 4 to 5 inches by 2090.[122]

If GHG emissions continue to increase, more precipitation is projected to fall as rain instead of snow, and the snow that does fall will melt earlier.[123] This has significant implications for the Sierra Nevada spring snowpack. The water distribution system for the state, including Berkeley and many other parts of the Bay Area, depends on the snowpack for water during the dry spring and summer months. Rising temperatures and more precipitation falling as rain instead of snow could reduce the snowpack by as much as 70 to 90 percent by century's end.[124] A shrinking snowpack poses significant challenges for water managers and for all communities that depend on this vital source of the state's water. The loss of snowpack also poses challenges for hydropower generation, which is a significant portion of the state's energy supply mix.

While the Bay Area can expect moderately less rainfall overall, climate change causes more extreme rainfall events. These intense rainstorms may cause flooding, which is discussed further below.

Sea-Level Rise

Warmer temperatures associated with climate change are causing global sea levels to rise through two processes:

1. Warmer temperatures are increasing the amount of ice melt from the world's glaciers and ice caps. This melted ice increases the volume of water in the ocean.

2. In a process termed "thermal expansion," warmer temperatures cause ocean water to increase in volume.

Sea-level rise is an ongoing challenge for communities surrounding the San Francisco Bay. It is estimated that the Bay has already risen approximately 7.9 inches during the

past century.[125] San Francisco Bay sea levels are projected to rise considerably in the coming decades. Relative to their 2000 levels, it is estimated that by 2050, sea level rise will range from 11-19 inches; and by 2100, sea level rise will range from 30 - 55 inches.[126]

The National Oceanic and Atmospheric Administration (NOAA) developed a web-based Sea Level Rise and Coastal Flooding Impacts Viewer[127] that enables users to identify lands that are vulnerable to various levels of sea-level rise. The Viewer depicts sea-level rise in 12-inch increments. According to the Viewer, at 12 inches of sea-level rise, low-lying areas around Berkeley Aquatic Park are potentially vulnerable to inundation. At 48 - 60 inches of sea-level rise, other areas become vulnerable to inundation, including land around the Berkeley Marina and infrastructure east of the highway along 2nd Street.[128]

It is possible that key underpasses and roads accessing Highway 80 could flood more often or be permanently inundated as sea-level rises, impacting transportation on this major regional artery. Other infrastructure that is vulnerable to inundation includes Berkeley's stormwater pipes and the East Bay Municipal Utility District's wastewater treatment plant, located near the Bay Bridge trouch-down. The combination of sea-level rise, storm surges, and high tides pose significant risk to low-lying infrastructure around the San Francisco Bay.

More comprehensive vulnerability assessments are necessary to clearly define the structures and infrastructure that will be affected with particular levels of sea-level rise.

More generally, sea-level rise means that beaches and shoreline habitats will be permanently inundated, erosion will increase, and levees and storm walls will have to endure increasing loads and may be susceptible to overtopping. Traditional measures for addressing sea-level rise, such as the use of levees and storm walls, may no longer be adequate or financially feasible.

The groundwater table and stream water levels will also rise, increasing areas subject to flooding. These changes will have impacts on the natural environment. According to the San Francisco Bay Conservation and Development Commission[129], these changes are "expected to substantially alter the Bay ecosystem by inundating or eroding wetlands and transitional habitats, altering species composition, changing freshwater inflow, and impairing water quality. Changes in salinity from reduced freshwater inflow may adversely affect fish, wildlife and other aquatic organisms in intertidal and subtidal habitats. The highly developed Bay shoreline constrains the ability of tidal marshes to migrate landward, while the declining sediment supply in the Bay reduces the ability of tidal marshes to grow upward as sea-level rises." With many miles of natural shoreline in Berkeley, these impacts on habitats are of significant concern.

Also, as with many other climate change impacts, sea-level rise may disproportionately affect those in our community that can least afford to plan for or respond to it. For example, low income residents would likely face greater difficulty relocating should their home or neighborhood be impacted by flooding.

Map 3.19 Berkeley Shoreline Areas Prone to Sea Level Rise[130]

Source: NOAA Sea Level Rise and Coastal Flooding Impacts Viewer

The above map depicts areas in Berkeley (and surrounding areas) potentially vulnerable to inundation from 48 inches of sea-level rise. Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue, where darker blue shows a greater depth. Areas in green are at or below sea level at 48 inches of sea-level rise. They are determined solely by how well the elevation data captures the area's hydraulics.

A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Food-, Water-, and Vector-Borne Diseases[131]

Climate change may also accelerate the incidence and geographic distribution of diseases and conditions that are transmitted through food, water, and animals such as deer, birds, mice, and insects. Increases in air temperature and change in precipitation may expand the territory of many pests. In California, three vector-borne diseases are of particular concern: West Nile virus, human hanta virus, and Lyme disease. Salmonella and other bacteria-related food poisoning also grow more rapidly in warm environments, causing gastrointestinal distress and, in severe cases, death.

3.8.2 Climate Change Impacts to Natural Hazards of Concern

Climate change is expected to exacerbate the natural hazards of concern identified in this plan. The ways that climate change affects Berkeley's natural hazards of concern are described below.

Earthquake (Section 3.3)

Sea-level rise will cause the groundwater table and stream water levels to rise, increasing the areas subject to liquefaction risks in the event of an earthquake.

Wildland-Urban Interface Fires (Section 3.4)

The incidences of large wildfires in California could more than double by century's end,[132] and higher summer temperatures will likely lengthen the fire season in our region.[133] Due to Berkeley's biophysical setting, climate, and other jurisdictional characteristics, scientists project little change to Berkeley's fire risk.[134] However, development that expands Berkeley's wildland urban interface area may increase the vulnerability to property losses due to wildfire.[135]

Landslides (Sections 3.3 and 3.5)

Increases in the intensity and frequency of winter storms will lead to more frequent landslides in the Berkeley hills.

Floods (Section 3.6)

Climate change will increase the frequency of flood events, and will expand the areas of Berkeley that are subject to flooding. A confluence of factors contributes to these changes:

- More extreme rainfall events; [136]
- Frequent and more hazardous storms, combined with a sea-level rise and high tides, can lead to more frequent and amplified storm surge events;
- Outfalls in Berkeley go directly to the Bay, and are influenced by tidal effects. As the sea level rises, it will require less rain to cause upstream flooding.

These factors will likely cause more frequent and extensive flooding events long before sea-level rise leads to permanent inundation of the shoreline.[137] FEMA's National Flood Insurance Rate Maps are currently being revised to account for areas that may become flood zones in the future due to sea-level rise.[138] Potential public health impacts of flooding include contamination of potable water, wastewater, and irrigation systems, resulting in an increase of water- and food-borne diseases.[139] [140]

Tsunami (Section 3.7)

Rising sea levels will extend tsunami inundation areas in Berkeley, putting more people and property at risk.

Notable Climate Change Mitigation and Adaptation Activities

The Berkeley Climate Action Plan provides policy and project recommendations designed to advance community-wide efforts to reduce, or mitigate, global warming emissions and to prepare for and adapt to the climate change impacts identified above.

CAP recommendations are implemented through the efforts of several City departments and community stakeholders. Outlined below are examples of specific CAP recommendations related to both mitigating global warming emissions and adapting to climate change impacts, and some explanation of how each of the identified recommendations is being implemented.[141]

Water Efficiency and Recycling

The CAP recommends proactive efforts mitigate the impacts of climate change on precipitation and the region's water supply, including the following:

In preparation for the impacts of climate change on the region's water resources, partner with local, regional, and State agencies to encourage water conservation and efficiency and expand and diversify the water supply (see CAP, Adapting to a Changing Climate, Goal 1, Policy B).

Water efficiency and reuse reduces global warming emissions and helps the community prepare for potential future water resource constraints. The City is advancing water efficiency and water recycling efforts in several ways. For example, in 2010 the City developed its *Guide to Conserving Water through Rainwater Harvesting and Graywater Reuse for Outdoor Use*. The purpose of the guide is to give homeowners the information they need to install effective, safe, and legal rainwater and/or graywater irrigation systems. Rainwater and graywater systems can help residents save water (and money) by reducing demand for potable water.

The City also provides in-person assistance to buildings committed to achieving a high level of green building, including installing water-efficient technologies to increase indoor and outdoor water efficiency.

Key Partner: United States Forest Service[142]

The U.S. Forest Service is charged with sustaining the health and productivity of the nation's forests for the benefit of the public. A primary reason that national forests were set aside a century ago was to protect the source of water for a growing nation. Water is the most important product of our public forests. In California, the Forest Service manages 20.8 million acres for the good of the public, and fully half of the state's water supply arises from those national forests. When people turn on the tap or the garden hose in Berkeley, they are using water from the Eldorado and the Stanislaus National Forests.

Ninety percent of the water that East Bay Municipal Utility District (EBMUD) conveys to Berkeley customers comes from the Mokelumne River in the Sierra foothills. The Mokelumne is fed by tributaries high in the Sierra Nevada mountains on 352,000 acres of the Eldorado and Stanislaus National Forests. The forests and meadows of these two national forests collect, filter, and store this water in the form of snowpack and groundwater. The storage capacity of the healthy ecosystem has helped make it possible for EBMUD to deliver clean, high quality water throughout the year, even throughout the annual summer droughts. However, that is already changing.

Climate change is a major threat to the health of these headwater forests, and their capacity to provide these vital storage and filtration services to East Bay residents into the future. The Sierra Nevada is predicted to receive more of its annual precipitation in the form of rain instead of snow, and the snowpack will melt earlier in the year. Both of these effects will make spring runoff occur earlier in the year and make it more challenging for EBMUD to physically store enough clean water to provide to Berkeley residents and businesses throughout the annual summer droughts.

There is a pressing need to restore the headwater forests of the Mokelumne River to a more resilient and healthy state, so they can withstand future stresses of climate change, benefit from regular forest fires, and continue to store and filter water for downstream users. These forests can be rehabilitated by mechanically removing small-diameter trees and by using prescribed fire to clear out underbrush. Fire scientists and modelers are currently working to determine areas at highest risk of severe wildfire in the upper Mokelumne River watershed so that restoration efforts have the highest positive impact.

If the upper Mokelumne Watershed is returned to a healthy state and the headwater forests are not allowed to become overly dense, Berkeley residents and businesses and other EBMUD customers will likely continue to enjoy high quality, reliable, and low-cost water throughout the 21st century, even in the face of climate change. If the upper watershed is not managed so that it can fulfill its natural hydrologic functions, EBMUD will eventually need to consider manmade, "gray infrastructure" storage and filtration options, such as additional dams, reservoirs, and filters, at a cost to water ratepayers, in order to ensure future water supplies.

Mitigating Impacts of Flooding and Coastal Erosion

The CAP recommends proactive efforts to prepare for potential flooding associated with climate change impacts, including:

In preparation for rising sea levels and more severe storms, partner with local, regional, and State agencies to reduce the property damage associated with flooding and coastal erosion (see CAP, Adapting to a Changing Climate, Goal 1, Policy C).

West Berkeley is particularly low-lying and potentially vulnerable to sea-level rise, especially when rising seas are compounded with severe storms. For all City-owned development projects, the City reviews and works to mitigate any risk from coastal flooding. The City will continue to analyze the latest data on the risk of sea-level rise in Berkeley, and to address the risk to new and existing infrastructure as necessary.

The City's urban forestry program mitigates global warming emissions through a process called carbon sequestration. It also mitigates the impacts of climate change, such as flooding and extreme heat events. For example, one of the benefits of the City's ongoing urban forestry program is stormwater management. Trees store rainwater, reducing runoff and delaying peak flows. Tree roots also loosen the soil around the base of the tree and increase water penetration. Berkeley's urban forest also helps to mitigate the impacts of extreme heat events by shading buildings and paved and dark-colored surfaces, such as roads and parking lots that absorb and store heat.

Another strategy designed to assist with stormwater management is installation of green roofs. As part of the City's education and outreach efforts, the City developed a Permit Guide to Living Roofs, which is designed to assist residents and businesses to understand the benefits and permitting requirements associated with installing a green roof. A green roof, also known as a "living roof" or "vegetated roof," is a planted rooftop garden that offers an attractive and energy-saving alternative to a conventional rooftop. One of the many benefits of green roofs is that they help filter and retain rainwater onsite.

In order to ensure accountability and progress on its emissions reduction and climate adaptation efforts, the City regularly reports on the status and outcomes of CAP implementation (see www.CityofBerkeley.info/climateprogress). Effectively monitoring and reporting progress and working to engage the community in advancing CAP-related actions is fundamental to achieving the CAP goals. Actions outlined in this plan are designed to be consistent with CAP goals.