Draft Water Quality Assessment Report

St. Mary's Road Double Roundabouts Project

Town of Moraga, Contra Costa County, California

Prepared for:

Prepared by:

Draft Water Quality Assessment Report

St. Mary's Road Double Roundabouts Project

Town of Moraga, Contra Costa County, California

August 2019

Prepared By: _____ Date: _____

Analette Ochoa, P.E.
(925) 941-0017
1243 Alpine Road, Suite 108
WRECO

Approved By: _____ Date: _____

Professional Content Reviewer, Title
Phone Number
Office Name
Town of Moraga

Table of Contents

Figures

Tables

Appendices

Executive Summary

The Town of Moraga (Town) is proposing the Saint Mary's Road Double Roundabouts Project (Project). The Project would construct two roundabouts on Saint (St.) Mary's Road at the Rheem Boulevard and Bollinger Canyon Road intersections and create safer pedestrian and bicycle crossings. The Project would be implemented in the Town of Moraga, Contra Costa County, California. The purpose of the Project is to alleviate the current congestion, reduce intersection delays and queues, improve safety, and to better accommodate pedestrian and bicycle traffic.

The proposed improvements include widening St. Mary's Road, Rheem Boulevard, and Bollinger Canyon Road to accommodate two new roundabouts and the approaches to the roundabouts. Efforts to improve traffic operations and safety would require the roadway to be relocated, partially outside the existing right-of-way. The two directions of traffic would be separated by road stripping (and medians approaching the roundabouts). Retaining walls are proposed at the St. Mary's Road/Bolling Canyon Road intersection to avoid impacts to the creek due to steeper surface slopes from the proposed roadway widenings.

The purpose of the Water Quality Assessment Report is to fulfill the requirements of the National Environmental Policy Act and the California Environmental Quality Act, and to provide information, to the extent possible, for National Pollutant Discharge Elimination System (NPDES) permitting. The document includes a discussion of the proposed Project, the physical setting of the Project area, and the regulatory framework with respect to water quality. It also provides data on surface water and groundwater resources within the Project area and the quality of these waters, describes water quality impairments and beneficial uses, identifies potential water quality impacts/benefits associated with the proposed Project, and recommends avoidance and/or minimization measures for potentially adverse impacts.

The Project is under the jurisdiction of the San Francisco Bay Regional Water Quality Control Board. The Project's receiving water bodies are Las Trampas Creek and a drainage feature (Drainage 1). Las Trampas Creek flows through the study area in a northerly direction, traveling below St. Mary's Road through a concrete box culvert. Upstream of the culvert, the bed of Las Trampas Creek is approximately 16 feet (ft) wide, with flowing water at a depth of approximately 2 ft. The channel is incised with steep banks, approximately 30 ft tall from the channel bed, with a 1:1 (horizontal:vertical) slope. The bed of the channel contains primarily sand and gravel. Downstream of the culvert, the bed of Las Trampas Creek is approximately 20 ft wide, with flowing water at a depth of approximately 3 ft. The bed of the channel contains primarily sand, with gravel and large rocks greater than 8 inches (in.). Approximately 270 ft south of the St. Mary's Road intersection, Drainage 1 is located adjacent to Bollinger Canyon Road. Drainage 1 originates from the hillside east of the study area along Bollinger Canyon Road, which consists of a residential community. The bankfull width ranged from 8 ft wide to 3 ft wide, and flowing water was observed during the site visit conducted on March 31, 2017. The hillside drainage enters an 18-in. corrugated plastic pipe and travels west below Bollinger Canyon Road, where it outlets approximately 50-ft down the embankment into Las Trampas Creek. Las Trampas Creek and Drainage 1 are not listed as pollutant impaired on the Clean Water Act 303 (d) List of Water Quality Limited Segments.

The Town of Moraga is not within a named groundwater basin. A monitoring well located approximately 1.38 miles southwest of the Project at a former Shell service station recorded groundwater depths ranging from 2.74 ft to 10.72 ft below ground surface.

The Project would not add additional travel lanes and therefore, stormwater treatment and hydromodification management measures are not considered for the Project. The Project would implement site design features such as dispersal of stormwater runoff to adjacent pervious areas to maximize sheet flow from impervious areas in the Project areas.

The Project would have a disturbed soil area (DSA) of more than one acre and has the potential to cause water quality impacts to Las Trampas Creek and Drainage 1. Temporary impacts include sediment from grading and excavation activities and pollutants from accidental spills. The Project would be required to comply with the requirements of the State Water Resources Control Board Construction General Permit (CGP) (Order No. 2012-0006-DWQ). In compliance with the CGP, the Contractor for the Project would be required to prepare and submit a Storm Water Pollution Prevention Plan (SWPPP). To determine the applicable monitoring and sampling requirements during construction, the SWPPP would include the determination of the Project's risk level. Based on the site of the Project and the current planned improvements, the Project is classified as Risk Level 2 under the CGP. Temporary BMPs for stormwater would include scheduling, preservation of existing vegetation, hydraulic mulch, hydroseeding, soil binders, straw mulch, geotextiles and mats, wood mulching, earth dikes and drainage swales, velocity dissipation devices, slope drains, streambank stabilization, compost blanket, soil preparation/roughening, non-vegetative stabilization, silt fence, check dam, fiber rolls, gravel bag berm, street sweeping and vacuuming, storm drain inlet protection, manufactured linear sediment controls, compost socks and berms, biofilters bags, wind erosion control, non-stormwater management measures, and waste management and material pollution control measures. Groundwater may be temporarily impacted due to excavation activities. Temporary BMPs for groundwater may include non-stormwater use for dust control, desilting basins/tanks, and transport to publicly owned treatment works during dewatering operations. If the Project area contains contaminated groundwater or groundwater that may release contaminated plumes when disturbed, applicable dewatering permits would be obtained during the design phase. There would be minimal temporary impacts to biological and human use characteristics of the aquatic environment due to biological monitoring and scheduled road/trail closures during construction. Temporary BMPs for biological characteristics may include water quality monitoring for fish species and management of invasive species. Construction site BMPs for human use characteristics would be similar to those for temporary stormwater BMPs.

The general approach of the Project is to avoid impacts. This Project would have minimal impacts to water quality if BMPs, in compliance with the applicable NPDES permits, are incorporated.

Acronyms

Basin Plan	San Francisco Bay Basin Water Quality Control Plan
BMP	best management practices
BSA	Biological Study Area
Caltrans	California Department of Transportation
CCCWP	Contra Costa Clean Water Program
CIP	Capital Improvement Program
CGP	Construction General Permit
CEQA	California Environmental Quality Act
CWA	Clean Water Act
DSA	disturbed soil area
EBMUD	East Bay Municipal Utility District
FEMA	Federal Emergency Management Agency
ft	foot/feet
in.	inch/inches
KHA	Kimley-Horn and Associates
MRP	San Francisco Bay Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
Project	St. Mary’s Double Roundabouts Project
RPW	relatively permanent water
RWQCB	Regional Water Quality Control Board
SMARTS	Storm Water Multiple Application and Report Tracking System
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
Town	Town of Moraga
TMDL	total maximum daily load
U.S.	United States
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
WDR	Waste Discharge Requirement
WQAR	Water Quality Assessment Report

1 INTRODUCTION

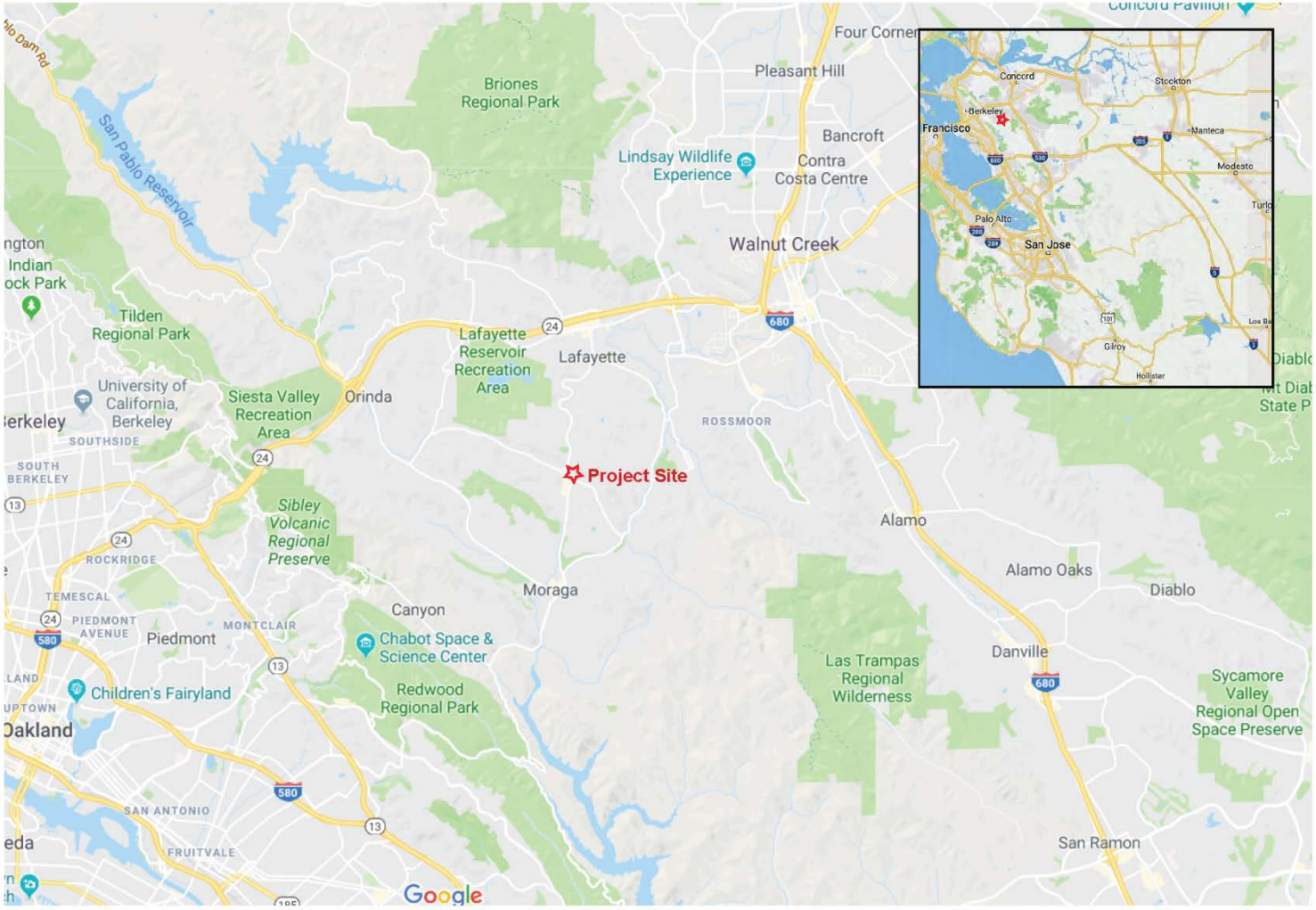
1.1 Approach to Water Quality Assessment

The purpose of the Water Quality Assessment Report (WQAR) is to fulfill the requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), and to provide information for National Pollutant Discharge Elimination System (NPDES) permitting. The WQAR includes a discussion of the proposed Project, the general environmental setting of the Project area, and the regulatory framework with respect to water quality. It also provides data on surface water and groundwater resources within the Project area and the water quality of these waters, describes water quality impairments and beneficial uses, identifies potential water quality impacts/benefits associated with the proposed Project, and recommends avoidance and/or minimization measures for potentially adverse impacts.

1.2 Project Description

The Town of Moraga (Town) proposes to provide improvements to a single-lane roundabout corridor at the intersections of St. Mary's Road/Rheem Boulevard and St. Mary's Road/Bollinger Canyon Road. The St. Mary's Double Roundabouts Project (Project) would improve traffic operations and pedestrian and bicycle access and safety. The Project would construct two roundabouts on St. Mary's Road at the Rheem Boulevard and Bollinger Canyon Road intersections and create safer pedestrian and bicycle crossings. The Project would be implemented in the Town of Moraga, Contra Costa County, California. Figure 1, *Regional Location Map,* and Figure 2, *Vicinity Map,* show the Project location and vicinity, respectively. The Town is the lead agency under CEQA.

The Project is included in the Town of Moraga Capital Improvement Program (CIP). The design concept and scope of the Project is consistent with the Project description in the CIP and is intended to meet the traffic needs in the area based on local land use plans. The Project would improve traffic operations, and pedestrian and bicycle access and safety. The Project is partially funded through Measure J 2013 Strategic Plan: Major Streets category.



Source: Google Maps, 2019

Figure 1: Regional Location Map
St Mary's Double Roundabouts Project

Not to scale

Kimley»Horn
Expect More. Experience Better.

Figure 1. Project Location

Source: ESRI World Imagery, 2019.

Figure 1: Vicinity Map
St Mary's Double Roundabouts Project

Figure 2. Project Vicinity

1.2.1 Project Purpose

The purpose of the Project is to provide congestion relief at the St. Mary's Road and Rheem Boulevard and improve stopping sight distance and visibility at the Rheem Boulevard and Bollinger Canyon Road intersections. The Project is proposed to alleviate the current congestion, reduce intersection delays and queues, improve safety and to better accommodate pedestrian and bicycle traffic.

1.2.2 Project Need

The proposed Project is needed because the roadway presently experiences inadequate intersection level of service under cumulative build-out conditions with traffic queue lengths exceeding existing intersection geometry. Improvements at this intersection are also needed to accommodate projected growth of the St. Mary's College campus, and to address safety issues at the intersection. Additionally, the roadway geometry and topography at these closely spaced intersections has insufficient stopping sight distance with visibility issues approaching the Rheem Boulevard and Bollinger Canyon Road intersections, which in turn, result in high accident rates and decreased safety.

Traffic collision data from 2010 through 2015 for the Rheem Boulevard and Bollinger Canyon Road intersections were provided by the Town of Moraga Police Department. Eight traffic related incidents were reported involving minor injuries and property damage. A majority of reported accidents occurred at the St. Mary's/Rheem stop controlled intersection with rear end and side impact collisions between motor vehicles due to limited visibility and sight distance. Two collisions involving bicyclists were also reported, one resulting in an injury. There was also a report of an overturned truck on the curve in between the intersections in 2012.

In December 2008, Fehr & Peers prepared a report titled St. Mary's Road Improvement Evaluation at Rheem Boulevard and Bollinger Canyon Road, which evaluated the physical and operation characteristics of the St. Mary's intersections at Rheem Boulevard and Bollinger Canyon Road to recommend near-term and long-term improvements. In May 2015, Omni-means prepared the St. Mary's Road Roundabout Feasibility Study, which analyzes the design features and safety assessment of a proposed single-lane roundabout corridor at the intersections of St. Mary's Road/Rheem Boulevard and St. Mary's Road/Bollinger Canyon Road in the Town of Moraga.

The heavy congestion along this roadway can be attributed to several regional destinations having access from St. Mary's Road, including the St. Mary's College campus, the shopping center on Moraga Way, and existing residential development.

In addition to vehicle traffic, the Project site contains pedestrian and bicycle traffic. The Lafayette/Moraga Regional Trail runs parallel to St. Mary's Boulevard and crosses the intersection of St. Mary's Road/Rheem Boulevard via an at-grade crosswalk. The crossing is marked with white striping and does not have any lighting or sign features. Currently, there are gaps in the pedestrian network, with limited sidewalks along most of the Project corridor. This results in unsafe pedestrian movements through the Project site.

1.2.3 Build Alternative (Proposed Project)

The proposed Project would accommodate anticipated multimodal transportation increases by improving capacity for all travel modes, provide designated facilities separated from the vehicular traffic for pedestrians and bicycles, improve intersection capacity, and reduce overall delays and improve safety.

1.2.3.1 Roadway Facilities

The Project would widen St. Mary's Road, Rheem Boulevard, and Bollinger Canyon Road to accommodate two new roundabouts and the approaches to the roundabouts. The existing two-lane roadways would remain as two-lane roadways. The roundabout geometry will be designed in a way to decrease approaching speeds at these intersections and improve visibility, subsequently improving traffic operations and safety. These improvements would require the roadway to be relocated, partially outside the existing right-of-way.

As shown in Figures 3a, 3b, and 3c, *Proposed Roadway Design*, the vehicle travel lanes would be 12 feet (ft) wide. The proposed roundabouts would have single-lane entries on all intersection approaches and the central islands would be circular in shape with a symmetric diameter. The St. Mary's Road/Rheem Boulevard roundabout would be approximately 120 ft in diameter, with landscaping in the center. The St. Mary's Road/Bollinger Canyon roundabout would be a mini-roundabout, approximately 80 ft in diameter. The existing roadway would be excavated from between 4 to 16 inches (in.) where pavement would be replaced. The new relocated segments of roadway would require excavation of depths up to 2 ft. The two directions of traffic would be separated by road striping and medians approaching the roundabouts. The medians would be excavated to a maximum depth of 6 ft, measured from existing roadway surface, to provide room for import soil and roadway signs.

To accommodate the roadway widening, existing slopes would need to be excavated and laid back. This may result in a vertical difference between the existing slope surface and the new slope surface. Retaining walls would be needed at north and south sides of the St. Mary's Road/Bollinger Canyon Road intersection to avoid impacts to the creek. Retaining walls would range in height up to a maximum of 8 ft. Retaining walls would require excavation up to 10 ft from existing surface.

Native material from the Project site would be used to construct the proposed roadway embankment. Up to 480 cubic yards of native materials would need to be imported to the site during construction.

As shown in Figures 4a and 4b, *Proposed Roundabout Sections*, the existing intersections of St. Mary's Road/Rheem Boulevard and St. Mary's Road/Bollinger Canyon Road would be converted to roundabouts. The existing side-street stop-controlled (SSSC) intersections of St. Mary's Road/Rheem Boulevard and St. Mary's Road/Bollinger Canyon Road would be converted to 'yield' approaches. New yield sign pole foundations may be necessary at both intersections, requiring excavation of up to 6 ft deep.

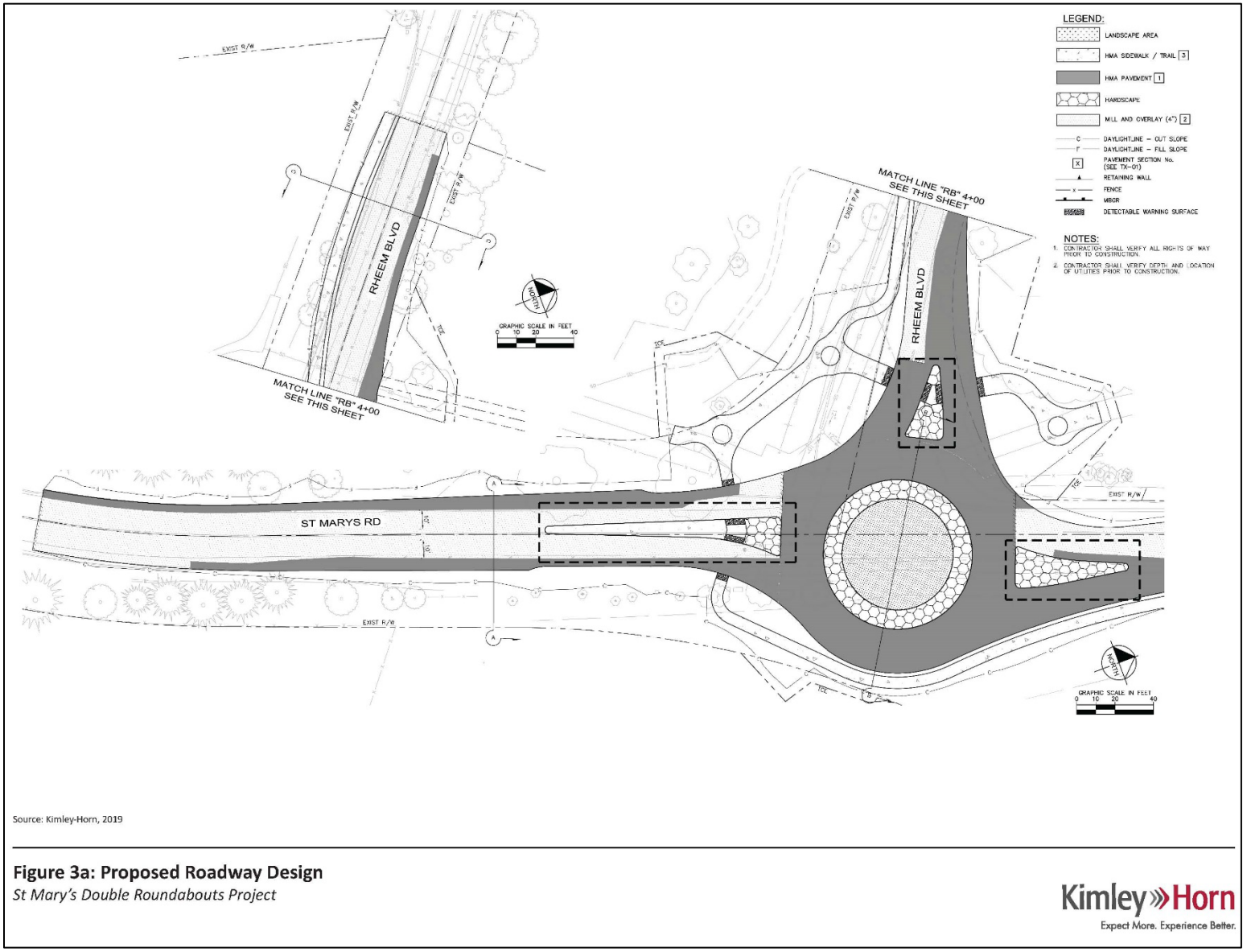
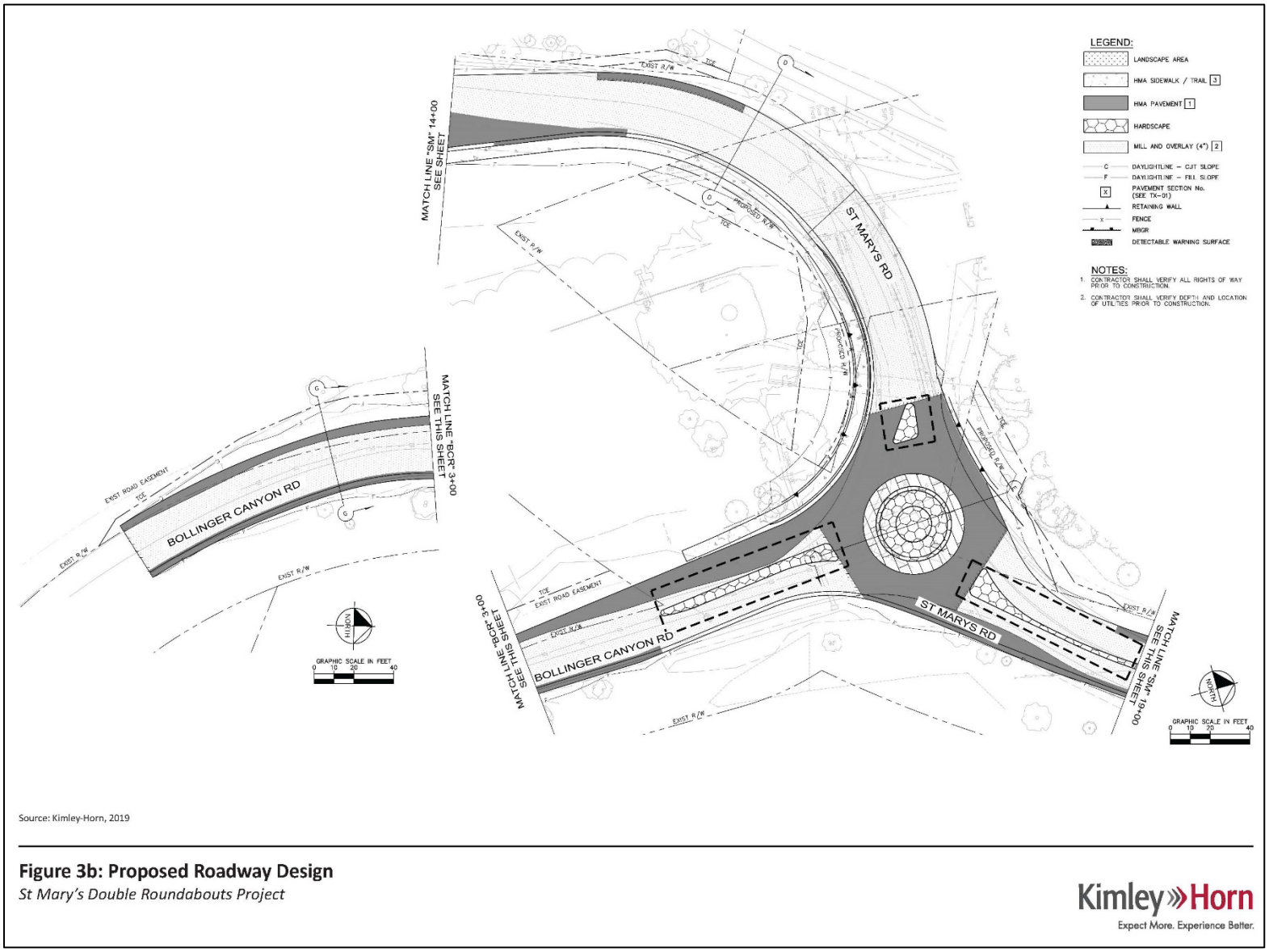


Figure 3a. Proposed Roadway Design



Source: Kimley-Horn, 2019

Figure 3b: Proposed Roadway Design
St Mary's Double Roundabouts Project

Kimley»Horn
Expect More. Experience Better.

Figure 3b. Proposed Roadway Design

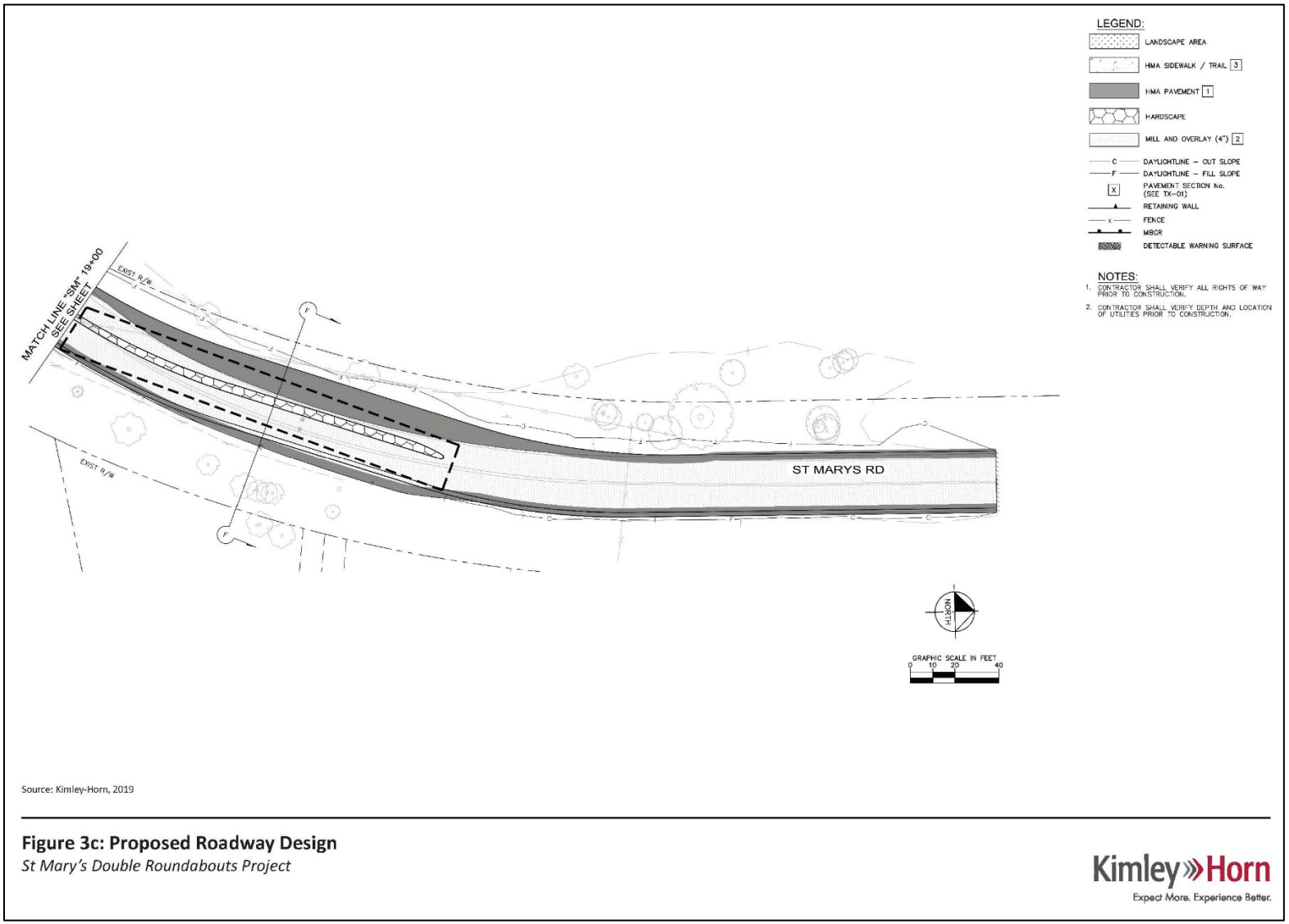


Figure 3c. Proposed Roadway Design

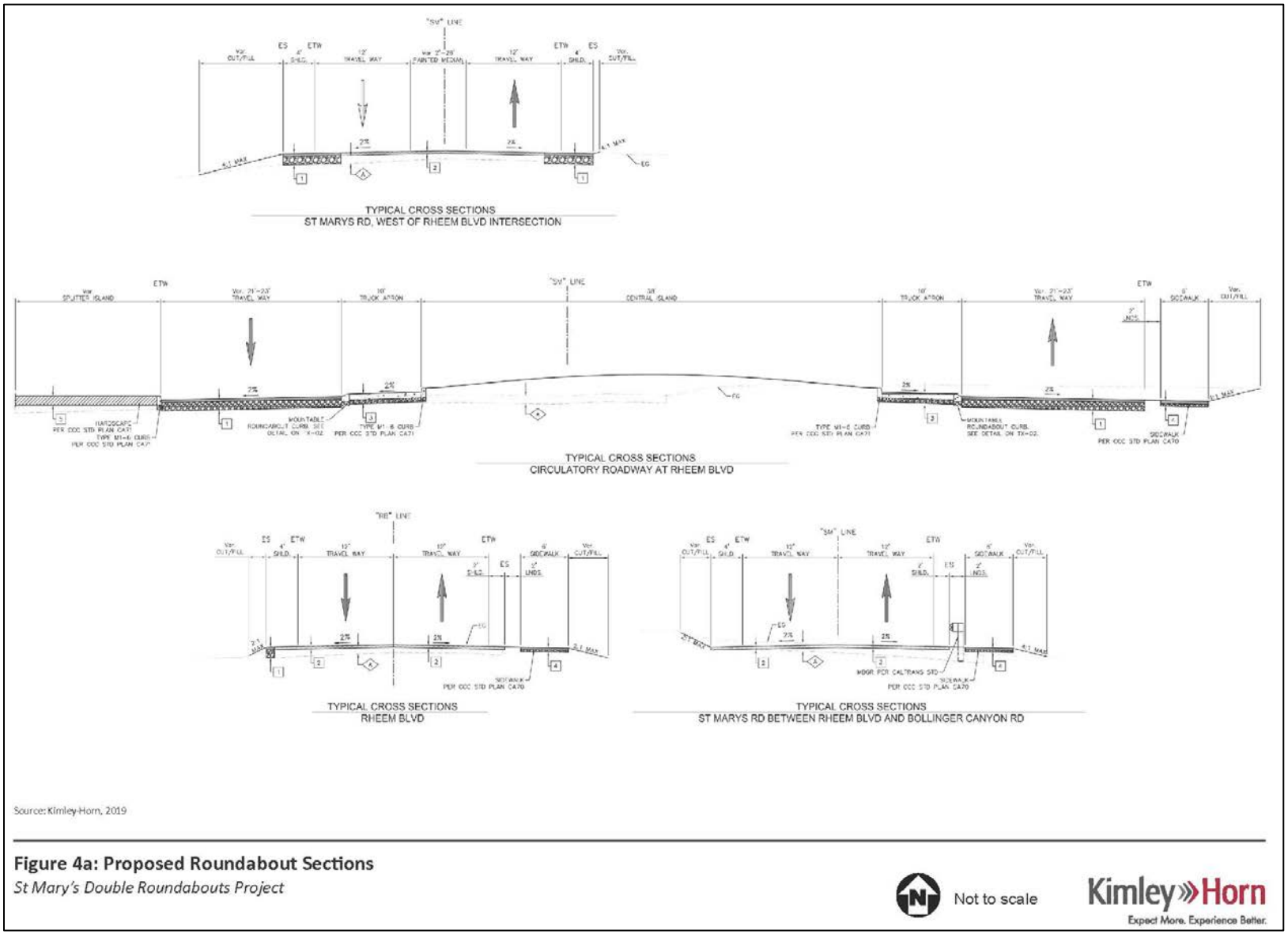


Figure 4a. Proposed Roundabout Sections

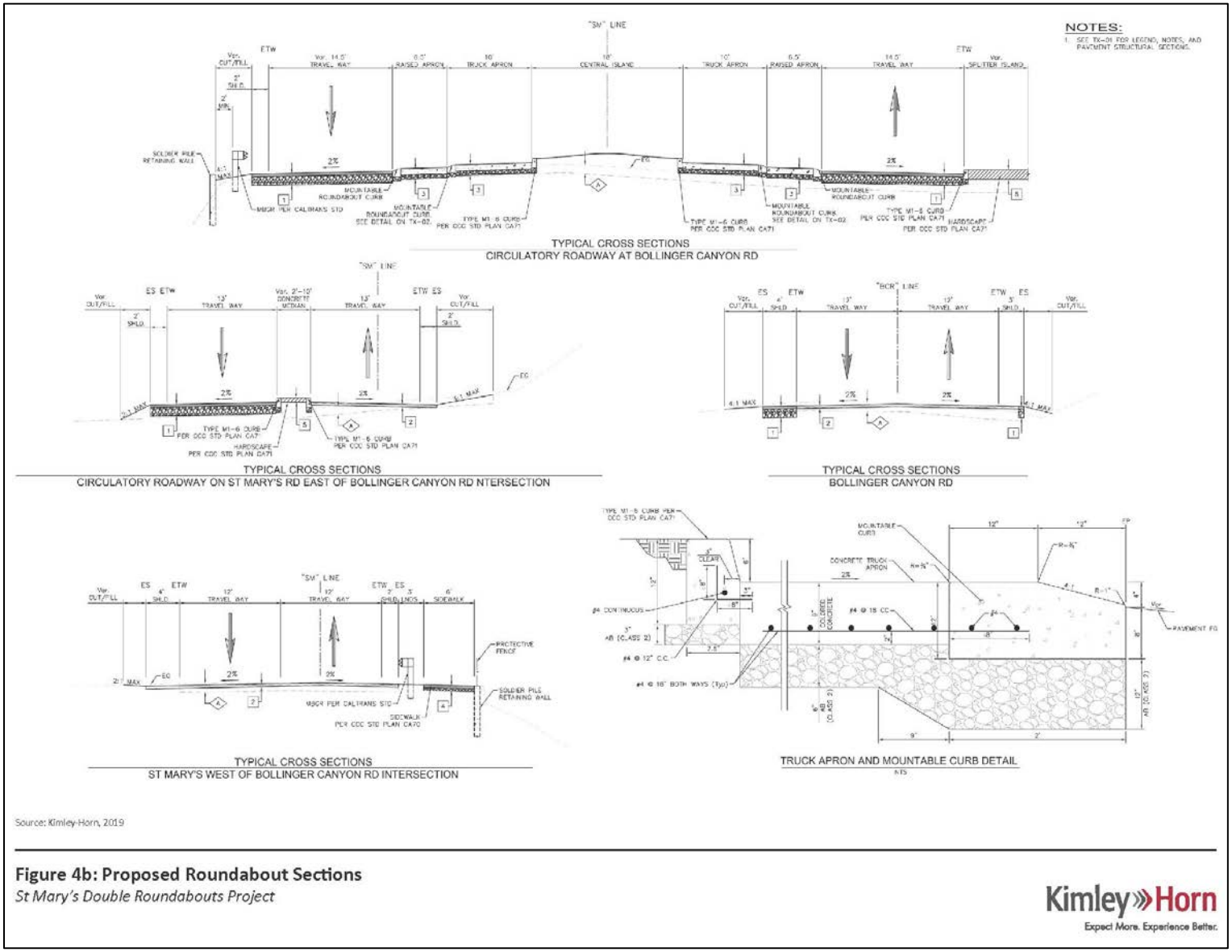


Figure 4b. Proposed Roundabout Sections

1.2.3.2 Bicycle and Pedestrian Facilities

The Lafayette/Moraga Regional Trail runs parallel and west of St. Mary's Road, crossing Rheem Boulevard via a crosswalk in front of the SSSC intersection. A new trail crossing at Rheem Boulevard would realign the trail crossing to be located approximately 40 ft west of the existing trail crossing. The new crossing would connect to the existing trail. The new trail crossing would allow for safe pedestrian and bicycle crossings west of the proposed roundabout by improving visibility and with decreased approaching vehicular speeds.

The roundabouts accommodate bicyclists by allowing users to choose their path of travel. Cyclists who have experience and confidence riding on the roadway can travel through the facility as a vehicle by merging with other vehicular traffic and occupying the lane within the roundabout itself. Other cyclists that may not feel comfortable riding within the travel lane can access the shared-use pathway with bike ramps and travel through the roundabout and cross as a pedestrian.

A new sidewalk is proposed along the east side of St. Mary's Road, starting near the Bollinger Canyon Road intersection and connecting to the regional trail on the south side of the proposed roundabout at the Rheem Boulevard intersection. The new sidewalk installation would allow for safe pedestrian crossings for the users on Bollinger Canyon Road.

1.2.3.3 Utilities

There are existing street lights within the Project area along the St. Mary's Road, which would be relocated. A new streetlight would be constructed outside of the proposed roadway pavement area. These would require excavation up to 6 ft in depth.

Existing telephone and electrical poles and boxes are located along St. Mary's Road. These telephone and electrical poles and boxes would be relocated outside the proposed roadway. These would require excavation up to 6 ft in depth.

Several sanitary sewer manholes exist along St. Mary's Road and one, located at the St. Mary's Road/Bollinger Canyon Road intersection, would require relocation. The new sanitary sewer manhole will require excavation with maximum depths of 10 ft.

There are existing water lines within the proposed Project limits. It is intended the water valves be adjusted to the proposed grade. An existing culvert crosses Rheem Boulevard, just north of the St. Mary's Road/Rheem Boulevard intersection. The Project would realign a portion of the culvert, requiring excavation up to 2 ft in depth.

1.2.3.4 Construction Activities

Construction of the proposed Project is anticipated to take 12 months. St. Mary's Road would remain open during construction; however, there may be temporary lane closures on St. Mary's Road, Rheem Boulevard, and Bollinger Canyon Road during non-commute times, and there may be one-way traffic control at night during stage construction switchovers. Access to adjacent and adjoining properties would be maintained during the duration of construction activities. Bus

access would also be maintained. Construction methods would include excavator trenching, pipe, valve and fitting installation, backfill and compaction of native fill.

Construction limits are the limits of the proposed Project. A staging area would be located on the east side of St. Mary's Road, between Rheem Boulevard and Bollinger Canyon Road intersections.

1.3 Construction General Permit Risk Level Assessment

This Project would disturb more than one acre of soil and must comply with the Construction General Permit (CGP), which includes performing a risk level determination to determine the required monitoring and sampling of stormwater during construction. The risk level assessment is determined from the combined sediment risk and receiving water risk and is documented in Appendix A.

The sediment risk factor is determined from the product of the rainfall erosivity factor (R), the soil erosion factor (K), and the length-slope factor (LS). The R, K, and LS factor information is included in Section 3.1.4.1 of this report. Using the United States Environmental Protection Agency's (USEPA) "Rainfall Erosivity Factor Calculator for Small Construction Sites" website (2019), for a construction duration of one year, the calculated R factor at the Project site is 61.33. The K factor, stated in Section 3.1.4.1, is 0.24. The State Water Resources Control Board's (SWRCB) *LS Factor KMZ File* (2011) identifies the LS factor as 4.38 for the Project area. The product of these values is 64.47 tons/acre (61.33 x 0.24 x 4.38). Because this value is more than 15 tons/acre but less than 75 tons/acre, the Project has a medium sediment risk.

The Project has a low receiving water risk because the Project's receiving water bodies, Las Trampas Creek and its tributaries (Drainage 1), do not have an impairment for sedimentation and the combined existing beneficial uses of cold freshwater habitat, fish spawning, and fish migration.

The medium sediment and low receiving water risks result in the Project being classified as Risk Level 2. Therefore, in addition to implementation of standard construction site best management practices (BMP), the contractor would be required to perform quarterly non-stormwater discharge visual inspections, and rain event visual inspections pre-storm, daily during a storm event, and post-storm. Risk Level 2 projects are also required to implement Rain Event Action Plans and comply with Numeric Action Level effluent limits for pH and turbidity. This risk level assessment may be updated during the design phase as more detailed Project information becomes available.

2 REGULATORY SECTION

2.1 Federal Laws and Requirements

2.1.1 Clean Water Act

In 1972, Congress amended the Federal Water Pollution Control Act, making the addition of pollutants to the waters of the United States (U.S.) from any point source unlawful unless the discharge is in compliance with an NPDES permit. Known today as the Clean Water Act (CWA), Congress has amended it several times. In the 1987 amendments, Congress directed dischargers of stormwater from municipal and industrial/construction point sources to comply with the NPDES permit program. This legislation, issued by the USEPA, established the contemporary legal foundation and structure for regulating water quality throughout the U.S. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The list below summarizes some of its more important sections:

- Sections 303 and 304 provide for water quality standards, criteria, and guidelines for all surface waters of the U.S. Waters of the U.S. including all navigable water bodies and all waters that drain into a navigable water body.
- Section 401 requires an applicant for a federal project that proposes an activity that may result in a discharge to waters of the U.S. to obtain certification from the State that the discharge will comply with other provisions of the CWA (most frequently in tandem with a Section 404 permit request); 401 certifications are discussed further in Section 2.2.3 below.
- Section 402 establishes the NPDES, a permitting system for the discharges (except for dredge or fill material) of any pollutant into waters of the U.S. The USEPA delegated to the SWRCB the implementation and administration of the NPDES program in California. The SWRCB established nine Regional Water Quality Control Boards (RWQCB). The SWRCB enacts and enforces the Federal NPDES program and all water quality programs and regulations that cross Regional boundaries. The nine RWQCBs enact, administer, and enforce all programs, including NPDES permitting, within their jurisdictional boundaries. Section 402(p) requires permits for discharges of stormwater from industrial, construction, and Municipal Separate Storm Sewer Systems (MS4s).
- Section 404 establishes a permit program for the discharge of dredge or fill material into waters of the U.S., including wetlands. This permit program is administered by the U.S. Army Corps of Engineers (USACE).

The USACE issues two types of 404 permits: General and Individual. There are two types of General permits: Regional and Nationwide permits. Regional permits are issued for a general category of activities when they are similar in nature and cause minimal environmental effects. Nationwide permits are issued to authorize a variety of minor project activities with no more than minimal effects. There are two types of Individual permits: Standard Individual permit and Letter of Permission. Ordinarily, projects that do not meet the criteria of a Nationwide Permit

may be permitted under one of USACE's Individual permits. For Standard Individual permit, the USACE decision to approve is based on compliance with USEPA Section 404 (b)(1) Guidelines (USEPA CFR 40 Part 230), and whether permit approval is in the public interest.

The 404(b)(1) Guidelines were developed by the USEPA in conjunction with USACE and allow the discharge of dredged or fill material into the aquatic system ("Waters of the U.S.") only if there is no practicable alternative which would have less adverse effects. The Guidelines state that USACE may not issue a permit if there is a least environmentally damaging practicable alternative, to the proposed discharge that would have less effects on "Waters of the U.S.," and not have any other significant adverse environmental consequences. Per the Guidelines, documentation is needed that a sequence of avoidance, minimization, and compensation measures have been followed, in that order. The Guidelines also restrict permitting activities that violate water quality or toxic effluent standards, jeopardize the continued existence of listed species, violate marine sanctuary protections, or cause "significant degradation" to "Waters of the U.S." In addition, every permit from the USACE, even if not subject to the 404(b)(1) Guidelines, must meet general requirements (see 33 CFR 320.4.).

2.2 State Laws and Requirements

2.2.1 Porter-Cologne Water Quality Control Act

California's Porter-Cologne Act, enacted in 1969, provides the legal basis for water quality regulation within California. This Act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or gaseous) to land or surface waters that may impair beneficial uses for surface and/or groundwater of the state. It predates the CWA and regulates discharges to "waters of the State." Waters of the State include more than just waters of the U.S., such as groundwater and surface waters which are not considered waters of the U.S. Additionally, it prohibits discharges of "waste" as defined and this definition is broader than the CWA definition of "pollutant." Discharges under the Porter-Cologne Act are permitted by Waste Discharge Requirements (WDR) and may be required even when the discharge is already permitted or exempt under the CWA.

The SWRCB and RWQCBs are responsible for establishing water quality standards as required by the CWA, and regulating discharges to protect beneficial uses of water bodies. Details regarding water quality standards in a project area are contained in the applicable RWQCB Basin Plan. In California, the RWQCBs designate beneficial uses for all water body segments in their jurisdictions, and then set standards necessary to protect these uses.

Consequently, water quality standards developed for particular water body segments are based on the designated use and vary depending on such use. Water body segments that fail to meet standards for specific pollutants are included in a statewide list in accordance with CWA Section 303(d). If a RWQCB determines that waters are impaired for one or more constituents and the standards cannot be met through point source or non-point source controls (NPDES permits or WDRs), the CWA requires the establishment of Total Maximum Daily Loads (TMDL). TMDLs specify allowable pollutant loads from all sources (point, non-point, and natural) for a given watershed.

2.2.2 State Water Resources Control Board and Regional Water Quality Control Boards

The SWRCB adjudicates water rights, sets water pollution control policy, issues water board orders on matters of statewide application, and oversees water quality functions throughout the state by approving Basin Plans, TMDLs, and NPDES permits. RWCQBs are responsible for protecting beneficial uses of water resources within their regional jurisdiction using planning, permitting, and enforcement authorities to meet this responsibility.

2.2.3 Section 401 Permitting

Under Section 401 of the CWA, any project requiring a federal license or permit that may result in a discharge to a water of the U.S., must obtain a 401 Certification, which certifies that the project will comply with State water quality standards. The most common federal permit triggering 401 Certification is a CWA Section 404 permit, issued by the USACE. The 401 permit certifications are obtained from the appropriate RWQCB, dependent on the project location, and are required before USACE issues a 404 permit.

In some cases, the RWQCB may have specific concerns with discharges associated with a project. As a result, the RWQCB may issue a set of requirements known as WDRs under the State Water Code (Porter-Cologne Act). WDRs may specify the inclusion of additional project features, effluent limitations, monitoring, and plan submittals that are to be implemented for protecting or benefiting water quality. WDRs can be issued to address both permanent and temporary discharges of a project.

2.2.4 CGP

The CGP (NPDES No. CAS000002, SWRCB Order No. 2009-0009-DWQ, adopted on November 16, 2010) became effective on February 14, 2011 and was amended by Order No. 2010-0014-DWQ and Order No. 2012-0006-DWQ. The permit regulates stormwater discharges from construction sites which result in a disturbed soil area (DSA) of one acre or greater, and/or are smaller sites that are part of a larger common plan of development.

For all projects subject to the CGP, the applicant is required to hire a Qualified Storm Water Pollution Prevention Plan (SWPPP) Developer to develop and implement an effective SWPPP. All Project Registration Documents, including the SWPPP, are required to be uploaded into the SWRCB's on-line Storm Water Multiple Application and Report Tracking System (SMARTS), at least 30 days prior to construction.

The CGP separates projects into risk levels 1, 2, or 3. Risk levels are determined during the planning and design phases and are based on potential erosion and transport to receiving waters. Requirements apply according to the risk level determined.

All construction projects subject to the CGP must adhere to its post-construction standards, unless the project lies within an area subject to a Phase I or Phase II MS4 permit. The pre-project water balance (volume of rainfall that ends up at runoff) must be maintained upon completion of the project. The water balance calculation is based on the 85th percentile storm event or the smallest storm event that creates runoff, whichever is larger. For projects disturbing more than

two acres of soil, the pre-construction drainage density (miles of stream length per square mile of drainage area) must also be preserved.

2.3 Regional and Local Requirements

2.3.1 RWQCB Basin Plan

The Project is under the jurisdiction of the San Francisco Bay RWQCB. The San Francisco Bay RWQCB implements the *San Francisco Bay Basin Water Quality Control Plan* (Basin Plan) (2017), which regulates surface and groundwater quality in the region. The Basin Plan lists beneficial uses and water quality objectives to protect those uses.

2.3.2 MS4

The Town is a permittee under the San Francisco Bay Municipal Regional Permit (MRP), Order No. R2-2015-0049 and is part of the Contra Costa Clean Water Program (CCCWP). The CCCWP developed the *Stormwater C.3 Guidebook* (2017) to summarize the requirements of the MRP and provide guidance for low-impact development design strategies and specific BMP selection criteria. This manual provides technical guidance for project designs that require the implementation of permanent stormwater BMPs and hydromodification assessment, susceptibility, and management measures throughout the San Francisco Bay RWQCB's boundary within Contra Costa County.

3 AFFECTED ENVIRONMENT/EXISTING CONDITIONS

The Project is located along St. Mary's Road at the intersections with Rheem Boulevard and Bollinger Canyon Road in the Town of Moraga, Contra Costa County, California. Las Trampas Creek crosses St. Mary's Road near the Bollinger Canyon Road intersection and the Lafayette/Moraga Regional Trail runs parallel to St. Mary's Road. See Figure 5 for the Project study area.

3.1 General Setting

3.1.1 Population and Land Use

According to the U.S. Census Bureau, the population of the Town was approximately 17,962 in 2018. The land surrounding the Project area is zoned as two dwelling units per acre along Rheem Boulevard, one dwelling unit per acre east of the St. Mary's Road-Bollinger Canyon Road intersection, St. Mary's College to the south, and open space areas designated by the Moraga Open Space Ordinance to the north and southwest, as shown in Figure 6 (Moraga Planning Department 2018).

3.1.2 Topography

The Project area is bounded by Las Trampas Ridge to the east, the Gudde Ridge to the west, the Town to the south, and the City of Lafayette to the north. The study area is located along St. Mary's Road, with Las Trampas Creek located approximately 30 ft below the road. Elevations within the Project area range from approximately 523 ft to 586 ft above mean sea level. See Figure 7 for the topographic map.

3.1.3 Hydrology

3.1.3.1 Regional Hydrology

Per the CalWater watershed delineation in the California Department of Transportation's (Caltrans) *Water Quality Planning Tool* (2012), the Project is within the Walnut Creek Hydrologic Sub-area (#207.32) of the Concord Hydrologic Area in the Suisun Hydrologic Unit.

3.1.3.2 Local Hydrology

The Project is located within the Las Trampas Creek Watershed. It originates from the hills southeast of the Town of Moraga, along Las Trampas Ridge. The watershed drains on a northerly course to the City of Walnut Creek, where it drains into Walnut Creek. Las Trampas Creek flows primarily in an open natural channel, with some flows through underground culverts and concrete open channels through the City of Walnut Creek until it reaches Suisun Bay, approximately 17 miles north of the Project. See Figure 8 for the watershed map.

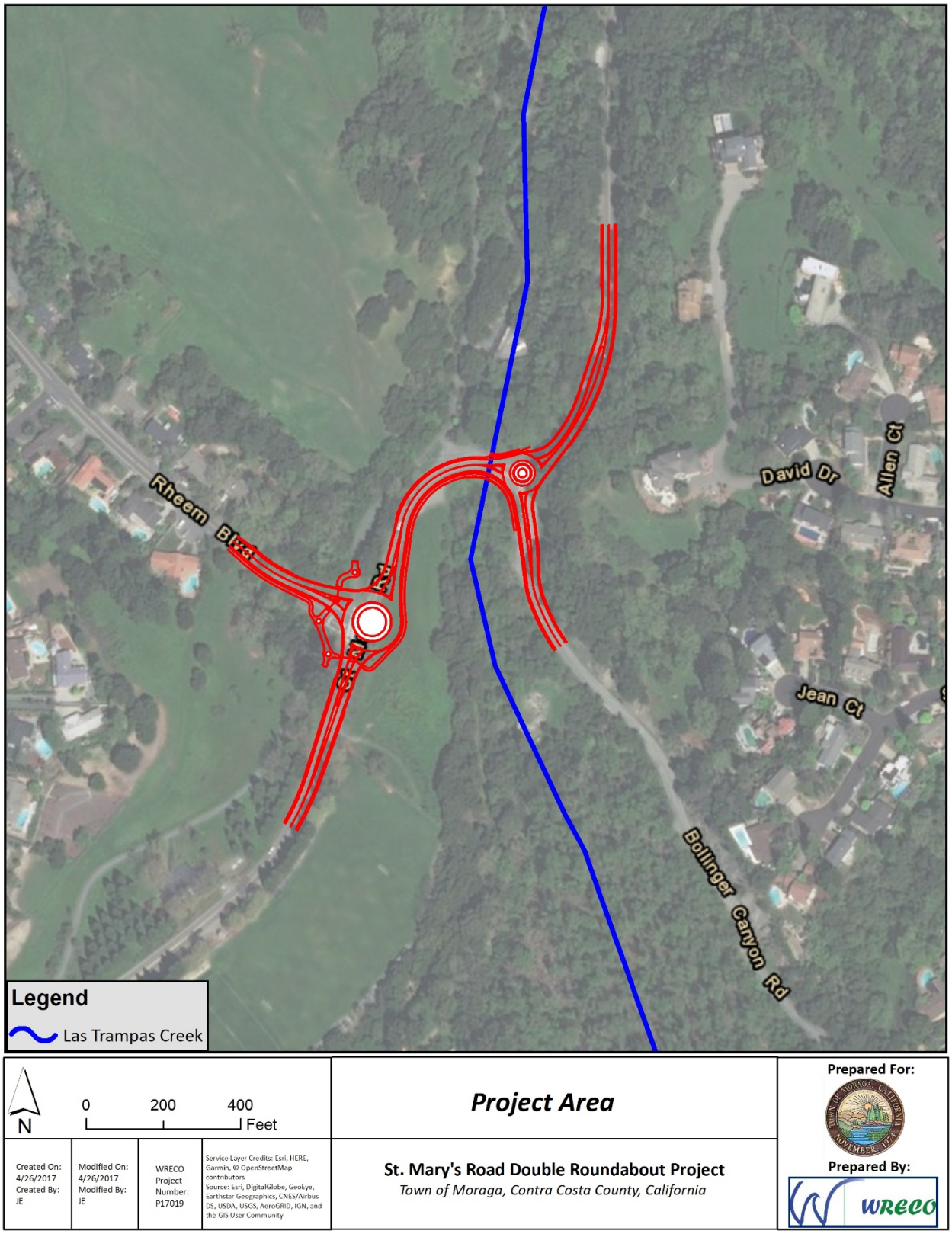


Figure 5. Project Study Area

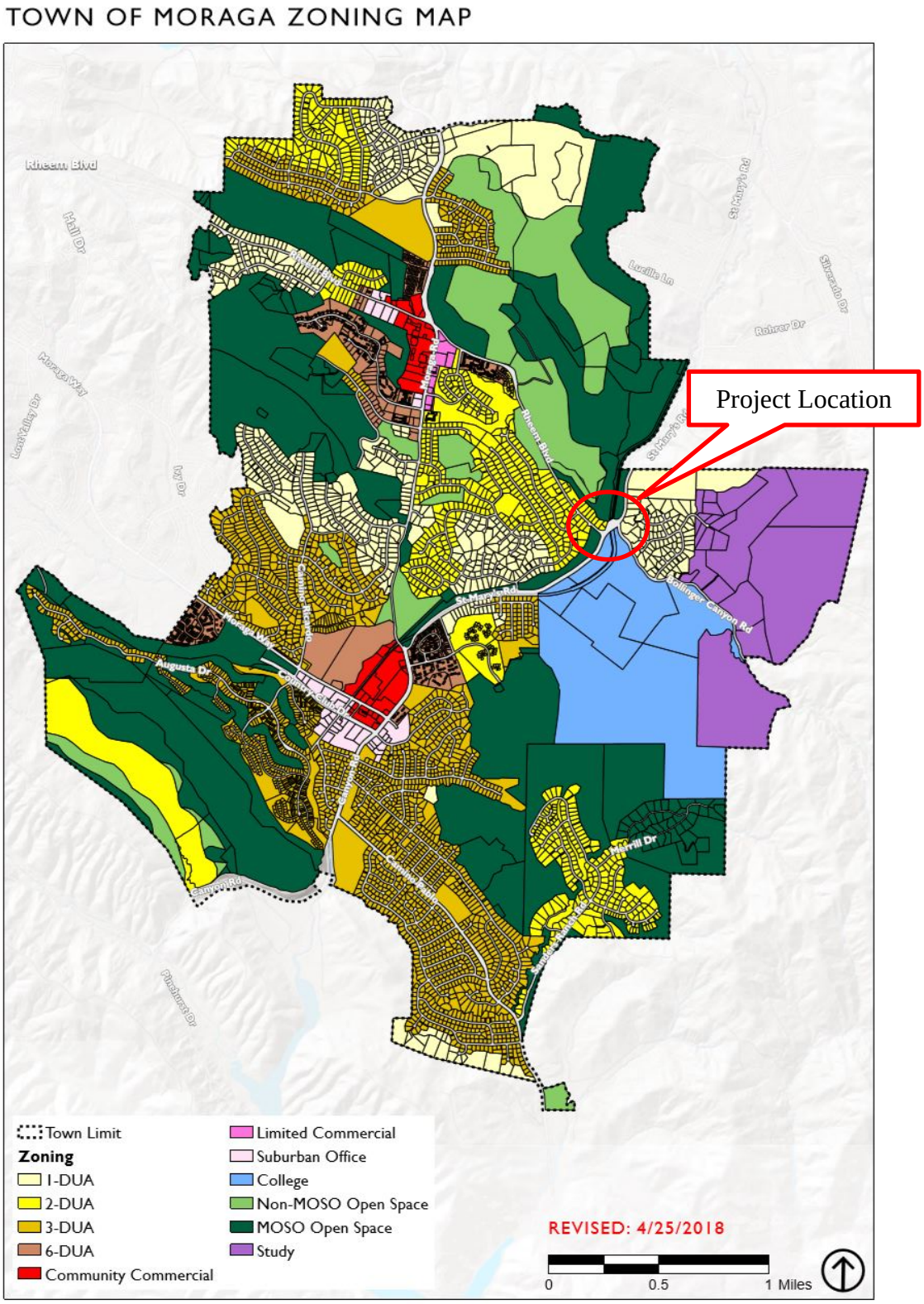


Figure 6. Zoning Surrounding Project Site

Source: Moraga Planning Department 2018

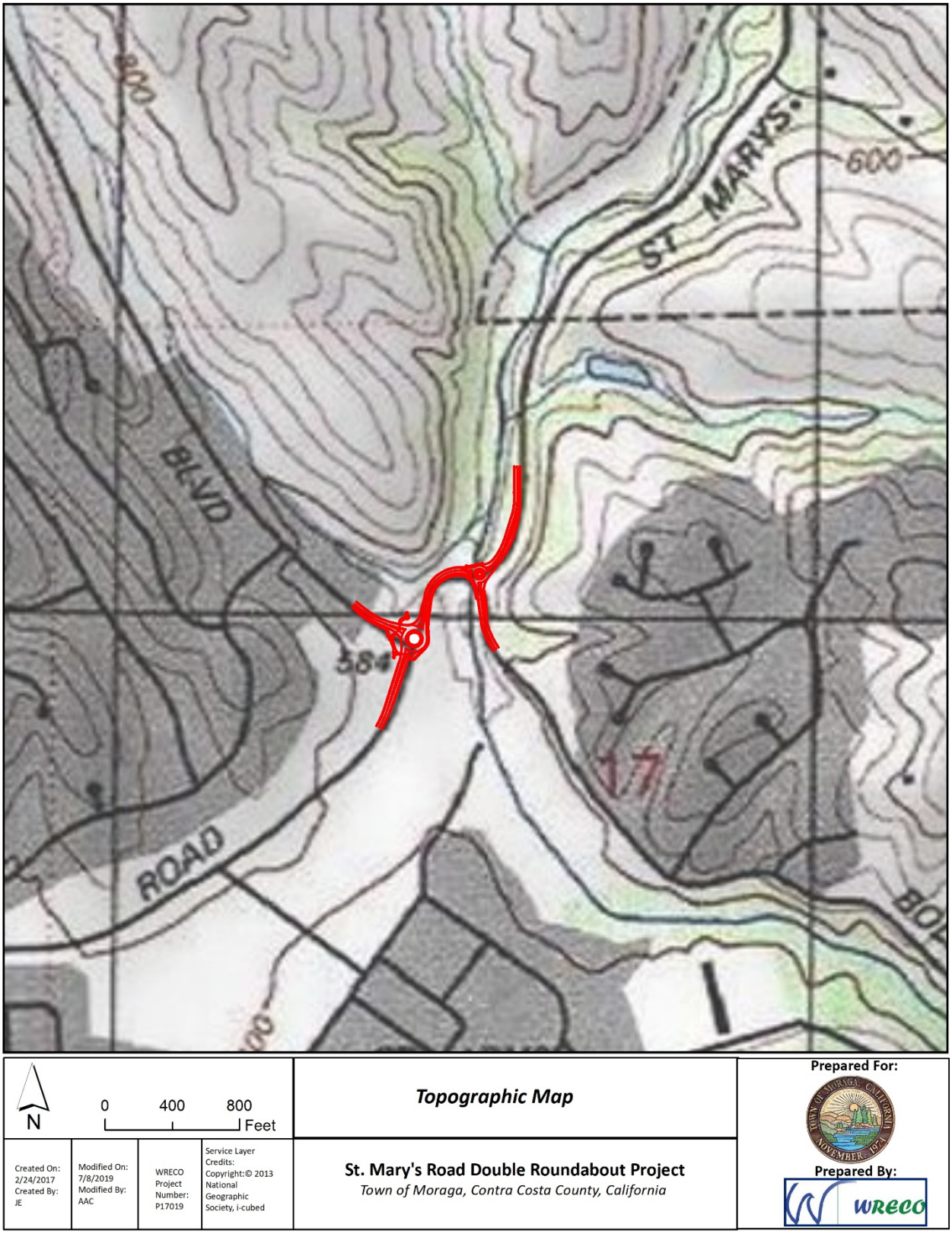


Figure 7. Topographic Map

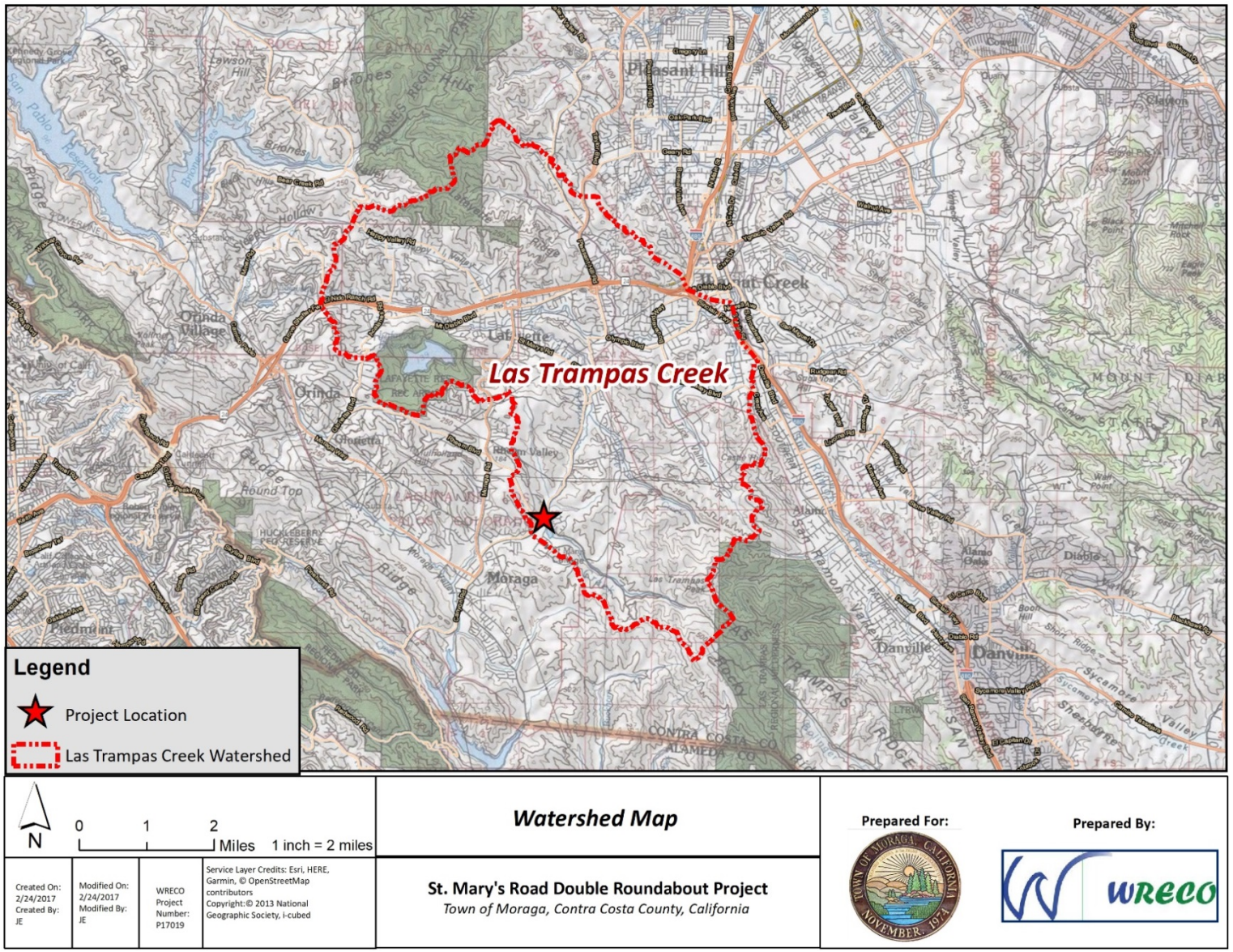


Figure 8. Las Trampas Creek Watershed Map

3.1.3.2.1 Precipitation and Climate

According to the Köeppen climate classification system, the study area has a Mediterranean climate, characterized by hot, dry summers and mild, moist winters. The Project area generally experiences precipitation between mid-October and mid-April. A climate summary for the nearest National Oceanic and Atmospheric Administration (NOAA) weather station with similar elevation and topography to the Project reports the following precipitation and temperature information (Western Regional Climate Center 2019):

Saint Mary's College Station 047661 (1942-1981)

- Average annual rainfall for Moraga is 27.48 inches (in.)
- Average temperatures range seasonally from 44.4 to 68.4 degrees Fahrenheit (ºF)

The maximum average temperature reported for the Moraga area was 81.9ºF in July, and the lowest average temperature is 53.1ºF in January. The wettest month of the year is January with an average rainfall of 6.12 in., and the driest month is July with an average of 0.05 in. Winter storms are usually of moderate duration and intensity (Western Regional Climate Center 2019).

3.1.3.2.2 Surface Waters

The Project's receiving water bodies are Las Trampas Creek and a drainage feature (Drainage 1).

Las Trampas Creek flows through the study area in a northerly direction, traveling below St. Mary's Road through a concrete box culvert. Upstream of the culvert, the bed of Las Trampas Creek is approximately 16 ft wide, with flowing water at a depth of approximately 2 ft. The channel is incised with steep banks, approximately 30 ft tall from the channel bed, with a 1:1 (horizontal:vertical) slope. The bed of the channel contains primarily sand and gravel. Downstream of the culvert, the bed of Las Trampas Creek is approximately 20 ft wide, with flowing water at a depth of approximately 3 ft. The bed of the channel contains primarily sand, with gravel and large rocks greater than 8 in.

Approximately 270 ft south of the St. Mary's Road intersection, Drainage 1 is located adjacent to Bollinger Canyon Road. Drainage 1 originates from the hillside east of the study area along Bollinger Canyon Road, which consists of a residential community. The bankfull width ranged from 8 ft wide to 3 ft wide, and flowing water was observed during the site visit conducted on March 31, 2017. The hillside drainage enters an 18-in. corrugated plastic pipe and travels west below Bollinger Canyon Road, where it outlets approximately 50-ft down the embankment into Las Trampas Creek.

Surface Water Quality Objectives/Standards and Beneficial Uses

Water quality objectives are numeric and narrative objectives used to define the appropriate levels of environmental quality, to protect beneficial uses, and to manage activities that can impact aquatic environments. The San Francisco Bay RWQCB Basin Plan (2017) lists the following narrative and numeric water quality objectives for the region's surface waters: bacteria, bioaccumulation, biostimulatory substances, color, dissolved oxygen, floating material, oil and grease, population and community ecology, pH, radioactivity, salinity, sediment,

settleable material, suspended material, sulfide, taste and odors, temperature, toxicity, turbidity, and un-ionized ammonia. The water quality objectives from the Basin Plan (2017) are also included in Appendix B.1 of this WQAR.

Las Trampas Creek and its tributaries (Drainage 1) have the following existing beneficial uses as stated in the San Francisco Bay RWQCB's Basin Plan (2017):

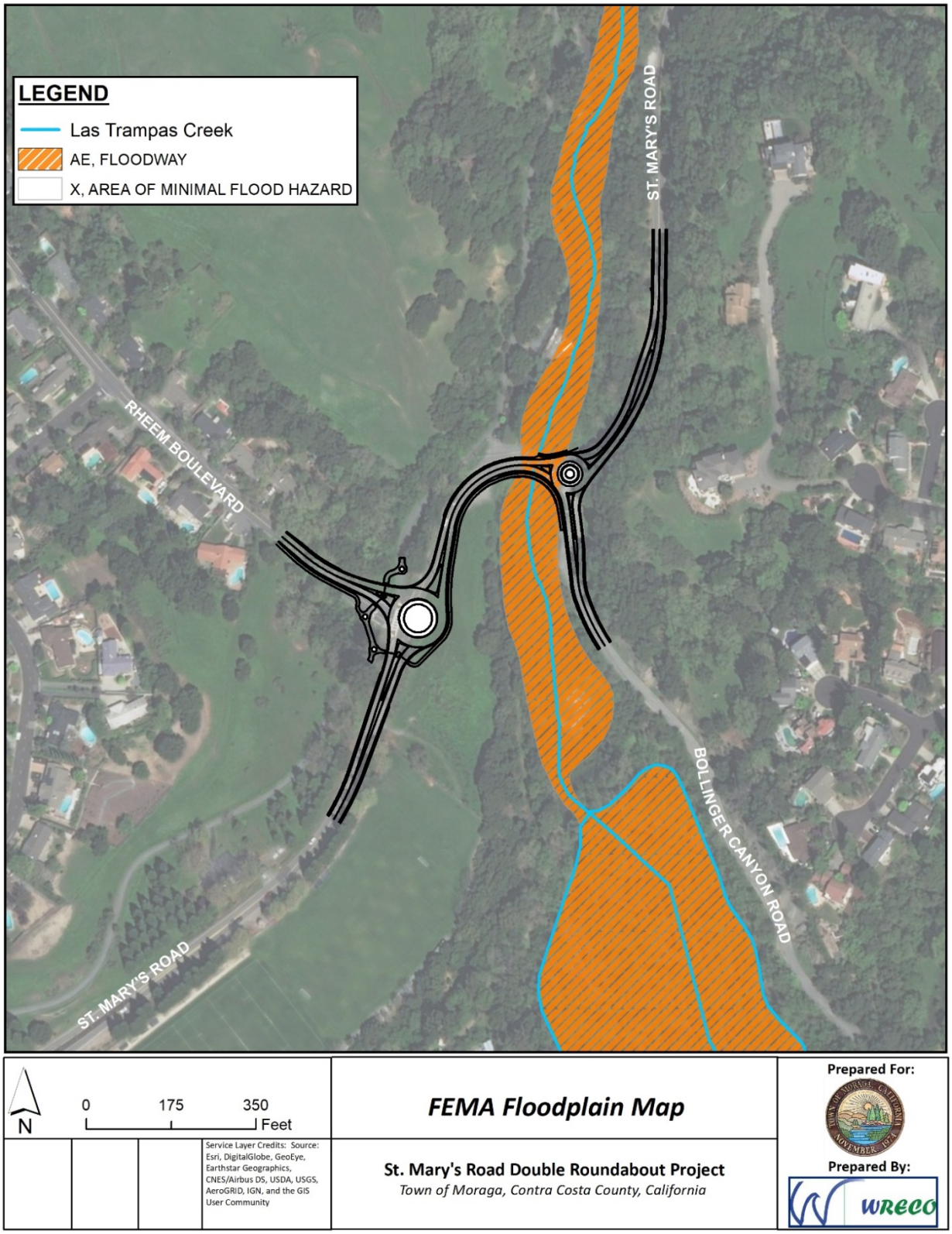
- Cold freshwater habitat
- Preservation of rare and endangered species
- Warm freshwater habitat
- Wildlife habitat
- Water contact recreation
- Non-contact water recreation

Detailed descriptions of the beneficial uses from the Basin Plan are included in Appendix B.2 of this WQAR.

Water Quality Impairments and Total Maximum Daily Loads (TMDL)
The *2014/2016 California Integrated Report (CWA Section 303[d] List / 305[b] Report)* (SWRCB 2018) does not list Las Trampas Creek or Drainage 1 as pollutant impaired.

3.1.3.2.3 Floodplains

The Project is located within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps 06013C0426F and 06013C0428F (provided in Appendix C). The Las Trampas Creek floodplain in the vicinity of the Project is a FEMA designated Zone AE area with a regulatory floodway (see Figure 4). Zone AE floodplains represent areas subject to inundation during the 1%-annual chance (or the 100-year) flood event and determined by detailed methods where base flood elevations (BFE) are provided. The remainder of the Project area, where improvements are proposed, are located within a FEMA designated unshaded Zone X region. Unshaded Zone X represent areas of minimal flood hazard, which are defined as areas outside of the special flood hazard area and above the 500-year flood level. Refer to the Project's Floodplain Evaluation Report (WRECO 2019a) for more information.



Note: Unshaded Zone X area is transparent.

Figure 9. FEMA FIRM at Project Location

Source: ESRI and FEMA

Municipal Supply
The Town receives water from the East Bay Municipal Utility District (EBMUD). According to the EBMUD's *Urban Water Management Plan* (2015), sources of its municipal water supply originate from the Mokelumne River watershed in the Sierra Nevada and the East Bay Plain Groundwater Subbasin within the Santa Clara Valley Groundwater Basin.

3.1.3.3 Groundwater Hydrology

The Town is not within a groundwater basin designated by the California Department of Water Resources' Groundwater Information Center Interactive Map Application (2019). According to the SWRCB's Groundwater Ambient Monitoring Assessment Program GeoTracker application (2019), a monitoring well located approximately 1.38 miles southwest of the Project at a former Shell service station recorded groundwater depths ranging from 2.74 ft to 10.72 ft below ground surface. This information will be updated when the Geotechnical Report for the Project is available.

3.1.3.3.1 Groundwater Quality Objectives/Standards and Beneficial Uses

The San Francisco Bay RWQCB Basin Plan (2017) identifies narrative and numerical groundwater objectives for the region (Appendix B.1). It states, "at a minimum, groundwater shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor." The Basin Plan lists the following beneficial uses that are suitable or potentially suitable for groundwater outside of designated groundwater basins:

- Municipal and domestic water supply
- Industrial process water supply
- Industrial water supply
- Agricultural water supply
- Groundwater recharge
- Freshwater replenishment to surface waters

Detailed descriptions of the beneficial uses from the Basin Plan are included in Appendix B.2 of this WQAR.

3.1.4 Geology/Soils

Originally published by the U.S. Department of Agriculture (USDA), soil data for Contra Costa County were downloaded from the Soil Survey Geographic database (USDA 2019), and the data were imported to ArcGIS, as shown in Figure 10. Additional soil information was obtained from the Natural Resource Conservation Service's soil surveys for the listed counties. The *Soil Survey of Contra Costa County, California* (USDA 1977) was reviewed for the Project. Two soil types are mapped in the study area, and described below.

Clear Lake clay, 0 to 15 percent slopes, Major Land Resource Area (MLRA) 15
This soil type is the only Clear Lake soil mapped in the Contra Costa County. Its drainage has been improved by natural stream cutting, and the water table is below a depth of 6 inches in most places. Runoff is very slow, and there is no hazard of erosion where the soil is tilled and exposed. The soil is subject to flooding once every 7 to 10 years unless surface drainage is

provided. This soil is used for dryland small grain and volunteer hay and for homesites. This soil type is hydric (USDA 1977).

Cropley clay, 2 to 5 percent slopes
This soil type is typically found on gently sloping terrain, in small upland valleys. Runoff for this soil type is slow, and the hazard of erosion is slight where the soil is tilled and exposed. This soil is used for dryland grain and range and for homesites. This soil type is hydric (USDA 1977).

This information will be updated when the Geotechnical Report for the Project is available.

3.1.4.1 Soil Erosion Potential

The erosion factor (K) indicates the erodibility of the fine-earth fraction of the soil. The factor is given as a percentage or fraction ranging from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water. The SWRCB's *K Factor KMZ File* (2011) shows the Project has K factor of 0.24, which suggests the soils have a low-moderate potential for erosion. The Project K factor is shown in Appendix A.

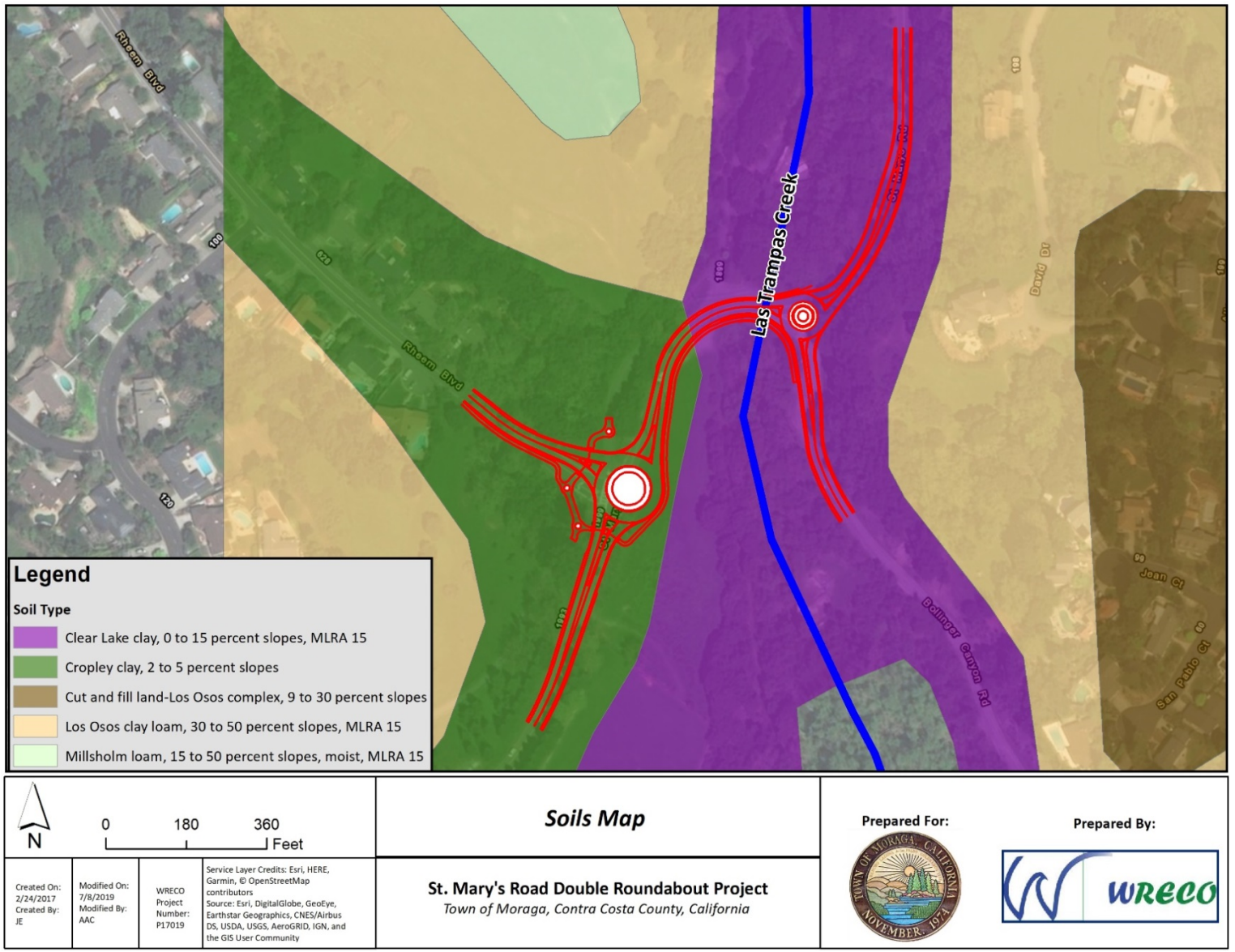


Figure 10. Soils Map

3.1.5 Biological Communities

The following sections summarize the information from the *Draft Biological Resource Study* (WRECO 2019b), which provides detailed information regarding the biological communities within the Biological Study Area (BSA), as defined in the *Draft Biological Resource Study*.

3.1.5.1 Aquatic Habitat and Wetlands

Wetland delineations were conducted in 2017 and 2019 in areas that exhibited characteristic wetland vegetation and/or hydrologic indicators. Las Trampas Creek is a perennial stream classified as a relatively permanent water (RPW) subject to USACE jurisdiction, pursuant to Section 404 of the CWA. Drainage 1 is a non-RPW hillside drainage feature, likely subject to USACE jurisdiction as other waters of the U.S. under the significant nexus test. No potential wetlands are present within the BSA.

3.1.5.2 Special-Status Species

There are five special-status wildlife species that have the potential to occur within the BSA: western pond turtle (*Emys marmorata*), Alameda whipsnake (*Masticophis lateralis euryxanthus*), foothill yellow-legged frog (*Rana boylii*), California red-legged frog (*Rana draytonii*), and San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*). There are no special-status plant species within the BSA.

3.1.5.3 Stream/Riparian Habitats

The riverine waters in Las Trampas Creek are perennial, and the water level ranges from high and fast-flowing in the winter to low with slow moving in the summer. Riverine waters provide food for birds such as waterfowl and herons. They provide breeding and foraging habitat for fish, amphibians, and other aquatic species.

Riverine habitats provide migration corridors for a variety of mammals, amphibians, reptiles, including Alameda whipsnake and birds. Las Trampas Creek also provides suitable migration and dispersal corridors for species including, California red-legged frog, California tiger salamander (*Ambystoma californiense*), and western pond turtle.

3.1.5.4 Fish Passage

Las Trampas Creek is outside the range for salmonid species, including steelhead (*Oncorhynchus mykiss*) and Chinook salmon (*Oncorhynchus tshawytscha*). However, the Project is within NOAA Fisheries' designated essential fish habitat for Chinook salmon.

4 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

The following sections present the potential temporary and permanent water quality impacts from the Project activities and standard BMPs that would be implemented to avoid these impacts.

Temporary water quality impacts can result from sediment discharge from DSAs and construction near water resources or drainage facilities that discharge to water bodies. Permanent impacts to water quality result from the addition of impervious area; this additional impervious area prevents runoff from naturally dispersing and infiltrating into the ground, resulting in increased concentrated flow. The estimates for DSA and existing impervious, added, removed, and replaced impervious areas within the Project are listed in Table 1. The DSA and impervious area values would be further refined during the design phase once the limits of grading, construction staging locations, roadway geometry, and other areas of improvements have been further developed.

Table 1. DSA and Impervious Areas (acres)

DSA	Existing Impervious Area	Added Impervious Area	Removed Impervious Area	Replaced Impervious Area	Added and Replaced Impervious Area
2.61	1.61	0.68	0.01	1.44	2.12

Source: Kimley Horn and Associates

4.1.1 Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

The following sections describe the specific physical and chemical characteristics that can potentially be impacted by the Project.

4.1.1.1 Currents, Circulation, or Drainage Patterns

The added impervious area created by the Project may result in minimal impacts to the existing hydrograph, including minimal increases in low-flow and peak-flow velocity and volume, due to the Project not adding additional travel lanes. The goal of the Project drainage design would be to maintain existing drainage patterns and reduce the increased peak flow velocities and volumes to pre-Project conditions. The Project drainage design will be determined during the design phase.

4.1.1.2 Suspended Particulates (Turbidity)

Potential permanent impacts related to increased turbidity within receiving waters may result from roadway, retaining wall, and new trail construction.

The Project would result in additional impervious area from the creation of the new trail would potentially increase deposition of sediment and other pollutants from vehicular and human traffic. Because the Project would not add additional travel lanes, stormwater treatment and hydromodification management measures are not considered for the Project per the exemption criteria stated in the MRP and the CCCWP's *Stormwater C.3 Handbook* (2017). The Project would implement site design features such as dispersal of stormwater runoff to adjacent pervious areas to maximize sheet flow from impervious areas in the Project areas. The Project would also implement additional Project features such as erosion control measures and revegetation of slopes to reduce dispersal of sediment into Las Trampas Creek.

4.1.1.3 Oil, Grease, and Chemical Pollutants

Heavy metals associated with vehicle tire and brake wear, oil and grease, and exhaust emissions are the primary pollutants associated with transportation corridors. Generally, roadway stormwater runoff has the following pollutants: total suspended solids, nitrate nitrogen, total Kjeldahl nitrogen, phosphorus, ortho-phosphate, copper, lead, and zinc. The pollutants are dispersed from combustion products from fossil fuels, the wearing of brake pads and tires, and tree leaves that have been exposed through aerial deposition. The Project is expected to ease congestion, leading to less deposition of particulates from exhaust and heavy metals from braking.

As discussed in Section 4.1.1.2, the Project would disperse stormwater runoff to adjacent pervious areas, which would filter pollutants from the runoff.

4.1.1.4 Temperature, Oxygen, Depletion, and Other Parameters

Removal of vegetation can potentially cause a reduction in shade to adjacent waters, temporarily increasing temperature and decreasing dissolved oxygen levels. Existing native vegetation will be preserved to the maximum extent practicable.

As discussed in Section 4.1.1.2, the Project would disperse stormwater runoff to adjacent pervious areas, which would filter pollutants from the runoff before discharging into Las Trampas Creek. The Project would also implement additional Project features such as erosion control measures and revegetation of slopes to reduce erosion impacts and promote infiltration and habitat restoration.

4.1.1.5 Groundwater

The Project would result in the addition of impervious area and reduce the available unpaved area that previously allowed runoff to infiltrate into the native soils. Although the Project is not within a designated groundwater basin, the groundwater is suitable or may be suitable for groundwater recharge, as discussed in Section 3.1.3.3.1.

As discussed in Section 4.1.1.2, the Project would disperse stormwater runoff to adjacent pervious areas, which would promote infiltration of stormwater into the native soils.

4.1.2 Anticipated Changes to the Biological Characteristics of the Aquatic Environment

The following sections summarize the information from the *Draft Biological Resource Study* (WRECO 2019b), which provides detailed information regarding potential changes or impacts to the biological communities and environment for the Project.

4.1.2.1 Aquatic Habitat

As described in Section 3.1.5.1, there are no wetlands within the BSA. There would be impacts to the creek bank where fill will be placed. With implementation of Project features that limit or prevent discharges of sediment, debris, material, and waste to storm drain inlets and receiving waters (including Las Trampas Creek and Drainage 1) there would be no impacts to aquatic habitat.

4.1.2.2 Wildlife Habitat

Las Trampas Creek and Drainage 1 are identified as having beneficial uses of preservation of rare and endangered species and wildlife habitat; however, no permanent impacts are expected. If wildlife is encountered, the Contractor should work with approved biologists in accordance with the Project specifications.

4.1.2.3 Invasive Species

The BSA supports a number of limited and moderate invasive species. The Project would comply with Executive Order 13112. This order is designed to prevent the introduction of invasive species and provide for their control in order to minimize economic, ecological, and human health impacts. Noxious weeds are defined and prioritized by the California Department of Food and Agriculture or the California Invasive Plant Council and will be identified at the site by approved biologists.

4.1.3 Anticipated Changes to the Human Use Characteristics of the Aquatic Environment

4.1.3.1 Existing and Potential Water Supplies; Water Conservation

Las Trampas Creek and Drainage 1 do not have a beneficial use for municipal and domestic supply. Although groundwater within the Project study area is suitable or potentially suitable for municipal and domestic supply, groundwater within the Town of Moraga is not a source of the municipal water supplied by the EBMUD. No permanent impacts are anticipated to water supplies and conservation.

4.1.3.2 Other Water Related Recreation

Las Trampas Creek and Drainage 1 have beneficial uses for water contact and non-contact water recreation; however, no permanent impacts are anticipated to these beneficial uses.

4.1.3.3 Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, Wilderness Areas, etc.

The Project is located within the Lafayette/Moraga Regional Trail, which would be realigned to accommodate the roundabouts and widening. Site design measures, as discussed in Section 4.1.1.2, would promote infiltration into pervious areas adjacent to the impervious areas. No permanent impacts are anticipated.

4.1.3.4 Navigation

Las Trampas Creek and Drainage 1 have a beneficial use for navigation; however, no permanent impacts are anticipated to this beneficial use.

4.1.4 Temporary Impacts to Water Quality

4.1.4.1 Stormwater

The Project would have potential short-term water quality impacts during construction. Earth-moving and other construction activities may cause minor erosion and runoff of top soils into the drainage systems along the Project corridor during construction, which could temporarily affect water quality in Las Trampas Creek and Drainage 1. The Project would disturb an estimated 2.61 acres of soil during construction. Stormwater runoff over DSAs could potentially cause sediment-laden flows to enter storm drainage facilities sheet flowing discharge into Las Trampas Creek and Drainage 1, increasing the turbidity, decreasing the clarity, and potentially impacting the beneficial uses of the creek. Generally, as the DSAs increase, the potential for temporary water quality impacts also increases. Additional sources of sediment include uncovered or improperly covered active and non-active stockpiles, unstabilized slopes and construction staging areas, and construction equipment not properly maintained or cleaned.

If fueling or maintenance of construction vehicles occurs within the Project site during construction, there is a risk of accidental spills or releases of fuels, oils, or other potentially toxic materials. An accidental release of these materials may pose a threat to water quality if contaminants enter storm drains, open channels, or receiving bodies. The magnitude of the impact from an accidental release depends on the amount and type of material spilled.

Temporary impacts to water quality during construction can be avoided by implementing temporary Project features (or BMPs). Typical temporary BMPs that should be considered for this Project is listed in Table 2. The selected BMPs are described in further detail in the California Stormwater Quality Association's (CASQA) *Stormwater Best Management Practice Handbook for Construction* (2015) and are consistent with the practices required under the CGP. The actual minimum temporary BMPs necessary for the Project to comply with the CGP and the Town standards would be determined during the design phase.

The CGP and Town standards require the Project's contractor to implement a SWPPP to comply with the conditions of the CGP. The SWPPP would be submitted by the Contractor and approved by Caltrans prior to the start of construction. The SWPPP would detail the measures to address the temporary water quality impacts resulting from construction activities associated with this Project. The SWPPP would also include the development of a Construction Site Monitoring

Program that presents procedures and methods related to the visual monitoring, sampling, and analysis plans. In compliance with the CGP, prior to any soil disturbance work, a Notice of Intent would need to be filed with the SWRCB's SMARTS. To maintain proper permit coverage under the CGP, in addition to filing a Notice of Intent, all dischargers must electronically file Permit Registration Documents, Notice of Termination, changes of information, sampling and monitoring information, annual reporting, and other required compliance documents through the SWRCB's SMARTS.

4.1.4.2 Groundwater

Dewatering during construction may be necessary due to the shallow groundwater within the Project study area. Dewatering activities would have to comply with Caltrans' *Field Guide to Construction Site Dewatering* (2014) and if needed, a separate dewatering permit would be obtained prior to the start of construction. Further details of the dewatering activities are discussed in Section 5.2.1.

4.1.4.3 Biological Characteristics of the Aquatic Environment

The short-term impacts to biological characteristics of the aquatic environment during construction are expected to be minimal. Water quality monitoring would be performed during dewatering activities to document changes in turbidity in compliance with water quality standards, permits, and approvals from the NOAA Fisheries and/or the California Department of Fish and Wildlife. In the event that high- or medium-priority noxious weeds were disturbed or removed during construction-related activities, the contractor would contain the plant material and dispose of it in a manner that will not promote the spread of the species. The contractor would be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Further information of BMPs listed in Table 2 and additional BMPs for biological resources are discussed in the Project's *Draft Biological Resource Study* (WRECO 2019b).

4.1.4.4 Human Use Characteristics of the Aquatic Environment

The short-term impacts to human use characteristics of the aquatic environment during construction are expected to be minimal. Public access to the Lafayette/Moraga Regional Trail would be restricted during construction. There are minimal to no anticipated water quality impacts expected that would impact the human use characteristics of the aquatic environment.

4.1.5 Long-Term Impacts During Operation and Maintenance

The added impervious are would have a minimal hydromodification impacts and stormwater pollution effects because runoff from the Project activities would be treated with site design measures. Pollution and runoff sources are not expected to change.

4.2 Cumulative Impacts

The Saint Mary's College of California's *Campus Master Plan* (2017) identifies past, current, and future development projects within the campus. Because these projects are or would be subject to NPDES requirements and implement their own Project features, cumulative impacts are not anticipated.

Table 2. Temporary Project Features (BMPs)

Temporary BMP	Purpose
Erosion Control	
Scheduling	Plan that details sequence of construction activities and BMP implementation, taking local climate into consideration to reduce amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking and to perform the construction activities and control practice in accordance with the schedule.
Preservation of Existing Vegetation	Protection of existing trees, vines, shrubs, and grasses that protect soil from erosion.
Hydraulic Mulch	Fibrous materials mixed with water sprayed onto the soil surface in slurry form to provide layer of temporary protection from wind and water erosion.
Hydroseeding	Mixture of hydraulic mulch, seed, fertilizer, and stabilizing emulsion with hydraulic mulcher to temporarily protect exposed soils from erosion by water and wind.
Soil Binders	Soil stabilizer applied to soil surface to temporarily prevent water and wind included erosion of exposed soils.
Straw Mulch	Uniform layer of straw incorporated into the soil or anchored with a tackifier or stabilizing emulsion to protect soil surface from impact of rain drops.
Geotextiles and Mats	Mattings or Rolled Erosion Control Products made of natural and/or synthetic materials used to cover soil surfaces to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface.
Wood Mulching	Mixture of shredded wood mulch, bark or compost applied to disturbed soils to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.
Earth Dikes and Drainage Swales	Temporary berm/ridge or sloped depression used to divert/convey runoff to a desired location.
Velocity Dissipation Devices	Outlet protection composed of rock, grouted riprap, or concrete rubble placed at the pipe/channel outlet to prevent soil scour by concentrated, high velocity flows.
Slope Drains	Pipe used to intercept and direct runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area.
Streambank Stabilization	Stabilization of stream channels, streambanks, and associated riparian areas to reduce discharges of sediment and other pollutants during construction activities.
Compost Blanket	Blanket applied to slopes and earth disturbed areas to prevent erosion and increase infiltration and/or establish vegetation.
Soil Preparation/Roughening	Assessment and preparation of surface soils for BMP installation.
Non-Vegetative Stabilization	Temporary or permanent stabilization of areas prone to erosion where vegetative options are not feasible. This includes decomposed granite, degradable mulches, geotextiles and mats, gravel mulch, rock slope protection, and soil binders.

Table 2. Temporary Project Features (BMPs), continued

Temporary BMP	Purpose
Sediment Control	
Silt Fence	Woven geotextile entrenched, attached to supporting poles, and backed by plastic or wire mesh for support to detain water and promote sedimentation of course sediment behind the fence.
Check Dam	Small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products placed across constructed swale or drainage ditch to reduce the effective slope of channel.
Fiber Rolls	Straw, coir, or other biodegradable materials bound into tight tubular roll wrapped by photodegradable or natural netting that are placed on slopes to intercept runoff, reduce flow velocity, release runoff as sheet flow, and provide sediment removal from runoff.
Gravel Bag Berm	Series of gravel-filled bags placed on a level contour to intercept sheet flows, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.
Street Sweeping and Vacuuming	Self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving.
Storm Drain Inlet Protection	Sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet to temporarily pond runoff before it enters the storm drain,
Manufactured Linear Sediment Controls	Premanufactured devices typically specified and installed for drainage and sediment control on the perimeter of disturbed sites or stockpiles and as check dams within channels.
Compost Socks and Berms	Three-dimensional biodegradable filtering structures that intercept runoff where sheet flow occurs and are generally placed at the site perimeter or at intervals on sloped areas.
Biofilter Bags	Multi-purpose sediment control BMP consisting of a plastic mesh bag filled with 100% recycled wood product waste.
Wind Erosion Control	
Wind Erosion Control	Application of water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.
Tracking Control	
Stabilized Construction Entrance/Exit	Point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.
Entrance/Outlet Tire Wash	Area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Table 2. Temporary Project Features (BMPs), continued

Temporary BMP	Purpose
Non-Stormwater Management	
Water Conservation Practices	Activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants off-site.
Dewatering Operations • Non-stormwater use for dust control • Desilting basins/tanks • Transport to publicly owned treatment works	Practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.
Paving and Grinding Operations	Prevention or reduction of pollutant discharge from paving operations, using measures to prevent run on and runoff pollution, properly disposing of wastes, and training employees and subcontractors.
Illicit Connection/Discharge	Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.
Potable Water/Irrigation	Practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.
Vehicle and Equipment Cleaning	Procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations.
Vehicle and Equipment Fueling	Procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater.
Vehicle and Equipment Maintenance	Prevention or reduction of the contamination of stormwater resulting from vehicle and equipment maintenance by running a “dry and clean site”.
Pile Driving Operations	Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.
Concrete Curing	Proper procedures and care when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.
Concrete Finishing	Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.
Temporary Batch Plants	Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the discharge of potential pollutants to the storm drain system or watercourses, reduce air emissions, and mitigate noise impacts.

Table 2. Temporary Project Features (BMPs), continued

Temporary BMP	Purpose
Waste Management and Materials Pollution Control	
Temporary Concrete Washout Facilities	Prevention, reduction, or elimination of pollutant discharges from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.
Material Use	Prevention or reduction of pollutant discharges to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.
Stockpile Management	Procedures and practices designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials, and pressure treated wood.
Spill Prevention and Control	Prevention or reduction of pollutant discharges to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.
Solid Waste Management	Procedures and practices designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.
Hazardous Waste Management	Prevention or reduction of pollutant discharges to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.
Contaminated Soil Management	Prevention or reduction of pollutant discharges to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.
Concrete Waste Management	Prevention of pollutant discharges to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.
Sanitary/Septic Waste Management	Proper sanitary and septic waste management prevent pollutant discharges to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.
Liquid Waste Management	Procedures and practices to prevent pollutant discharges to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

Source: CASQA 2015

5 AVOIDANCE AND MINIMIZATION MEASURES

5.1 Avoidance and/or Minimization Measures for Water Resources

The Project is required to obtain a Section 401 Water Quality Certification from the San Francisco Bay RWQCB, a Nationwide 404 Permit from the USACE, and a Section 1602 Lake and Streambed Alteration Agreement Permit from the California Department of Wildlife. The Project would also comply with additional federal laws for wildlife species. Details of these permits and additional avoidance and minimization measures for water resources are discussed in the Project's *Draft Biological Resource Study* (WRECO 2019b)

5.2 Avoidance and or Minimization Measures for Stormwater and Groundwater

5.2.1 Temporary Dewatering Activities

Groundwater extracted from temporary dewatering activities would be managed based on the groundwater quality within the Project area. Clean groundwater could be used for dust control, collected on-site using desilting basins and/or tanks prior to discharging to receiving waters, transported to a publicly owned treatment works, as mentioned in Table 2. If the Project area contains contaminated groundwater or groundwater that may release contaminated plumes when disturbed, applicable waste discharge requirements or permits would be obtained during the design phase.

6 REFERENCES

California Department of Transportation. (2012). Caltrans Water Quality Planning Tool. <https://www.owp.csus.edu/wqpt/wqpt.aspx> (Last accessed: July 2019).

California Department of Water Resources. (2019). Groundwater Information Center Interactive Map Application. <https://gis.water.ca.gov/app/gicima/> (Last accessed: July 2019).

California Stormwater Quality Association. (2015). *Stormwater Best Management Practice Handbook Portal: Construction*.

Contra Costa Clean Water Program. (2017). *Stormwater C.3 Guidebook*. Seventh Edition.

East Bay Municipal Utility District. (2015). *Urban Water Management Plan.*

Federal Emergency Management Agency. (2009). *Flood Insurance Rate Map* for Contra Costa County, California and Incorporated Areas. Map Number FM06013C0426F. Panel 426 of 602.

Federal Emergency Management Agency. (2009). *Flood Insurance Rate Map* for Contra Costa County, California and Incorporated Areas. Map Number FM06013C0428F. Panel 428 of 602.

San Francisco Bay Regional Water Quality Control Board. (February 2015). Municipal Regional Stormwater NPDES Permit. Order No. R2-2015-0049. NPDES Permit No. CAS612008.

San Francisco Bay Regional Water Quality Control Board. (May 4, 2017). *San Francisco Bay Basin Water Quality Control Plan*.

State Water Resources Control Board. (2017). Final 2014/2016 California Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report). <https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml> (Last accessed: July 2019).

State Water Resources Control Board. (2019). Groundwater Ambient Monitoring Assessment Program GeoTracker Application. <https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp> (Last accessed: July 2019).

Town of Moraga Planning Department. (2018). *Town of Moraga Zoning Map.*

United States Census Bureau. (2018). QuickFacts. Moraga town, California; United States. <https://www.census.gov/quickfacts/fact/table/moragatowncalifornia,US/PST045218> (Last accessed: July 2019).

United States Department of Agriculture. (1977). Soil Survey of Contra Costa County California. <https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA013/0/contracosta.pdf > (Last accessed: February 2017).

United States Department of Agriculture. Natural Resources Conservation Service. (2019). Soil Survey Geographic Database. Available online at http://sdmdataaccess.nrcs.usda.gov/. (Last accessed: June 2019).

United States Environmental Protection Agency. (2019). Rainfall Erosivity Factor Calculator for Small Construction Sites. <https://lew.epa.gov/> (Last accessed: July 2019).

Western Regional Climate Center. (2019). Cooperative Climatological Data Summaries. <http://www.wrcc.dri.edu/climate data/climsum> (Last accessed: June 2019).

WRECO. 2019a. St. Mary’s Road Roundabouts Project: Floodplain Evaluation Report.

WRECO. 2019b. St. Mary’s Road Roundabouts Project: Draft Biological Resource Study.

Appendix A Project Risk Level Assessment

SEDIMENT RISK

R FACTOR (R = 61.33)

Facility Information

Start Date: 01/01/2021	**Latitude:** 37.8472
End Date: 01/01/2022	**Longitude:** -122.1091

Calculation Results

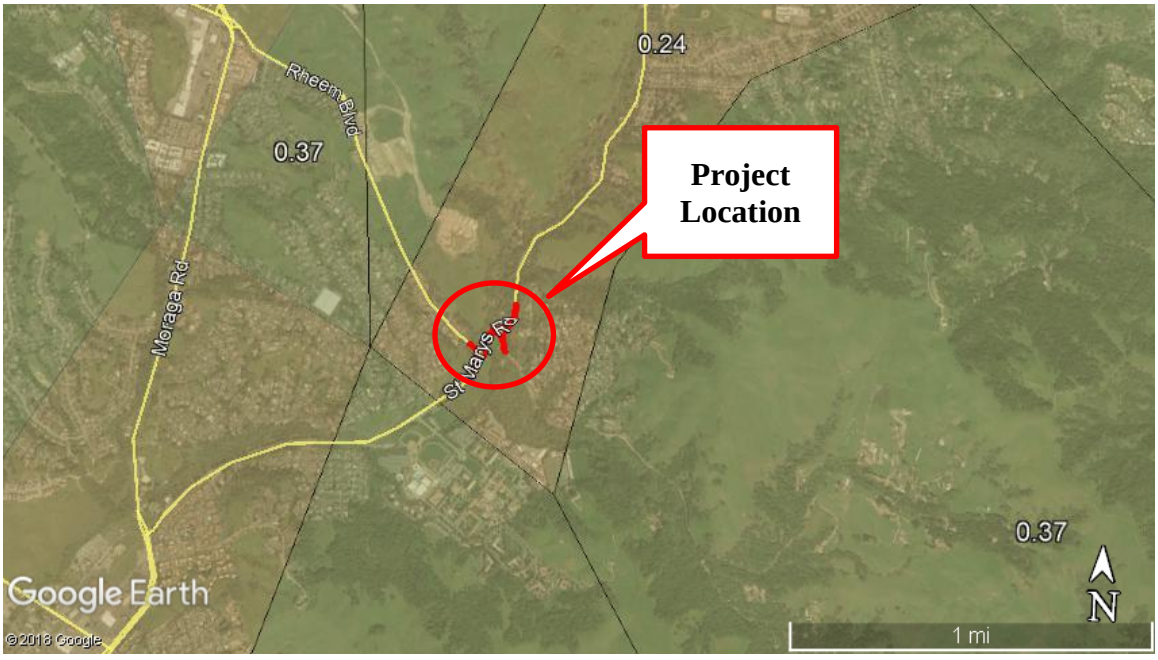
Rainfall erosivity factor (R Factor) = **61.33**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage. If you are located in an area where EPA is the permitting authority, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT).Otherwise, you must seek coverage under your state's CGP.

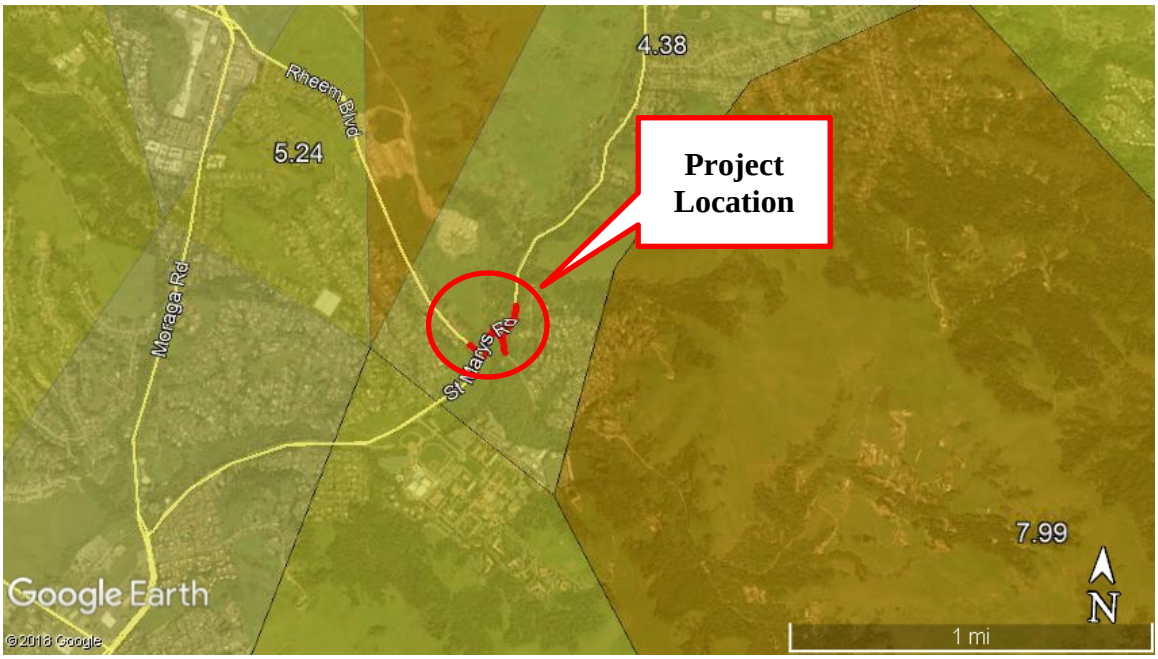
Source: USEPA 2019

K FACTOR (K = 0.24)



Source: Google Earth and SWRCB 2011

LS FACTOR (LS = 4.38)

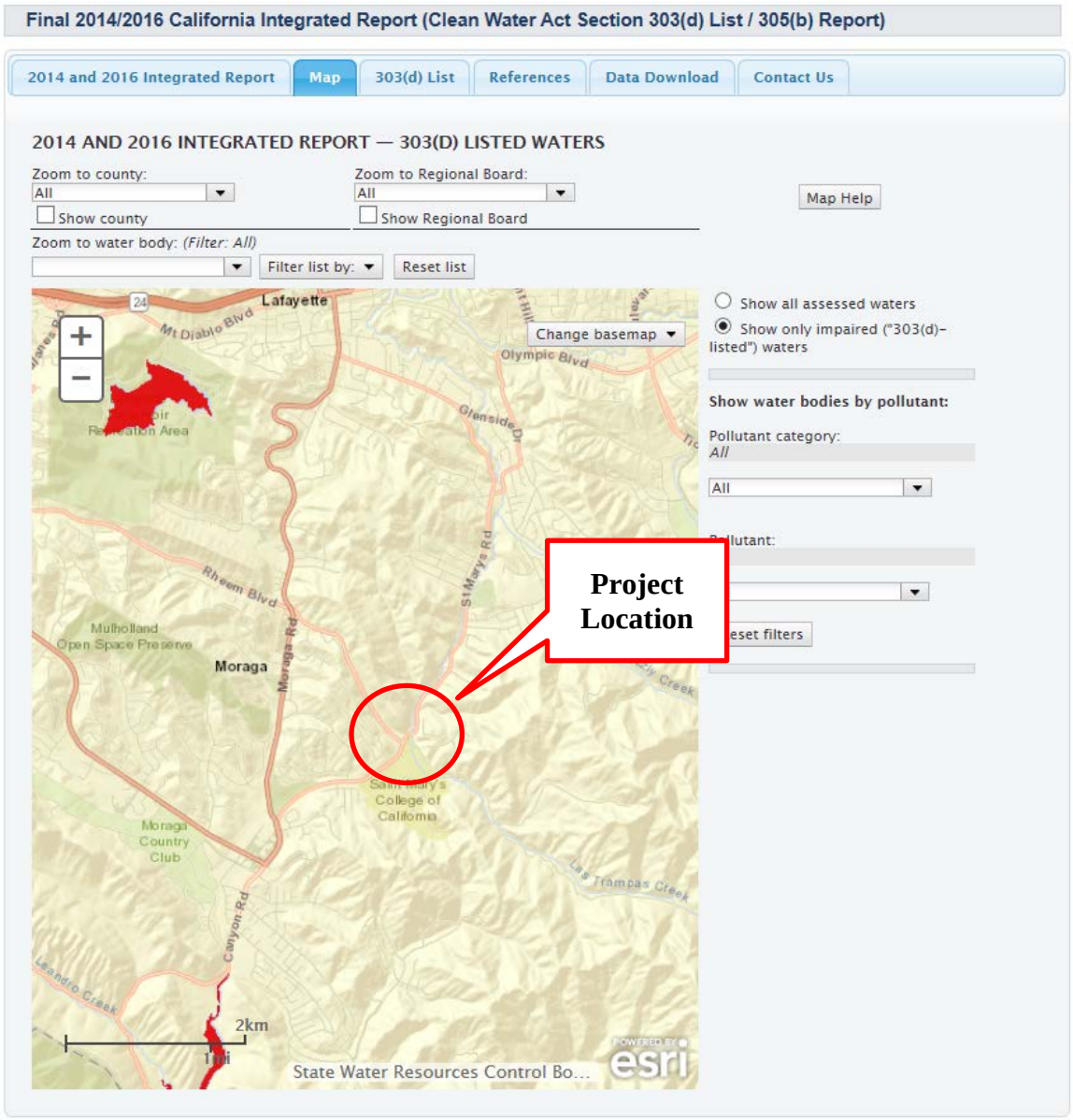


Source: Google Earth and SWRCB 2011

RECEVING WATER RISK (LOW)

COUNTY Waterbody	AGR	MUN	FRSH	GWR	IND	PROC	COMM	SHELL	COLD	EST	MAR	MIGR	RARE	SPWN	WARM	WILD	REC-1	REC-2	NAV
SOLANO COUNTY, continued																			
Volanti Slough							E			E			E			E	E	E	
Montezuma Slough							E			E		E	E	E	E	E	E	E	E
Nurse Slough							E			E		E	E			E	E	E	
Denverton Slough							E			E		E	E			E	E	E	
Denverton Creek													E	E	E	E	E	E	
CONTRA COSTA COUNTY																			
Alhambra Creek									E			E	E		E	E	E	E	
Franklin Creek									E			E	E	E	E	E	E	E	
Arroyo del Hambre									E						E	E	E	E	
Peyton Slough					E		E			E		E	E			E	E	E	
Pacheco Creek															E	E	E	E	
Walnut Creek									E			E	E	E	E	E	E	E	
Grayson Creek									E			E	E		E	E	E	E	
Pine Creek									E			E	E	E	E	E	E	E	
Galindo Creek									E						E	E	E	E	
San Ramon Creek															E	E	E	E	
Bollinger Canyon Creek									E					E	E	E	E	E	
Las Trampas Creek									E				E		E	E	E	E	

Source: San Francisco Bay RWQCB 2017



Source: SWRCB 2017

Sediment Risk Factor Worksheet	Entry
A) R Factor	
Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.	
https://www.epa.gov/npdes/rainfall-erosivity-factor-calculator-small-construction-sites#getTool	
R Factor Value	61.33
B) K Factor (weighted average, by area, for all site soils)	
The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.	
Site-specific K factor guidance	
K Factor Value	0.24
C) LS Factor (weighted average, by area, for all slopes)	
The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.	
LS Table	
LS Factor Value	4.38
Watershed Erosion Estimate (=RxKxLS) in tons/acre	64.47
Site Sediment Risk Factor	**Medium**
Low Sediment Risk: < 15 tons/acre	
Medium Sediment Risk: >=15 and <75 tons/acre	
High Sediment Risk: >= 75 tons/acre	

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml	**no**	**Low**
OR		
A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml		

Combined Risk Level Matrix

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level 1	Level 2	
High	Level 2		Level 3

Project Sediment Risk:	**Medium**
Project RW Risk:	**Low**
Project Combined Risk:	**Level 2**

Appendix B Excerpts from the San Francisco Bay RWQCB Basin Plan

Appendix B.1 Water Quality Objectives

3.2 OBJECTIVES FOR OCEAN WATERS

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan) and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revision to them will apply to ocean waters. These plans describe objectives and effluent limitations for ocean waters.

3.3 OBJECTIVES FOR SURFACE WATERS

The following objectives apply to all surface waters within the region, except the Pacific Ocean.

3.3.1 BACTERIA

Table 3-1 provides a summary of the bacterial water quality objectives and identifies the sources of those objectives. Table 3-2 summarizes U.S. EPA's water quality criteria for water contact recreation based on the frequency of use a particular area receives. These criteria will be used to differentiate between pollution sources or to supplement objectives for water contact recreation.

3.3.3.1 Implementation Provisions for Water Contact Recreation Bacteria Objectives

Water quality objectives for bacteria in Table 3-1 shall be strictly applied except when otherwise provided for in a TMDL. In the context of a TMDL, the Water Board may implement the objectives in fresh and marine waters by using a "reference system and antidegradation approach" as discussed below. Implementation of water quality objectives for bacteria using a "reference system and antidegradation approach" requires control of bacteria from all anthropogenic sources so that bacteriological water quality is consistent with that of a reference system. A reference system is defined as an area (e.g., a subwatershed or catchment) and associated monitoring point(s) that is minimally impacted by human activities that potentially affect bacteria densities in the reference receiving water body.

This approach recognizes that there are natural sources of bacteria (defined as non-anthropogenic sources) that may cause or contribute to exceedances of the objectives for indicator bacteria. It also avoids requiring treatment or diversion of water bodies or treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Water Board, could have the potential to adversely affect valuable aquatic life and wildlife beneficial uses supported by water bodies in the region.

Under the reference system approach, a certain frequency of exceedance of the single-sample objectives shall be permitted. The permitted number of exceedances shall be based on the observed exceedance frequency in a selected reference system(s) or the targeted water body, whichever is less. The "reference system and antidegradation approach" ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system(s).

The appropriateness of this approach, the specific exceedance frequencies to be permitted under it, and the permittees to whom it would apply will be evaluated within the context of TMDL development for a specific water body, and decided by the Water Board when considering

adoption of a TMDL. These implementation provisions may only be used within the context of a TMDL addressing municipal stormwater (including discharges regulated under statewide municipal NPDES waste discharge requirements), discharges from confined animal facilities, and discharges from nonpoint sources.

3.3.2 BIOACCUMULATION

Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

3.3.3 BIOSTIMULATORY SUBSTANCES

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

3.3.4 COLOR

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

3.3.5 DISSOLVED OXYGEN

For all tidal waters, the following objectives shall apply:

In the Bay:

Downstream of Carquinez Bridge	5.0 mg/l minimum
Upstream of Carquinez Bridge	7.0 mg/l minimum

For nontidal waters, the following objectives shall apply:

Waters designated as:

Cold water habitat	7.0 mg/l minimum
Warm water habitat	5.0 mg/l minimum

The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.

Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/l and 7 mg/l are frequently used as objectives to protect fish life,

higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

3.3.6 FLOATING MATERIAL

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.7 OIL AND GREASE

Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

3.3.8 POPULATION AND COMMUNITY ECOLOGY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.9 pH

The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.

3.3.10 RADIOACTIVITY

Radionuclides shall not be present in concentrations that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the limits specified in Table 4 of Section 64443 (Radioactivity) of Title 22 of the California Code of Regulations (CCR), which is incorporated by reference into this Plan. This incorporation is prospective, including future changes to the incorporated provisions as the changes take effect (see Table 3-5).

3.3.11 SALINITY

Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.

3.3.12 SEDIMENT

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.

3.3.13 SETTLEABLE MATERIAL

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

3.3.14 SUSPENDED MATERIAL

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

3.3.15 SULFIDE

All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment.

Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.

3.3.16 TASTES AND ODORS

Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

3.3.17 TEMPERATURE

Temperature objectives for enclosed bays and estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California," including any revisions to the plan.

In addition, the following temperature objectives apply to surface waters:

- The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.
- The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°F (2.8°C) above natural receiving water temperature

3.3.18 TOXICITY

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test.

There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community.

Attainment of this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, or toxicity tests (including those described in Chapter 4), or other methods selected by the Water Board. The Water Board will also consider other relevant information and numeric criteria and guidelines for toxic substances developed by other agencies as appropriate.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors.

3.3.19 TURBIDITY

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.

3.3.20 UN-IONIZED AMMONIA

The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits (in mg/l as N):

Annual Median	0.025
Maximum, Central Bay (as depicted in Figure 2-5) and upstream	0.16
Maximum, Lower Bay (as depicted in Figures 2-6 and 2-7):	0.4

The intent of this objective is to protect against the chronic toxic effects of ammonia in the receiving waters. An ammonia objective is needed for the following reasons:

- Ammonia (specifically un-ionized ammonia) is a demonstrated toxicant. Ammonia is generally accepted as one of the principle toxicants in municipal waste discharges. Some industries also discharge significant quantities of ammonia.

- Exceptions to the effluent toxicity limitations in Chapter 4 of the Plan allow for the discharge of ammonia in toxic amounts. In most instances, ammonia will be diluted or degraded to a nontoxic state fairly rapidly. However, this does not occur in all cases, the South Bay being a notable example. The ammonia limit is recommended in order to preclude any build up of ammonia in the receiving water.
- A more stringent maximum objective is desirable for the northern reach of the Bay for the protection of the migratory corridor running through Central Bay, San Pablo Bay, and upstream reaches.

3.3.21 OBJECTIVES FOR SPECIFIC CHEMICAL CONSTITUENTS

Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use. Water quality objectives for selected toxic pollutants for surface waters are given in Tables 3-3, 3-3A, 3-3B, 3-3C, 3-4 and 3-4A.

The Water Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Site-specific objectives to be considered by the Water Board shall be developed in accordance with the provisions of the federal Clean Water Act, the State Water Code, State Board water quality control plans, and this Plan. These site-specific objectives will take into consideration factors such as all available scientific information and monitoring data and the latest U.S. EPA guidance, and local environmental conditions and impacts caused by bioaccumulation. The objectives in Tables 3-3 and 3-4 apply throughout the region except as otherwise indicated in the tables or when site-specific objectives for the pollutant parameter have been adopted. Site-specific objectives have been adopted for copper in segments of San Francisco Bay (see Figure 7.2-1-01), for nickel in South San Francisco Bay (Table 3-3A), and for cyanide in all San Francisco Bay segments (Table 3-3C). Objectives for mercury that apply to San Francisco Bay are listed in Table 3-3B. Objectives for mercury that apply to Walker Creek, Soulajule Reservoir, and their tributaries, and to waters of the Guadalupe River watershed are listed in Table 3-4A.

South San Francisco Bay south of the Dumbarton Bridge is a unique, water-quality-limited, hydrodynamic and biological environment that merits continued special attention by the Water Board. Controlling urban and upland runoff sources is critical to the success of maintaining water quality in this portion of the Bay. Site-specific water quality objectives have been adopted for dissolved copper and nickel in this Bay segment. Site-specific objectives may be appropriate for other pollutants of concern, but this determination will be made on a case-by-case basis, and after it has been demonstrated that all other reasonable treatment, source control and pollution prevention measures have been exhausted. The Water Board will determine whether revised water quality objectives and/or effluent limitations are appropriate based on sound technical information and scientific studies, stakeholder input, and the need for flexibility to address priority problems in the watershed.

3.3.22 CONSTITUENTS OF CONCERN FOR MUNICIPAL AND AGRICULTURAL WATER SUPPLIES

At a minimum, surface waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Table 64431-A (Inorganic Chemicals) of Section 64431,

and Table 64433.2-A (Fluoride) of Section 64433.2, Table 64444-A (Organic Chemicals) of Section 64444, and Table 64449-A (SMCLs-Consumer Acceptance Limits) and 64449-B (SMCLs-Ranges) of Section 64449. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. Table 3-5 contains water quality objectives for municipal supply, including the MCLs contained in various sections of Title 22 as of the adoption of this plan.

At a minimum, surface waters designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

3.4 OBJECTIVES FOR GROUNDWATER

Groundwater objectives consist primarily of narrative objectives combined with a limited number of numerical objectives. Additionally, the Water Board will establish basin- and/or site-specific numerical groundwater objectives as necessary. For example, the Water Board has groundwater basin-specific objectives for the Alameda Creek watershed above Niles to include the Livermore-Amador Valley as shown in Table 3-7.

The maintenance of existing high quality of groundwater (i.e., "background") is the primary groundwater objective.

In addition, at a minimum, groundwater shall not contain concentrations of bacteria, chemical constituents, radioactivity, or substances producing taste and odor in excess of the objectives described below unless naturally occurring background concentrations are greater. Under existing law, the Water Board regulates waste discharges to land that could affect water quality, including both groundwater and surface water quality. Waste discharges that reach groundwater are regulated to protect both groundwater and any surface water in continuity with groundwater. Waste discharges that affect groundwater that is in continuity with surface water cannot cause violations of any applicable surface water standards.

3.4.1 BACTERIA

In groundwater with a beneficial use of municipal and domestic supply, the median of the most probable number of coliform organisms over any seven-day period shall be less than 1.1 most probable number per 100 milliliters (MPN/100 mL) (based on multiple tube fermentation technique; equivalent test results based on other analytical techniques as specified in the National Primary Drinking Water Regulation, 40 CFR, Part 141.21 (f), revised June 10, 1992, are acceptable).

3.4.2 ORGANIC AND INORGANIC CHEMICAL CONSTITUENTS

All groundwater shall be maintained free of organic and inorganic chemical constituents in concentrations that adversely affect beneficial uses. To evaluate compliance with water quality objectives, the Water Board will consider all relevant and scientifically valid evidence, including relevant and scientifically valid numerical criteria and guidelines developed and/or published by other agencies and organizations (e.g., U.S. Environmental Protection Agency (U.S. EPA), the State Water Board, California Department of Health Services (DHS), U.S. Food and Drug

Administration, National Academy of Sciences, California Environmental Protection Agency's (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA), U.S. Agency for Toxic Substances and Disease Registry, Cal/EPA Department of Toxic Substances Control (DTSC), and other appropriate organizations.)

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of constituents in excess of the maximum (MCLs) or secondary maximum contaminant levels (SMCLs) specified in the following provisions of Title 22, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) of Section 64431, Table 64433.2-A (Fluoride) of Section 64433.2, and Table 64444-A (Organic Chemicals) of Section 64444. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

Groundwater with a beneficial use of agricultural supply shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use. In determining compliance with this objective, the Water Board will consider as evidence relevant and scientifically valid water quality goals from sources such as the Food and Agricultural Organizations of the United Nations; University of California Cooperative Extension, Committee of Experts; and McKee and Wolf's "Water Quality Criteria," as well as other relevant and scientifically valid evidence. At a minimum, groundwater designated for use as agricultural supply (AGR) shall not contain concentrations of constituents in excess of the levels specified in Table 3-6.

Groundwater with a beneficial use of freshwater replenishment shall not contain concentrations of chemicals in amounts that will adversely affect the beneficial use of the receiving surface water.

Groundwater with a beneficial use of industrial service supply or industrial process supply shall not contain pollutant levels that impair current or potential industrial uses.

3.4.3 RADIOACTIVITY

At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the MCLs specified in Table 4 (Radioactivity) of Section 64443 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.4.4 TASTE AND ODOR

Groundwater designated for use as domestic or municipal supply (MUN) shall not contain taste- or odor-producing substances in concentrations that cause a nuisance or adversely affect beneficial uses. At a minimum, groundwater designated for use as domestic or municipal supply shall not contain concentrations in excess of the SMCLs specified in Tables 64449-A (Secondary MCLs-Consumer Acceptance Limits) and 64449-B (Secondary MCLs-Ranges) of Section 64449 of Title 22, which is incorporated by reference into this plan. This incorporation-by-reference is

prospective, including future changes to the incorporated provisions as the changes take effect. (See Table 3-5.)

3.5 OBJECTIVES FOR THE DELTA

The objectives contained in the State Water Board's 1995 "Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary" and any revisions thereto shall apply to the waters of the Sacramento-San Joaquin Delta and adjacent waters as specified in that plan.

3.6 OBJECTIVES FOR ALAMEDA CREEK WATERSHED

The water quality objectives contained in Table 3-7 apply to the surface and groundwaters of the Alameda Creek watershed above Niles.

Wastewater discharges that cause the surface water limits in Table 3-7 to be exceeded may be allowed if they are part of an overall wastewater resource operational program developed by those agencies affected and approved by the Water Board.

TABLES

Table 3-1: Water Quality Objectives for Bacteria[a]

Beneficial Use	Fecal Coliform (MPN/100ml)	Total Coliform (MPN/100ml)	Enterococcus (MPN/100ml)[g]
Water Contact Recreation	geometric mean < 200 90th percentile < 400	median < 240 no sample > 10,000	geometric mean < 35 no sample > 104
Shellfish Harvesting[b]	median < 14 90th percentile < 43	median < 70 90th percentile < 230[c]	
Non-contact Water Recreation[d]	mean < 2000 90th percentile < 4000		
Municipal Supply: - Surface Water[e] - Groundwater	geometric mean < 20	geometric mean < 100 < 1.1[f]	

Notes:

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

b. Source: National Shellfish Sanitation Program.

c. Based on a five-tube decimal dilution test or 300 MPN/100 ml when a three-tube decimal dilution test is used.

d. Source: Report of the Committee on Water Quality Criteria, National Technical Advisory Committee, 1968.

e. Source: California Department of Public Health recommendation.

f. Based on multiple tube fermentation technique; equivalent test results based on other analytical techniques, as specified in the National Primary Drinking Water Regulation, 40 CFR, Part 141.21(f), revised June 10, 1992, are acceptable.

g. Applicable to marine and estuarine waters only. Numeric values are based on Section 7958 of Title 17 of the California Code of Regulations, 69FR 67217 et seq., and 40 CFR Part 131.41 (effective date December 16, 2004).

Table 3-2: U.S. EPA Bacteriological Criteria for Water Contact Recreation[1,2]
(in colonies per 100 ML)

	Fresh Water		Salt Water
	Enterococci	**E. Coli**	**Enterococci**
Steady State (all areas)	33	126	35
Maximum at:			
- designated beach	61	235	104
- moderately used area	89	298	124
- lightly used area	108	406	276
- infrequently used area	151	576	500

NOTES:

1. The criteria were published in the Federal Register, Vol. 51, No. 45 / Friday, March 7, 1986 / 8012-8016. The Criteria are based on:
(a) Cabelli, V.J. 1983. Health Effects Criteria for Marine Recreational Waters. U.S. EPA, EPA 600/1-80-031, Cincinnati, Ohio, and
(b) Dufour, A.P. 1984. Health Effects Criteria for Fresh Recreational Waters. U.S. EPA, EPA 600/1-84-004, Cincinnati Ohio.

2. The U.S. EPA criteria apply to water contact recreation only. The criteria provide for a level of production based on the frequency of usage of a given water contact recreation area. The criteria may be employed in special studies within this region to differentiate between pollution sources or to supplement the current coliform objectives for water contact recreation.

Table 3–4: Freshwater[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in ug/l)

Compound	4-day Average	1-hr Average
Arsenic[b, c, d]	150	340
Cadmium[b, d]	e	e
Chromium III[f]		
Chromium VI[b, c, d, g]	11	16
Copper[b, c, d]	9.0[h]	13[h]
Cyanide[i]		
Lead[b, c, d]	2.5[j]	65[j]
Mercury[k]	0.025	2.4
Nickel[b, c, d]	52[l]	470[l]
Selenium[m]		
Silver[b, c, d]		3.4[n]
Tributyltin[o]		
Zinc[b, c, d]	120[p]	120[p]

Notes:

a. Freshwaters are those in which the salinity is equal to or less than 1 part per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all freshwaters except for the South Bay south of Dumbarton Bridge, where the California Toxics Rule (CTR) applies. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the marine (Table 3-3) and freshwater objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. These objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. The objectives for cadmium and other noted metals are expressed by formulas where H = ln (hardness) as $CaCO_3$ in mg/l: The four-day average objective for cadmium is $e^{(0.7852\ H\ -\ 3.490)}$. This is 1.1 µg/l at a hardness of 100 mg/l as $CaCO_3$. The one-hour average objective for cadmium is $e^{(1.128\ H\ -\ 3.828)}$. This is 3.9 µg/l at a hardness of 100 mg/l as $CaCO_3$.

f. Chromium III criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 180 ug/l (4-day average) and 550 ug/l (1-hr. average). The objectives for chromium III are based on hardness. The values in this footnote assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for chromium III is $e^{(0.8190H+1.561)}$. The 1-hour average for chromium III is $e^{(0.8190\ H+3.688)}$.

g. This objective may be met as total chromium.

h. The objectives for copper are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for copper is $e^{(0.8545H-1.702)}$. The 1-hour average for copper is $e^{(0.9422H-1.700)}$.

i. Cyanide criteria were promulgated in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.2 ug/l (4-day average) and 22 ug/l (1-hr. average).

j. The objectives for lead are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(1.273H -4.705)}$. The 1-hour average for lead is $e^{(1.273H-1.460)}$.

k. Source: U.S. EPA Quality Criteria for Water 1986 (EPA 440/5-86-001), which established a mercury criterion of 0.012 ug/l. The Basin Plan set the objective at 0.025 based on considerations of the level of detection attainable at that time. The 4-day average value for mercury does not apply to Walker Creek and Soulajule Reservoir and their tributaries nor to waters of the Guadalupe River watershed; instead, the water quality objectives specified in Table 3-4A apply. The 1-hour average value continues to apply to waters specified in Table 3-4A.

l. The objectives for nickel are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective is $e^{(0.8460H + 0.0584)}$. The 1-hour average objective is $e^{(0.8460H + 2.255)}$.

m. Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.0 ug/l (4-day average) and 20 ug/l (1-hr. average).

n. The objective for silver is based on hardness. The table value assumes a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objective must be calculated using the following formula where H = ln (hardness): The 1-hour average objective for silver is $e^{(1.72H - 6.52)}$. U.S. EPA has not developed a 4-day criterion.

o. Tributyltin is a compound used as an antifouling ingredient in marine paints and toxic to aquatic life in low concentrations. U.S. EPA has published draft criteria for protection of aquatic life (Federal Register: December 27, 2002, Vol. 67, No. 249, Page 79090-79091). These criteria are cited for advisory purposes. The draft criteria may be revised.

p. The objectives for zinc are based on hardness. The table values assume a hardness of 100 mg/l $CaCO_3$. At other hardnesses, the objectives must be calculated using the following formulas where H = ln (hardness): The 4-day average objective for zinc is $e^{(0.8473 H+0.884)}$. The 1-hour average for zinc is $e^{(0.8473 H+ 0.884)}$.

Appendix B.2 Description of Beneficial Uses

CHAPTER 2: BENEFICIAL USES

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the state. Aquatic ecosystems and underground aquifers provide many different benefits to the people of the state. The beneficial uses described in detail in this chapter define the resources, services, and qualities of these aquatic systems that are the ultimate goals of protecting and achieving high water quality. The Water Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges in the region. Beneficial uses of waters of the State presented here serve as a basis for establishing water quality objectives and discharge prohibitions to attain these goals.

Beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist. Existing beneficial uses that have not been formally designated in this Basin Plan are protected whether or not they are identified. While the tables in this Chapter list a large, representative portion of the water bodies in our region, it is not practical to list each and every water body.

2.1 DEFINITIONS OF BENEFICIAL USES

The following definitions (in italic) for beneficial uses are applicable throughout the entire state. A brief description of the most important water quality requirements for each beneficial use follows each definition (in alphabetical order by abbreviation).

2.1.1 AGRICULTURAL SUPPLY (AGR)

Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

The criteria discussed under municipal and domestic water supply (MUN) also effectively protect farmstead uses. To establish water quality criteria for livestock water supply, the Water Board must consider the relationship of water to the total diet, including water freely drunk, moisture content of feed, and interactions between irrigation water quality and feed quality. The University of California Cooperative Extension has developed threshold and limiting concentrations for livestock and irrigation water. Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these hazards.

2.1.2 AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS)

Areas designated by the State Water Board.

These include marine life refuges, ecological reserves, and designated areas where the preservation and enhancement of natural resources requires special protection. In these areas,

alteration of natural water quality is undesirable. The areas that have been designated as ASBS in this Region are Bird Rock, Point Reyes Headland Reserve and Extension, Double Point, Duxbury Reef Reserve and Extension, Farallon Islands, and James V. Fitzgerald Marine Reserve, depicted in Figure 2-1. The California Ocean Plan prohibits waste discharges into, and requires wastes to be discharged at a sufficient distance from, these areas to assure maintenance of natural water quality conditions. These areas have been designated as a subset of State Water Quality Protection Areas as per the Public Resources Code.

2.1.3 COLD FRESHWATER HABITAT (COLD)

Uses of water that support cold water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold freshwater habitats generally support trout and may support anadromous salmon and steelhead fisheries as well. Cold water habitats are commonly well-oxygenated. Life within these waters is relatively intolerant to environmental stresses. Often, soft waters feed cold water habitats. These waters render fish more susceptible to toxic metals, such as copper, because of their lower buffering capacity.

2.1.4 COMMERCIAL AND SPORT FISHING (COMM)

Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

To maintain fishing, the aquatic life habitats where fish reproduce and seek their food must be protected. Habitat protection is under descriptions of other beneficial uses.

2.1.5 ESTUARINE HABITAT (EST)

Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

Estuarine habitat provides an essential and unique habitat that serves to acclimate anadromous fishes (e.g., salmon, striped bass) migrating into fresh or marine water conditions. The protection of estuarine habitat is contingent upon (1) the maintenance of adequate Delta outflow to provide mixing and salinity control; and (2) provisions to protect wildlife habitat associated with marshlands and the Bay periphery (i.e., prevention of fill activities). Estuarine habitat is generally associated with moderate seasonal fluctuations in dissolved oxygen, pH, and temperature and with a wide range in turbidity.

2.1.6 FRESHWATER REPLENISHMENT (FRESH)

Uses of water for natural or artificial maintenance of surface water quantity or quality.

Fresh water inputs are important for maintaining salinity balance, flow, and/or water quantity for such surface water bodies as marshes, wetlands, and lakes.

2.1.7 GROUNDWATER RECHARGE (GWR)

Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers.

The requirements for groundwater recharge operations generally reflect the future use to be made of the water stored underground. In some cases, recharge operations may be conducted to prevent seawater intrusion. In these cases, the quality of recharged waters may not directly affect quality at the wellfield being protected. Recharge operations are often limited by excessive suspended sediment or turbidity that can clog the surface of recharge pits, basins, or wells.

Under the state Antidegradation Policy, the quality of some of the waters of the state is higher than established by adopted policies. It is the intent of this policy to maintain that existing higher water quality to the maximum extent possible.

Requirements for groundwater recharge, therefore, shall impose the Best Available Technology (BAT) or Best Management Practices (BMPs) for control of the discharge as necessary to assure the highest quality consistent with maximum benefit to the people of the state. Additionally, it must be recognized that groundwater recharge occurs naturally in many areas from streams and reservoirs. This recharge may have little impact on the quality of groundwaters under normal circumstances, but it may act to transport pollutants from the recharging water body to the groundwater. Therefore, groundwater recharge must be considered when requirements are established.

2.1.8 INDUSTRIAL SERVICE SUPPLY (IND)

Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

Most industrial service supplies have essentially no water quality limitations except for gross constraints, such as freedom from unusual debris.

2.1.9 MARINE HABITAT (MAR)

Uses of water that support marine ecosystems, including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

In many cases, the protection of marine habitat will be accomplished by measures that protect wildlife habitat generally, but more stringent criteria may be necessary for waterfowl marshes and other habitats, such as those for shellfish and marine fishes. Some marine habitats, such as important intertidal zones and kelp beds, may require special protection.

2.1.10 FISH MIGRATION (MIGR)

Uses of water that support habitats necessary for migration, acclimatization between fresh water and salt water, and protection of aquatic organisms that are temporary inhabitants of waters within the region.

The water quality provisions acceptable to cold water fish generally protect anadromous fish as well. However, particular attention must be paid to maintaining zones of passage. Any barrier to migration or free movement of migratory fish is harmful. Natural tidal movement in estuaries and unimpeded river flows are necessary to sustain migratory fish and their offspring. A water quality barrier, whether thermal, physical, or chemical, can destroy the integrity of the migration route and lead to the rapid decline of dependent fisheries.

Water quality may vary through a zone of passage as a result of natural or human- induced activities. Fresh water entering estuaries may float on the surface of the denser salt water or hug one shore as a result of density differences related to water temperature, salinity, or suspended matter.

2.1.11 MUNICIPAL AND DOMESTIC SUPPLY (MUN)

Uses of water for community, military, or individual water supply systems, including, but not limited to, drinking water supply.

The principal issues involving municipal water supply quality are (1) protection of public health; (2) aesthetic acceptability of the water; and (3) the economic impacts associated with treatment- or quality-related damages.

The health aspects broadly relate to: direct disease transmission, such as the possibility of contracting typhoid fever or cholera from contaminated water; toxic effects, such as links between nitrate and methemoglobinemia (blue babies); and increased susceptibility to disease, such as links between halogenated organic compounds and cancer.

Aesthetic acceptance varies widely depending on the nature of the supply source to which people have become accustomed. However, the parameters of general concern are excessive hardness, unpleasant odor or taste, turbidity, and color. In each case, treatment can improve acceptability although its cost may not be economically justified when alternative water supply sources of suitable quality are available.

Published water quality objectives give limits for known health-related constituents and most properties affecting public acceptance. These objectives for drinking water include the U.S. Environmental Protection Agency Drinking Water Standards and the California State Department of Health Services criteria.

2.1.12 NAVIGATION (NAV)

Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Navigation is a designated use where water is used for shipping, travel, or other transportation by private, military, or commercial vessels.

2.1.13 INDUSTRIAL PROCESS SUPPLY (PROC)

Uses of water for industrial activities that depend primarily on water quality.

Water quality requirements differ widely for the many industrial processes in use today. So many specific industrial processes exist with differing water quality requirements that no meaningful criteria can be established generally for quality of raw water supplies. Fortunately, this is not a serious shortcoming, since current water treatment technology can create desired product waters tailored for specific uses.

2.1.14 PRESERVATION OF RARE AND ENDANGERED SPECIES (RARE)

Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.

The water quality criteria to be achieved that would encourage development and protection of rare and endangered species should be the same as those for protection of fish and wildlife habitats generally. However, where rare or endangered species exist, special control requirements may be necessary to assure attainment and maintenance of particular quality criteria, which may vary slightly with the environmental needs of each particular species. Criteria for species using areas of special biological significance should likewise be derived from the general criteria for the habitat types involved, with special management diligence given where required.

2.1.15 WATER CONTACT RECREATION (REC1)

Uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs.

Water contact implies a risk of waterborne disease transmission and involves human health; accordingly, criteria required to protect this use are more stringent than those for more casual water-oriented recreation.

Excessive algal growth has reduced the value of shoreline recreation areas in some cases, particularly for swimming. Where algal growths exist in nuisance proportions, particularly bluegreen algae, all recreational water uses, including fishing, tend to suffer.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

Public access to drinking water reservoirs is limited or prohibited by reservoir owner/operators for purposes of protecting drinking water quality and public health. In some cases, access to reservoir tributaries is also prohibited. For these water bodies, REC-1 is designated as E*, for the purpose of protecting water quality. No right to public access is intended by this designation.

2.1.16 NONCONTACT WATER RECREATION (REC2)

Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where water ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Water quality considerations relevant to noncontact water recreation, such as hiking, camping, or boating, and those activities related to tide pool or other nature studies require protection of habitats and aesthetic features. In some cases, preservation of a natural wilderness condition is justified, particularly when nature study is a major dedicated use.

One criterion to protect the aesthetic quality of waters used for recreation from excessive algal growth is based on chlorophyll a.

2.1.17 SHELLFISH HARVESTING (SHELL)

Uses of water that support habitats suitable for the collection of crustaceans and filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.

Shellfish harvesting areas require protection and management to preserve the resource and protect public health. The potential for disease transmission and direct poisoning of humans is of considerable concern in shellfish regulation. The bacteriological criteria for the open ocean, bays, and estuarine waters where shellfish cultivation and harvesting occur should conform with the standards described in the National Shellfish Sanitation Program, Manual of Operation.

Toxic metals can accumulate in shellfish. Mercury and cadmium are two metals known to have caused extremely disabling effects in humans who consumed shellfish that concentrated these elements from industrial waste discharges. Other elements, radioactive isotopes, and certain toxins produced by particular plankton species also concentrate in shellfish tissue. Documented cases of paralytic shellfish poisoning are not uncommon in California.

2.1.18 FISH SPAWNING (SPWN)

Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Dissolved oxygen levels in spawning areas should ideally approach saturation levels. Free movement of water is essential to maintain well-oxygenated conditions around eggs deposited in sediments. Water temperature, size distribution and organic content of sediments, water depth, and current velocity are also important determinants of spawning area adequacy.

2.1.19 WARM FRESHWATER HABITAT (WARM)

Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

The warm freshwater habitats supporting bass, bluegill, perch, and other fish are generally lakes and reservoirs, although some minor streams will serve this purpose where stream flow is sufficient to sustain the fishery. The habitat is also important to a variety of nonfish species, such as frogs, crayfish, and insects, which provide food for fish and small mammals. This habitat is less sensitive to environmental changes, but more diverse than the cold freshwater habitat, and natural fluctuations in temperature, dissolved oxygen, pH, and turbidity are usually greater.

2.1.20 WILDLIFE HABITAT (WILD)

Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.

The two most important types of wildlife habitat are riparian and wetland habitats. These habitats can be threatened by development, erosion, and sedimentation, as well as by poor water quality.

The water quality requirements of wildlife pertain to the water directly ingested, the aquatic habitat itself, and the effect of water quality on the production of food materials. Waterfowl habitat is particularly sensitive to changes in water quality. Dissolved oxygen, pH, alkalinity, salinity, turbidity, settleable matter, oil, toxicants, and specific disease organisms are water quality characteristics particularly important to waterfowl habitat. Dissolved oxygen is needed in waterfowl habitats to suppress development of botulism organisms; botulism has killed millions of waterfowl. It is particularly important to maintain adequate circulation and aerobic conditions in shallow fringe areas of ponds or reservoirs where botulism has caused problems.

2.2 EXISTING AND POTENTIAL BENEFICIAL USES

2.2.1 SURFACE WATERS

Surface waters in the Region consist of non-tidal wetlands, rivers, streams, and lakes (collectively described as inland surface waters), estuarine wetlands known as baylands, estuarine waters, and coastal waters. In this Region, estuarine waters consist of the Bay system including intertidal, tidal, and subtidal habitats from the Golden Gate to the Region's boundary near Pittsburg and the lower portions of streams that are affected by tidal hydrology, such as the Napa and Petaluma rivers in the north and Coyote and San Francisquito creeks in the south.

Inland surface waters support or could support most of the beneficial uses described above. The specific beneficial uses for inland streams include municipal and domestic supply (MUN), agricultural supply (AGR), commercial and sport fishing (COMM), freshwater replenishment (FRESH), industrial process supply (PRO), groundwater recharge (GWR), preservation of rare and endangered species (RARE), water contact recreation (REC1), noncontact water recreation (REC2), wildlife habitat (WILD), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish migration (MIGR), and fish spawning (SPWN).

The San Francisco Bay Estuary supports estuarine habitat (EST), industrial service supply (IND), and navigation (NAV) in addition to COMM, RARE, REC1, REC2, WILD, MIGR, and SPWN.

Coastal waters' beneficial uses include water contact recreation (REC1); noncontact water recreation (REC2); industrial service supply (IND); navigation (NAV); marine habitat (MAR); shellfish harvesting (SHELL); commercial and sport fishing (COMM); wildlife habitat (WILD), fish migration (MIGR), fish spawning (SPWN), and preservation of rare and endangered species (RARE). In addition, the California coastline within the Region is endowed with exceptional scenic beauty.

The beneficial uses of any specifically identified water body generally apply to all its tributaries. In some cases a beneficial use may not be applicable to the entire body of water, such as navigation in Richardson Bay or shellfish harvesting in the Pacific Ocean. In these cases, the Water Board's judgment regarding water quality control measures necessary to protect beneficial uses will be applied.

Beneficial uses of streams that have intermittent flows, as is typical of many streams in the region, must be protected throughout the year and are designated as "existing."

Beneficial uses of each significant water body have been identified and are organized according to the seven major Hydrologic Planning Areas within the Region (Figure 2-2). The maps locating each water body (Figures 2-3 through 2-9b) were produced using a geographical information system (GIS) at the Water Board. The maps use the hydrologic basin information compiled by the California Interagency Watershed map, with supplemental information from the Oakland Museum of California Creek and Watershed Map series, the Contra Costa County Watershed Atlas, and the San Francisco Estuary Institute EcoAtlas. More detailed representations of each location can be created using this GIS version.

Table 2-1 contains the beneficial uses for many surface water bodies in the Region, organized geographically by the Region's seven Hydrologic Planning Areas. Within each Hydrologic Planning Area, water bodies are listed geographically, with tributaries indented below their receiving water body. In cases where a water body shares the same name with another water body (e.g., Redwood Creek), the location of the water body (county and/or other identifier) is given in parentheses. An alternative name for a water body, where known, is also shown in parentheses. In Table 2-1, beneficial uses are indicated as follows:

E – indicates the beneficial use exists in the water body.

E* – indicates public access to the water body is limited or prohibited for purposes of protecting drinking water quality and public health. REC-1 is designated as E* for the purpose of protecting water quality. No right to public access is intended by this designation.

P – indicates the water body could potentially support the beneficial use.

2.2.2 GROUNDWATER

Groundwater is defined as subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated. Where groundwater occurs in a saturated geologic unit that contains sufficient permeable thickness to yield significant quantities of water to wells and springs, it can be defined as an aquifer. A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers.

Water-bearing geologic units occur within groundwater basins in the Region that do not meet the definition of an aquifer. For instance, there are shallow, low permeability zones throughout the Region that have extremely low water yields. Groundwater may also occur outside of currently identified basins. Therefore, for basin planning purposes, the term "groundwater" includes all

subsurface waters, whether or not these waters meet the classic definition of an aquifer or occur within identified groundwater basins.

The California Department of Water Resources (DWR) evaluated the characteristics of groundwater basins in the Region and throughout the state and summarized the results in California's Groundwater, Bulletin 118 (2003). Of special importance to the Region are the 28 groundwater basins and seven sub-basins classified by DWR that produce, or potentially could produce, significant amounts of groundwater (Figures 2-10 and 2-10A-D). The Water Board maintains a GIS for all water bodies in the Region and has the capacity to present information on each basin at a much higher level of resolution than is depicted in Figures 2-10A-D.

Existing and potential beneficial uses applicable to groundwater in the Region include municipal and domestic water supply (MUN), industrial water supply (IND), industrial process supply (PRO), agricultural water supply (AGR), groundwater recharge (GWR), and freshwater replenishment to surface waters (FRESH). Table 2-2 lists the 28 identified groundwater basins and seven sub-basins located in the Region and their existing and potential beneficial uses.

Unless otherwise designated by the Water Board, all groundwater is considered suitable, or potentially suitable, for municipal or domestic water supply (MUN). In making any exceptions, the Water Board will consider the criteria referenced in State Water Board Resolution No. 88-63 and Water Board Resolution No. 89-39, "Sources of Drinking Water," where:

- The total dissolved solids exceed 3,000 milligrams per liter (mg/L) (5,000 microSiemens per centimeter, μS/cm, electrical conductivity), and it is not reasonably expected by the Water Board that the groundwater could supply a public water system; or
- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices (BMPs) or best economically achievable treatment practices; or
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day; or
- The aquifer is regulated as a geothermal energy-producing source or has been exempted administratively pursuant to 40 Code of Federal Regulations (CFR) Part 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Part 261.3.

2.2.3 WETLANDS

Federal administrative law (e.g., 40 CFR Part 122.2, revised December 22, 1993) defines wetlands as waters of the United States. National waters include waters of the State of California, defined by the Porter-Cologne Act as "any water, surface or underground, including saline waters, within the boundaries of the State" (California Water Code §13050[e]). Wetland water quality control is therefore clearly within the jurisdiction of the State Water Board and Regional Water Boards.

Wetlands are further defined in 40 CFR 122.2 as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal

circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The Water Board recognizes that wetlands frequently include areas commonly referred to as saltwater marshes, freshwater marshes, open or closed brackish water marshes, mudflats, sandflats, unvegetated seasonally ponded areas, vegetated shallows, sloughs, wet meadows, playa lakes, natural ponds, vernal pools, diked baylands, seasonal wetlands, floodplains, and riparian woodlands.

Mudflats make up one of the largest and most important habitat types in the Estuary. Snails, clams, worms, and other animals convert the rich organic matter in the mud bottom to food for fish, crabs, and birds.

Mudflats generally support a variety of edible shellfish, and many species of fish rely heavily on the mudflats during at least a part of their life cycle. Additionally, San Francisco Bay mudflats are one of the most important habitats on the coast of California for millions of migrating shorebirds.

Another important characteristic of the Estuary is the fresh, brackish, and salt water marshes around the Bay's margins. These highly complex communities are recognized as vital components of the Bay system's ecology. Most marshes around the Bay have been destroyed through filling and development. The protection, preservation, and restoration of the remaining marsh communities are essential for maintaining the ecological integrity of the Estuary.

Identifying wetlands may be complicated by such factors as the seasonality of rainfall in the Region. Therefore, in identifying wetlands considered waters of the United States, the Water Board will consider such indicators as hydrology, hydrophytic plants, and/or hydric soils for the purpose of mapping and inventorying wetlands. The Water Board will, in general, rely on the federal manual for wetland delineation in the Region when issuing Clean Water Act Section 401 water quality certifications (U.S. Army Corps of Engineers (Corps) Wetlands Delineation Manual, 1987). In the rare cases where the U.S. EPA and Corps guidelines disagree on the boundaries for federal jurisdictional wetlands, the Water Board will rely on the wetlands delineation made by the U.S. EPA or the California Department of Fish and Game (CDFG). For the purpose of mapping and inventorying wetlands, the Water Board will rely on the protocols and naming conventions of the National Wetlands Inventory (NWI) prepared by the U.S. Fish and Wildlife Service (USFWS).

Many individual wetlands provide multiple benefits depending on the wetland type and location. There are many potential beneficial uses of wetlands, including Wildlife Habitat (WILD); Preservation of Rare and Endangered Species (RARE); Shellfish Harvesting (SHELL); Water Contact Recreation (REC1); Noncontact Water Recreation (REC2); Commercial, and Sport Fishing (COMM); Marine Habitat (MAR); Fish Migration (MIGR); Fish Spawning (SPAWN); and Estuarine Habitat (EST). Some of these general beneficial uses can be further described in terms of their component wetland function. For example, many wetlands that provide groundwater recharge (GWR) also provide flood control, pollution control, erosion control, and stream baseflow.

Table 2-3 shows how beneficial uses are associated with different wetland types. Table 2-4 lists and specifies beneficial uses for 34 significant wetland areas within the Region; generalized locations of these wetlands are shown in Figure 2-11. It should be noted that most of the wetlands listed in Table 2-4 are saltwater marshes, and that the list is not comprehensive.

The Water Board has participated in completing the Baylands Ecosystem Habitat Goals Report (1999) and the Baylands Ecosystem Species and Community Profiles (2000), which were written by scientists and managers in the Region in order to recommend sound wetland restoration strategies. Other efforts around the Bay to locate wetland sites include San Francisco Estuary Institute's (SFEI) EcoAtlas Baylands Maps (Baylands Maps) and Bay Area Wetlands Project Tracker (Wetlands Tracker), and the Wetland Tracker managed by the San Francisco Bay Joint Venture. Because of the large number of small and non-contiguous wetlands, it is not practical to delineate and specify beneficial uses of every wetland area. Therefore, beneficial uses may be determined site specifically, as needed. Chapter 4 of this Plan contains additional information on the process used to determine beneficial uses for specific wetland sites.

FIGURES

Figure 2-1: Areas of Special Biological Significance

Figure 2-2: Hydrologic Planning Areas

Legend for Figures 2-3 through 2-9b

Figures 2-3 through 2-3b: Marin Coastal Basin

Figures 2-4 through 2-4b: San Mateo Coastal Basin

Figure 2-5: Central Basin

Figures 2-6 through 2-6b: South Bay Basin

Figures 2-7 through 2-7b: Santa Clara Basin

Figures 2-8 through 2-8b: San Pablo Basin

Figures 2-9 through 2-9b: Suisun Basin

Figure 2-10: Significant Groundwater Basins

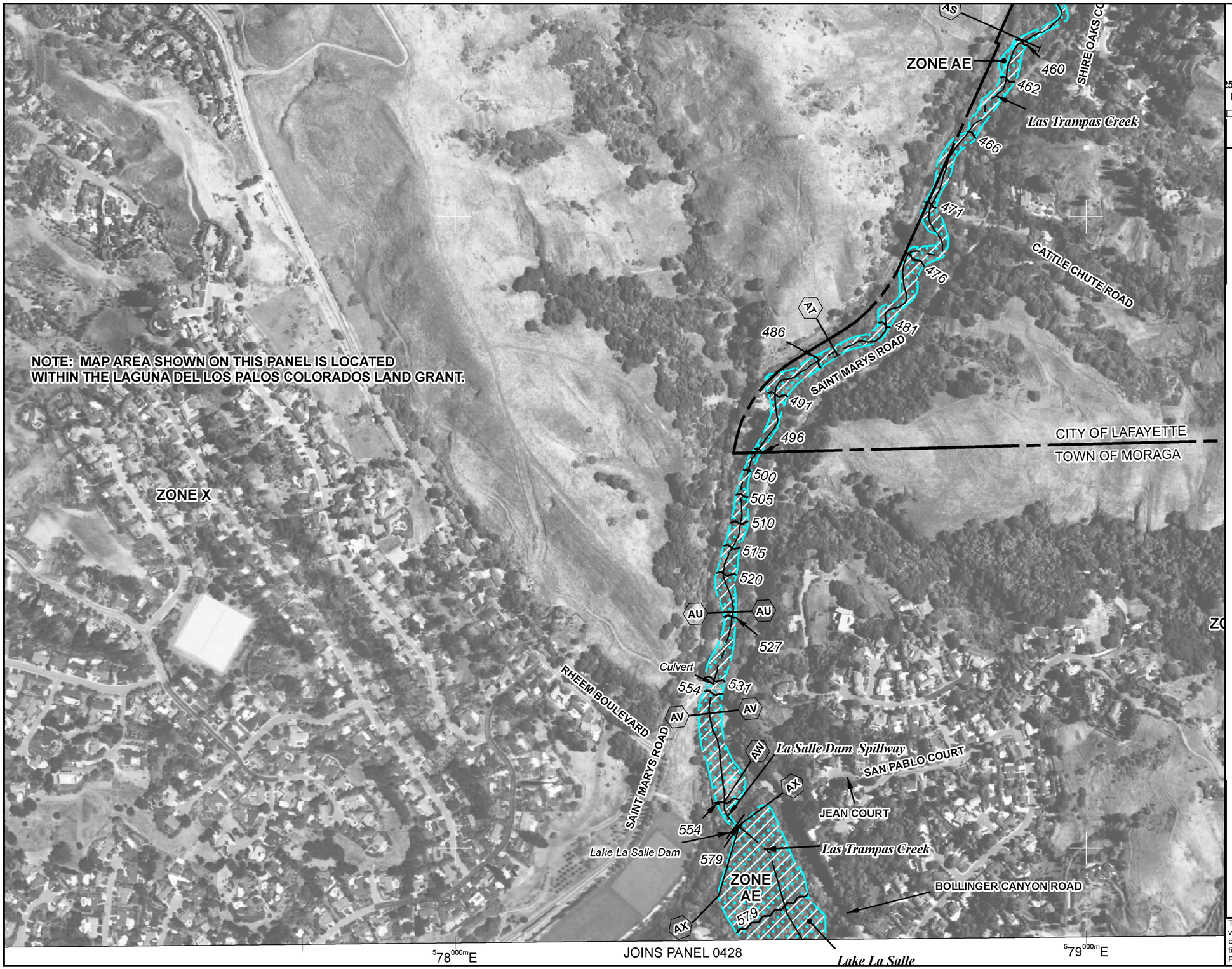
Figure 2-10A: Groundwater Basins: Marin / Sonoma / Napa

Figure 2-10B: Groundwater Basins: Napa / Solano

Figure 2-10C: Groundwater Basins: San Francisco

Figure 2-10D: Groundwater Basins: East and South Bay

Appendix C Federal Emergency Management Agency Flood Insurance Rate Maps



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0426F

FIRM

FLOOD INSURANCE RATE MAP

CONTRA COSTA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 426 OF 602
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAFAYETTE, CITY OF	065037	0426	F
MORAGA, TOWN OF	060637	0426	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06013C0426F

EFFECTIVE DATE
JUNE 16, 2009

Federal Emergency Management Agency

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0428F

FIRM

FLOOD INSURANCE RATE MAP

CONTRA COSTA COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 428 OF 602

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CONTRA COSTA COUNTY	060025	0428	F
MORAGA, TOWN OF	060637	0428	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06013C0428F

EFFECTIVE DATE
JUNE 16, 2009

Federal Emergency Management Agency