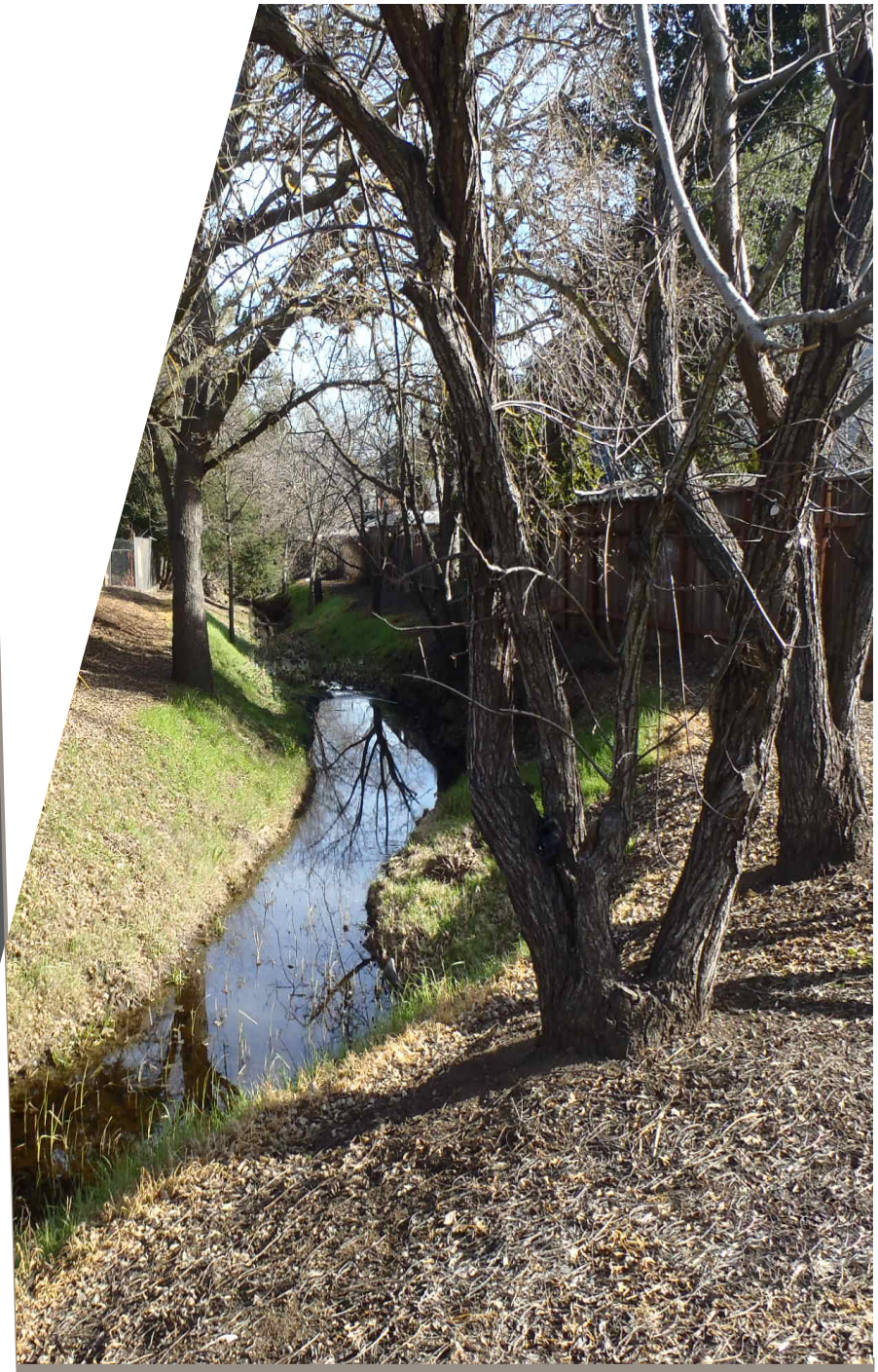
Upper Llagas Creek Project

Environmental Impact Report

Draft
January 2014

State Clearinghouse
No. 2012102032



Prepared for

Santa Clara Valley Water District

Cardno ENTRIX
Shaping the Future

Document Information

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/m_3	micrograms per cubic meter
11988	Executive Order (EO) 11988-Floodplain Management
A.D.	Anno Domini
AASHTO	American Association of State and Highway Transportation Officials
AB	Assembly Bill
ACHP	Advisory Council on Historic Preservation
ADT	average daily traffic
AF	acre-feet
APE	Area of Potential Effects
ATCM	Airborne Toxic Control Measure
B.C.	Before Christ
B.P.	before the present
BA	biological assessment
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan for the Central Coast Region
bcy	bank cubic yards
BETX	benzene, ethylbenzene, toluene, xylenes
bgs	below ground surface
BLS	Bureau of Labor Statistics
BMPs	Best Management Practices
BMX	bicycle motorcross
BO	biological opinion
BY	Reach 6 Bypass
C_2H_3Cl	Vinyl Chloride
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAL FIRE	California Department of Forestry and Fire Protection
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CAR	Coordination Act Report
CARB	California Air Resources Board

cc	cubic centimeter
CC	Culvert/Channel
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CDFW	California Department of Fish and Wildlife
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CDP	Census Designated Place
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGP	Construction General Permit
CGS	California Geological Survey
CH_4	methane
CHHSLs	California Human Health Screening Levels
CMP	Congestion Management Program
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
COCs	Constituents of Concern
CPI	Consumer Price Index
C-RC	C -Resource Code
CRHR	California Register of Historical Resources
CRLF	California red-legged frog
CTS	California tiger salamander
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
CY	cubic yards
dB	decibels
dBA	decibel scale
dbh	diameter at breast height
DECS	Diesel Emission Control Strategy
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DPM	diesel particulate matter

DSOD	Division of Safety of Dams
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EFH	essential fish habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESAs	Environmental Site Assessments
ESLs	Environmental screening levels
ESU	Evolutionary Significant Unit
FAA	Federal Highway Administration
FCWA	Fish and Wildlife Coordination Act
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Rodenticide, and Fungicide Act
FIRE	Finance, Insurance and Real Estate
FMMP	Farmland Mapping and Monitoring Program
FTA	Federal Transit Administration
FWCA	Fish and Wildlife Coordination Act
FYLF	foothill yellow-legged frog
GHGs	greenhouse gases
GRP	Gross Regional Product
GWP	Global Warming Potential
HAPs	Hazardous Air Pollutants
HCP	Habitat Conservation Plan
HEC-RAS	Hydrologic Engineering Center - River Analysis System
HFCs	hydrofluorocarbons
HMSO	Hazardous Materials Storage Ordinance
HRA	Health Risk Assessment
HSC	Health and Safety Code
HSI	Habitat Suitability Incex
HSLA	Hazardous Substance Liability Assessment
Hz	hertz
IMPLAN	Impact Analysis for Planning
IPCC	Intergovernmental Panel on Climate Control

IPM	Integrated Pest Management
ISTEA	Intermodal Surface Transportation Efficiency Act
ITP	Incidental Take Permit
JTU	Jackson Turbidity Units
KOPs	key observation points
L_2	A weighted sound level which happens 2 percent or more of the time of the measurement
L_{10}	A weighted sound level which happens 10 percent or more of the time of the measurement
L_{50} and L_{90}	Measures represent 50 percent and 90 percent of the case
LAFCO	Local Agency Formation Commission
lbs	pounds
LCFS	Low Carbon Fuel Standard
LCWPP	Llagas Creek Watershed Project Plan
L_{DN}	day-night sound level
L_{EQ}	equivalent sound level
$L_{EQ}(24)$	level of sound with the same energy as the time-varying sound of interest, averaged over a 24-hour period
L_{max}	The highest sound level measured during measurement time
LOP	Local Oversight Program
LOS	level of service
LUST	Leaking Underground Storage Tank
LWD	large woody debris
M	Magnitude
MBTA	Migratory Bird Treaty Act
MCLs	Maximum Contaminant Limit
MEI	Maximally Exposed Individual
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mmBTU	million British Thermal Units
MMRP	Mitigation Monitoring and Reporting Program
MMT	million metric tonnes
MND	Mitigated Negative Declaration
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MRZs	mineral resource zones
MSA	Metropolitan Statistical Area
MSATs	mobile source air toxics

MT	metric tonnes
MW	molecular weight, g/mole
N_2O	nitrous oxide
NA	No Action
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NAICS	North American Industry Classification System
NAVD	North Atlantic Vertical Datum
NEPA	National Environment Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NIDCD	National Institute on Deafness and Communication Disorder
NIHL	Noise-Induced Hearing Loss
nm	nanometer
NMFS	National Marine Fisheries Service
NO	nitric oxide
NO_2	nitrogen dioxide
NOA	naturally-occurring Asbestos
NOAA	National Oceanic and Atmospheric Administration
NOC	Notice of Completion
NOD	Notice of Determination
NOI	Notice of Intent
NOP	notice of preparation
NO_X	Nitrogen oxides (NO_2 and NO collectively)
NPDES	National Pollutant Discharge Elimination System
NPT	Native Plant Protection Act
NPW	Notice of Proposed Work
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
Ordinance	Santa Clara County Geologic Ordinance
O&M	Operations and Maintenance
O_3	ozone
OCC	Occupational Code
OEHHA	Office of Environmental Health Hazard Assessment
OES	Occupational Employment Statistics
OHP	Office of Historic Preservation
OHWM	ordinary high water mark
OSHA	Occupational Safety and Health Administration

OSMRE	Office of Surface Mining Reclamation and Enforcement
PAHs	polycyclic aromatic hydrocarbons
Pb	Lead
PCB	polychlorinated biphenyl
PCE	Perchloroethylene
PEM	Perennial Marsh
PERP	Portable Equipment Registration Program
PFCs	perfluorocarbons
PFO	Riparian Forest
PG&E	Pacific Gas and Electric Company
Phase I ESA	Phase I Environmental Site Assessment
Phase II ESA	Phase II Environmental Site Assessment
PL	Public Law
PM_{10}	respirable particulate matter, 10 microns
$PM_{2.5}$	fine particulate matter, 2.5 microns
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
ppt	parts per trillion
PPV	peak particle velocity
PRC	Public Resources Code
Project	Upper Llagas Creek Project
Proposition 65	Safe Drinking Water and Toxic Enforcement Act of 1986
psi	pound(s) per square inch
PSS	Riparian Scrub-shrub
PTO	permit to operate
public	protect human health
QC	Quality Control
RCB	reinforced concrete box
RCB	reinforced concrete boxes
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
RHA	Rivers and Harbors Act
Rn	Radon
ROCs	reactive organic compounds
ROGs	reactive organic gases
ROW	right-of-way
RPR	Rare Plant Rank

RPWs	relatively permanent waters
RSL	Regional Screening Levels
RWQCB	Regional Water Quality Control Board
RWQCB-SF	California Regional Water Quality Control Board – San Francisco Bay Region
SCAQMD	South Coast Air Quality Management District
S-CCC ESU	South-Central California Coast Steelhead
SCVCD	Santa Clara Vector Control District
SCJAP	Santa Clara Joint Area Plan
SCS	Soils Conservation Service
Valley HP	Santa Clara Valley Habitat Plan
SCVWD	Santa Clara Valley Water District
SEIR	Supplemental Environmental Impact Report
SEIS	Supplemental Environmental Impact Statement
SF_6	sulfur hexafluoride
SFBAAB	San Francisco Bay Area Air Basin
SGMP	Soil and Groundwater Management Plan
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLE	St. Louis encephalitis virus
SMARA	Surface Mining and Reclamation Act of 1975
SMCWD	San Martin County Water District
SMP	Stream Maintenance Program
SO_2	sulfur dioxide
Society	American Meteorological Society
SOI	Sphere of Influence
SO_x	sulfur oxides
SPCC	Spill Prevention, Control, and Countermeasure Plans
SPCP	Spill Prevention Control Plan
SPL	Sound Pressure Level
SSC	Suspended sediment concentration
SVOCs	Semi-volatile Organic Compounds
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
T	Tunnel
TCMs	Transportation Control Measures
TNWs	traditionally navigable waters
TMDL	total maximum daily loads
TMP	Transportation Management Plan

TOB	Top of bank
TOI	Total Industry Output
TPH	Total petroleum hydrocarbons
U.S. 101	United States Highway 101
UNFCCC	United Nations Framework Convention on Climate Change
UPRR	Union Pacific Railroad
URV	Unit Risk Value
USA	Urban Service Area
USACE	U.S. Army Corps of Engineers
USBM	U.S. Bureau of Mines
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
U/H	Upland Herbaceous
VdB	vibration decibels
VOCs	volatile organic compounds
VTA	Valley Transportation Authority
WEE	western equine encephalomyelitis virus
Weiss	Weiss Associates
WNV	West Nile Virus
WPT	Western pond turtle
WRDA	Water Resources Development Act (WRDA) of 1999
YOY	young of the year
ZBP	ZIP Code Business Patterns

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Summary

S.1 Comparison of Alternatives: Impacts and Mitigation Measures

Table S-1 presents a summary and comparison of the Upper Llagas Creek Project (Project), including the Proposed Project and its alternatives. The matrix shows the affected resource areas and impact issues and summarizes impact significance and mitigation for each alternative. The following discussion highlights key comparative impacts among the Project alternatives.

> If an environmental resource issue is specified as “*short term*" or "*long term*" in Table S-1, the referenced issue is limited to the respective definitions of these terms presented below and in Chapter 3 of this report:

  - *Short-term* impacts typically occur within the construction period (concurrent with the number of construction seasons, and vary from one alternative to another) or as a result of construction.
  - *Long-term* impacts persist beyond the construction period and typically involve operations. They may be intermittent but over a longer period.

> Some of the resource issues have impacts that are both short and long term.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Geology and Soils					
GEO-1: Project features could be subject to failure due to earthquake-induced liquefaction ground failures, which could diminish flood capacity and protection and/or present physical hazards to public safety	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Operations and Maintenance** LTSM **Mitigation** GEO-1a T: Post Earthquake Inspections. GEO-1b T: Post Earthquake Tunnel Inspection.	**Construction** NI **Operations and Maintenance** LTSM **Mitigation** GEO-1a T: Post Earthquake Inspections.	**Construction** NI **Operations and Maintenance** LTSM **Mitigation** GEO-1a T: Post Earthquake Inspections.	**Construction** NI **Operations and Maintenance** LTSM **Mitigation** GEO-1a T: Post Earthquake Inspections. GEO-1b T: Post Earthquake Tunnel Inspection.
Hydrology and Water Quality					
HYDRO-1: Potential to violate water quality standards	**Construction** N/A **Operations and Maintenance** S	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** S **Mitigation** None required
HYDRO-2: Substantially degrades water quality	**Construction** N/A **Operations and Maintenance** S	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** WILD-3c T: Development and Implementation of a Bat Monitoring Program and Development of Bat/Tunnel Exclusion Devices.	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** S **Mitigation** WILD-3c T: Development and Implementation of a Bat Monitoring Program and Development of Bat/Tunnel Exclusion Devices.
HYDRO-3: Creates or contributes runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provides substantial additional sources of potentially impacted runoff	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required
HYDRO-4: Substantially depletes or interferes with groundwater supplies, groundwater recharge, or water table level	**Construction** NI **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required

NI = no impact; S = significant; LTS = less than significant; LTSM = less than significant with mitigation; B = beneficial; N/A = not applicable

Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
HYDRO-5: Alteration of drainage pattern and course of stream resulting in substantial erosion or siltation on- or off-site	**Construction** NI **Operations and Maintenance** S	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** S **Mitigation** None required
HYDRO-6: Alteration of drainage pattern and course of stream resulting in flooding or increased surface runoff on- or off-site. Places housing within a 100-year-flood hazard area. Places within a 100-year-flood hazard area structures that would impede or redirect flood flows, and exposes people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.	**Construction** NI **Operations and Maintenance** S	**Construction** NI **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Operations and Maintenance** B **Mitigation** None required
Mineral Resources					
MIN-1: Result in the loss of availability of a known valuable mineral resource that would be of value to the region and the residents of California	**Construction** N/A **Operations and Maintenance** NI	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** B **Operations and Maintenance** NI **Mitigation** None required
MIN-2: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** MIN-2 T: Inadvertent Discovery of Poppy Jasper.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** MIN-2 T: Inadvertent Discovery of Poppy Jasper.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** MIN-2 T: Inadvertent Discovery of Poppy Jasper.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** MIN-2 T: Inadvertent Discovery of Poppy Jasper.
Botanical Resources					
BOT-1: Potential for adverse effects on rare or important plant communities, and special-status plant species and their suitable habitat	**Construction** N/A **Operations and Maintenance** LTS	**Construction** S **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** S **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** S **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** S **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.

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BOT-2: Potential for adverse effects on jurisdictional wetlands, other Waters of the United States and Waters of the State	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek. BOT-1e T: Dispose of Invasive Non-native Species.
BOT-3: Conflicts with local policies and/or plans	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1a T: Conduct Focused Protocol-level Surveys for Special-status Plant Species. BOT-1b T: Prepare a Mitigation Plan for Special-status Plant Species. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. BOT-1d T: Prepare a Monitoring Plan for West/East Little Llagas Creek.
Wildlife Resources					
WILD-1: Potential for adverse effects on common and special-status nesting birds	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-1a T: Vegetation Removal during Avian Non-breeding Season.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-1a T: Vegetation Removal during Avian Non-breeding Season.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-1a T: Vegetation Removal during Avian Non-breeding Season.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-1a T: Vegetation Removal during Avian Non-breeding Season.

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WILD-2: Potential for adverse effects on special-status reptiles and amphibians, including western pond turtle and California tiger salamander	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2a T: Preconstruction Surveys for Special-status Amphibian and Reptile Species. WILD-2b T: Biological Monitor for Dewatering Activities. WILD-2c T: Relocate Special-status Species from Construction Area. WILD-2d T: Implement Compensatory Mitigation for Special-status Amphibians and Reptiles, including California tiger salamander. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-2g T: Bullfrog population monitoring and control at Lake Silveira. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2a T: Preconstruction Surveys for Special-status Amphibian and Reptile Species. WILD-2b T: Biological Monitor for Dewatering Activities. WILD-2c T: Relocate Special-status Species from Construction Area. WILD-2d T: Implement Compensatory Mitigation for Special-status Amphibians and Reptiles, including California tiger salamander. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-2g T: Bullfrog population monitoring and control at Lake Silveira. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2a T: Preconstruction Surveys for Special-status Amphibian and Reptile Species. WILD-2b T: Biological Monitor for Dewatering Activities. WILD-2c T: Relocate Special-status Species from Construction Area. WILD-2d T: Implement Compensatory Mitigation for Special-status Amphibians and Reptiles, including California tiger salamander. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-2g T: Bullfrog population monitoring and control at Lake Silveira. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2a T: Preconstruction Surveys for Special-status Amphibian and Reptile Species. WILD-2b T: Biological Monitor for Dewatering Activities. WILD-2c T: Relocate Special-status Species from Construction Area. WILD-2d T: Implement Compensatory Mitigation for Special-status Amphibians and Reptiles, including California tiger salamander. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-2g T: Bullfrog population monitoring and control at Lake Silveira. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.
WILD-3: Potential for adverse effects on common and special-status bats	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-3a T: Preconstruction Surveys for Common and Special-status Bats prior to Removal of Trees and Removal/Replacement of Road Culverts. WILD-3b T: Provide Alternative Bat Roost. WILD-3c T: Development and Implementation of a Bat Monitoring Program and Development of Bat/Tunnel Exclusion Devices.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-3a T: Preconstruction Surveys for Common and Special-status Bats prior to Removal of Trees and Removal/Replacement of Road Culverts. WILD-3b T: Provide Alternative Bat Roost.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-3a T: Preconstruction Surveys for Common and Special-status Bats prior to Removal of Trees and Removal/Replacement of Road Culverts. WILD-3b T: Provide Alternative Bat Roost.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-3a T: Preconstruction Surveys for Common and Special-status Bats prior to Removal of Trees and Removal/Replacement of Road Culverts. WILD-3b T: Provide Alternative Bat Roost. WILD-3c T: Development and Implementation of a Bat Monitoring Program and Development of Bat/Tunnel Exclusion Devices.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
WILD-4: Potential for adverse effects on San Francisco dusky-footed woodrats	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-4 T: Preconstruction Surveys for San Francisco Dusky-footed Woodrat Nests prior to Vegetation Removal.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-4 T: Preconstruction Surveys for San Francisco Dusky-footed Woodrat Nests prior to Vegetation Removal.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-4 T: Preconstruction Surveys for San Francisco Dusky-footed Woodrat Nests prior to Vegetation Removal.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan. WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-4 T: Preconstruction Surveys for San Francisco Dusky-footed Woodrat Nests prior to Vegetation Removal.
WILD-5: Potential for adverse effects on special-status invertebrates (i.e., Opler's longhorn moth and Bay checkerspot butterfly)	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-5a T: Conduct Plant Surveys for Host Plants of Special-status Invertebrates. WILD-5b T: Compensatory Mitigation for Impacts to Serpentine-associated Special-status Invertebrates.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-5a T: Conduct Plant Surveys for Host Plants of Special-status Invertebrates. WILD-5b T: Compensatory Mitigation for Impacts to Serpentine-associated Special-status Invertebrates.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-5a T: Conduct Plant Surveys for Host Plants of Special-status Invertebrates. WILD-5b T: Compensatory Mitigation for Impacts to Serpentine-associated Special-status Invertebrates.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-5a T: Conduct Plant Surveys for Host Plants of Special-status Invertebrates. WILD-5b T: Compensatory Mitigation for Impacts to Serpentine-associated Special-status Invertebrates.
WILD-6: Potential for adverse effects on migratory mammals, including San Joaquin kit fox and American badger	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-6 T: Implementation of USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox prior to or during Ground Disturbance.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-6 T: Implementation of USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox prior to or during Ground Disturbance.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-6 T: Implementation of USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox prior to or during Ground Disturbance.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife. WILD-2f T: Special-status Species Environmental Awareness Training and Construction Avoidance Measures. WILD-6 T: Implementation of USFWS Standardized Recommendations for Protection of the San Joaquin Kit Fox prior to or during Ground Disturbance.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Aquatic Resources					
AQUA-1: Potential for adverse effects on upstream migration of adult S-CCC steelhead	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design. AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design. AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design. AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1 BY: Construction of Fish Exclusion Barrier at the Downstream End of Reach 14. AQUA-1a T: Steelhead Passage: Channel and Structure Design. AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels.
AQUA-2: Potential for adverse effects on S-CCC steelhead spawning habitat usage and quality	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** AQUA-2a T: Preconstruction Surveys prior to In-water Construction. AQUA-2b T: Biological Monitor for Dewatering Activities.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** AQUA-2a T: Preconstruction Surveys prior to In-water Construction. AQUA-2b T: Biological Monitor for Dewatering Activities.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** AQUA-2a T: Preconstruction Surveys prior to In-water Construction. AQUA-2b T: Biological Monitor for Dewatering Activities.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** AQUA-2a T: Preconstruction Surveys prior to In-water Construction. AQUA-2b T: Biological Monitor for Dewatering Activities.
AQUA-3: Potential for adverse effects on S-CCC steelhead rearing habitat	**Construction** N/A **Operations and Maintenance** S	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels. BOT-1b T: Prepare a Mitigation Plan for Special-status Plants. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels. BOT-1b T: Prepare a Mitigation Plan for Special-status Plants. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels. BOT-1b T: Prepare a Mitigation Plan for Special-status Plants. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1b T: Steelhead Passage: Inspection of In-channel of Large Woody Debris prior to Removal for Management of Flood Conveyance Channels. BOT-1b T: Prepare a Mitigation Plan for Special-status Plants. BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
AQUA-4: Potential for adverse effects on downstream migration of juvenile S-CCC steelhead	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-1a T: Steelhead Passage: Channel and Structure Design.	**Construction** LTS **Operations and Maintenance** LTSM **Mitigation** AQUA-4 BY: Construction of Fish Screen and Fish Bypass Facility at the Upstream End of the Bypass Channel. AQUA-1a T: Steelhead Passage: Channel and Structure Design.
AQUA-5: Potential for adverse effects to aquatic species from construction and maintenance within and outside the active channel	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
Agricultural and Forest Resources					
AG-1: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide or Local Importance	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments: AG-1b T: Agricultural Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments: AG-1b T: Agricultural Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments: AG-1b T: Agricultural Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments: AG-1b T: Agricultural Conversion Offsets.
AG-2: Conflict with existing zoning for agricultural use, or a Williamson Act contract	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments. AG-2 T: Williamson Act Lands Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments. AG-2 T: Williamson Act Lands Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments. AG-2 T: Williamson Act Lands Conversion Offsets.	**Construction** LTSM **Location of Project Features** S **Operations and Maintenance** NI **Mitigation** AG-1a T: Agricultural Soil Amendments and Treatments. AG-2 T: Williamson Act Lands Conversion Offsets.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
AG-3: Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required
Land Use and Planning					
LAND-1: Physically divide an established community	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Location of Project Features** NI **Operations and Maintenance** NI **Mitigation** None required
LAND-2: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project adopted for the purpose of avoiding or mitigating an environmental effect	**Construction** N/A **Operations and Maintenance** S	**Construction** NI **Location of Project Features** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Location of Project Features** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Location of Project Features** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** NI **Location of Project Features** LTS **Operations and Maintenance** B **Mitigation** None required
Cultural Resources					
CU-1: Potential for impacts to unidentified cultural and paleontological resources caused by ground disturbing activities	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
CU-2: Construction impacts to known cultural resources	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** CU-2 T: Avoid Known Cultural Resources during Implementation.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** CU-2 T: Avoid Known Cultural Resources during Implementation.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** CU-2 T: Avoid Known Cultural Resources during Implementation.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** CU-2 T: Avoid Known Cultural Resources during Implementation.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Traffic and Circulation					
TRAFFIC-1: Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** S **Operations and Maintenance** LTSM **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses.
TRAFFIC-2: Exceed, either individually or cumulatively, an LOS standard established by the County Congestion Management Agency for designated roads or highways	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
TRAFFIC-3: Result in inadequate emergency access	**Construction** N/A **Operations and Maintenance** S	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses.
TRAFFIC-4: Conflict with adopted policies, plans, or programs supporting alternative transportation	**Construction** N/A **Operations and Maintenance** S	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
TRAFFIC-5: Fail to provide safe access; obstruct access to nearby uses, including due to the loss of parking facilities; or fail to provide for future street right-of-way	**Construction** N/A **Operations and Maintenance** S	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-5 T: Coordinate with Local Businesses Regarding Parking.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-5 T: Coordinate with Local Businesses Regarding Parking. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-5 T: Coordinate with Local Businesses Regarding Parking. TRAFFIC-1 NRCS: Coordinate with Local Businesses Regarding Access.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-1 T: Maintain Access to Local Residences and Businesses. TRAFFIC-5 T: Coordinate with Local Businesses Regarding Parking.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
TRAFFIC-6: Potential damage to roads due to construction-generated traffic	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-6 T: Repair Local Roadways to Pre-Project Conditions.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-6 T: Repair Local Roadways to Pre-Project Conditions.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-6 T: Repair Local Roadways to Pre-Project Conditions.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** TRAFFIC-6 T: Repair Local Roadways to Pre-Project Conditions.
Air Quality and Greenhouse Gases					
AQ-1: Conflict with or obstruct implementation of the applicable Air Quality Attainment Plan or Congestion Management Plan	**Construction** NI **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
AQ-2: Violate any stationary source air quality standard or contribute to an existing or projected air quality violation	**Construction** NI **Operations and Maintenance** LTS	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.
AQ-3: Result in a net increase of any criteria pollutant for which the Project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)	**Construction** NI **Operations and Maintenance** LTS	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** AQ-2 T: Exhaust Emissions Reduction Measures.
AQ-4: Expose sensitive receptors to substantial pollutant concentrations	**Construction** NI **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
AQ-5: Create objectionable odors affecting a substantial number of people	**Construction** NI **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
GHG-1: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment	**Construction** NI **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
GHG-2: Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases	**Construction** NI **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
Noise					
NOI-1: Noise generation levels in excess of established standards	**Construction** N/A **Operations and Maintenance** S	**Construction** S **Operations and Maintenance** S **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** S **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** S **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** S **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.
NOI-2: Generation of excessive groundborne vibration	**Construction** N/A **Operations and Maintenance** LTS	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-2a T: Vibration Limits. NOI-2b T: Alternate Overnight Accommodations. NOI-2c T: Notify Residents of Pile Driving Activities/Vibratory Compactor Use. NOI-2d T: Prohibit Vibratory Pile Driving within 200 feet of Residential Structures.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-2a T: Reduce Vibration from Construction Activity.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-2a T: Reduce Vibration from Construction Activity.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-2a T: Vibration Limits. NOI-2b T: Alternate Overnight Accommodations. NOI-2c T: Notify Residents of Pile Driving Activities/Vibratory Compactor Use. NOI-2d T: Prohibit Vibratory Pile Driving within 200 feet of Residential Structures.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
NOI-3: Substantial permanent increase in ambient noise levels	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
NOI-4: Substantial temporary increase in ambient noise levels	**Construction** N/A **Operations and Maintenance** LTS	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.	**Construction** S **Operations and Maintenance** LTS **Mitigation** NOI-1a T: Reduce Noise from Construction and Operational Activity. NOI-1b T: Noise and Vibration Control Plan. NOI-1c T: Notify Residents of Construction Work; Implement Noise Complaint Procedure.
NOI-5: Excessive noise levels from public airport	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
NOI-6: Excessive noise levels from private airstrip	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required
Aesthetic Resources					
AES-1: Substantially degrade the visual character or quality of the site or surrounding area	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
AES-2: Permanently and substantially obstruct or block any scenic vista or view corridor that is designated on local plans as significant or important	**Construction** N/A **Operations and Maintenance** N/A	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required
AES-3: Conflict with local plans and policies on protecting visual and aesthetic resources	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.	**Construction** LTSM **Operations and Maintenance** LTS **Mitigation** BOT-1c T: Prepare a Revegetation, Monitoring, and Mitigation Plan.
AES-4: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	**Construction** N/A **Operations and Maintenance** N/A	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** WILD-2e T: Minimize Nightwork Disruption to Wildlife.
Utilities and Public Services					
UPS-1: Disrupt utility service by damaging or displacing infrastructure	**Construction** NI **Operations and Maintenance** S	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-1a T: Well Replacement.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-1a T: Well Replacement.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-1a T: Well Replacement.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-1a T: Well Replacement.
UPS-2: Served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs	**Construction** NI **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required
UPS-3: Implementation of an alternative would have a significant impact on one or more of the following public services: (a) Fire protection; (b) Police protection; (c) Schools (d) Other public facilities	**Construction** NI **Operations and Maintenance** NI	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-3 T: Emergency Response Plan and Notification.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-3 T: Emergency Response Plan and Notification.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-3 T: Emergency Response Plan and Notification.	**Construction** LTSM **Operations and Maintenance** NI **Mitigation** UPS-3 T: Emergency Response Plan and Notification.

NI = no impact; S = significant; LTS = less than significant; LTSM = less than significant with mitigation; B = beneficial; N/A = not applicable

Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Recreation Resources					
REC-1: Disrupt access to or diminish existing recreational resources, such as parks or trails	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Location of Project Features** LTSM **Operations and Maintenance** LTS **Mitigation** REC-1a T: Trail Detour. REC-1b T: Recreational Facility Protection. REC-1c T: Public Outreach.	**Construction** LTSM **Location of Project Features** LTSM **Operations and Maintenance** LTS **Mitigation** REC-1a T: Trail Detour. REC-1b T: Recreational Facility Protection. REC-1c T: Public Outreach.	**Construction** LTSM **Location of Project Features** LTSM **Operations and Maintenance** LTS **Mitigation** REC-1a T: Trail Detour. REC-1b T: Recreational Facility Protection. REC-1c T: Public Outreach.	**Construction** LTSM **Location of Project Features** LTSM **Operations and Maintenance** LTS **Mitigation** REC-1a T: Trail Detour. REC-1b T: Recreational Facility Protection. REC-1c T: Public Outreach.
REC-2: Displace recreational users to outlying and/or other regional facilities and physically deteriorate these areas	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Location of Project Features** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Location of Project Features** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Location of Project Features** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Location of Project Features** LTS **Operations and Maintenance** LTS **Mitigation** None required
Population and Housing					
POP-1: Induce substantial population growth in an area	**Construction** N/A **Operations and Maintenance** NI	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required
POP-2: Displace substantial numbers of existing housing and/or people	**Construction** N/A **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required
Socioeconomic Resources					
ECON-1: Create a housing shortage, whether by inducing population growth, depleting the housing stock, or constraining future housing development	**Construction** NI **Operations and Maintenance** NI	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required	**Construction** NI **Operations and Maintenance** NI **Mitigation** None required

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
ECON-2: Result in substantial losses of real property, whether physically or by sustained diminution in value	**Construction** LTS **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required
ECON-3: Substantially reduce employment or income	**Construction** LTS **Operations and Maintenance** NI	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** B **Operations and Maintenance** NI **Mitigation** None required	**Construction** LTS **Operations and Maintenance** NI **Mitigation** None required
ECON-4: Displace or substantially disrupt business operations	**Construction** S **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required
ECON-5: Substantially reduce the supply of fiscal resources to local jurisdictions through property assessments and taxable sales	**Construction** LTS **Operations and Maintenance** NI	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required	**Construction** LTS **Operations and Maintenance** B **Mitigation** None required
Hazards and Hazardous Materials					
HAZ-1: Creation of hazard through transport, use, or disposal of hazardous material	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required

NI = no impact; S = significant; LTS = less than significant; LTSM = less than significant with mitigation; B = beneficial; N/A = not applicable

Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
HAZ-2: Exposure of workers or the public to existing hazardous materials contamination	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-2b T: Soil and Groundwater Management Plan. HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2g T: Conduct Asbestos and Lead Surveys for Buildings that need to be Demolished. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM. HAZ-2i T: Evaluation of Soil for Reuse.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-2b T: Soil and Groundwater Management Plan. HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2g T: Conduct Asbestos and Lead Surveys for Buildings that need to be Demolished. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM. HAZ-2i T: Evaluation of Soil for Reuse.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-2b T: Soil and Groundwater Management Plan. HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2g T: Conduct Asbestos and Lead Surveys for Buildings that need to be Demolished. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM. HAZ-2i T: Evaluation of Soil for Reuse.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-2b T: Soil and Groundwater Management Plan. HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2g T: Conduct Asbestos and Lead Surveys for Buildings that need to be Demolished. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM. HAZ-2i T: Evaluation of Soil for Reuse.
HAZ-3: Generation of hazardous emissions or handling of hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ 2c T: Existing Hazardous Site Search. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered. HAZ-2h T: Develop an Asbestos Dust Mitigation Plan and Implement other Actions Required by the BAAQMD ATCM.

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Table S-1 Summary of Project Impacts

Environmental Resource Issue	No Project Alternative	Tunnel Alternative (Preferred Alternative)	NRCS Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
HAZ-4: Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2c T: Existing Hazardous Site Search. HAZ-2d T: Implement Recommended Phase I or Phase II Hazardous Materials Investigation and Any Required Follow-Up Remediation. HAZ-2e T: Minimize the Area of Disturbance. HAZ-2f T: Stop Work and Implement Hazardous Materials Investigations and Remediation in the Event that Unknown Hazardous Materials are Encountered.
HAZ-5: Potential to result in safety hazard due to location within 2 miles of a public use airport	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required
HAZ-6: Interference with emergency response or evacuation plan	**Construction** N/A **Operations and Maintenance** S	**Construction** LTSM **Operations and Maintenance** B **Mitigation** UPS-3 T: Emergency Plan and Notification.	**Construction** LTSM **Operations and Maintenance** B **Mitigation** UPS-3 T: Emergency Plan and Notification.	**Construction** LTSM **Operations and Maintenance** B **Mitigation** UPS-3 T: Emergency Plan and Notification.	**Construction** LTSM **Operations and Maintenance** B **Mitigation** UPS-3 T: Emergency Plan and Notification.
HAZ-7: Breeding or harborage of disease vector organisms	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-7 T: Prepare and Implement a Mosquito and Vector Control Plan.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-7 T: Prepare and Implement a Mosquito and Vector Control Plan.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-7 T: Prepare and Implement a Mosquito and Vector Control Plan.	**Construction** LTSM **Operations and Maintenance** LTSM **Mitigation** HAZ-2a T: Work Site Housekeeping Procedures. HAZ-7 T: Prepare and Implement a Mosquito and Vector Control Plan.
HAZ-8: Exposure of people or structures to risk of wildland fires	**Construction** N/A **Operations and Maintenance** LTS	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required	**Construction** LTS **Operations and Maintenance** LTS **Mitigation** None required

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S.2 Areas of Known Controversy and Issues to be Resolved

According to Section 15123 of the California Environmental Quality Act (CEQA) Guidelines, the Environmental Impact Report (EIR) shall identify "areas of controversy known to the Lead Agency including issues raised by agencies and the public". All proposals related to the use of private land to improve flood risk management in urban areas potentially generate controversy and receive a high level of public scrutiny. Areas of controversy and unresolved issues were identified during public meetings and written letters from responsible agencies. For this Project, much of the controversy is due to the sensitive nature of riparian corridors in general, aquatic resources, and obtaining property easements.

The Project area consists of the Upper Llagas Creek with riparian corridor, residential, commercial, and agricultural properties immediately adjacent to the creek that may be impacted in order to obtain the Project goal to provide a long-term flood risk management strategy to protect the city of Morgan Hill.

S.2.1 Potential Areas of Controversy

Several issues have been identified through the Environmental Impact Statement (EIS)/EIR process that could be considered controversial. Key concerns included the following.

> Effects of Project elements on vegetation, wildlife, stream habitat, and water quality.

> Disruption of recreational uses during construction.

> Effects of construction traffic on local traffic circulation, noise, air quality, and public safety.

S.2.2 Issues to Be Resolved

Prior to implementation of the Proposed Project, Santa Clara Valley Water District (SCVWD) will need to obtain easements from the various public and private land owners in the area. If any of the easements cannot be obtained, that portion of the Project may not be built as designed.

S.2.2.1 Agency Controversy

The resource agencies, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and the Central Coast Regional Water Quality Control Board (CCRWQCB), have been working with the lead agencies (U.S. Army Corps of Engineers and the Santa Clara Valley Water District) for many years to provide input on the design criteria for the Project to ensure the Proposed Project will be permitable. Issues they have expressed are summarized in the following:

> Water quality issues currently exist in the watershed that could be reduced by the Project design by providing channel stability and native riparian vegetation.

> Minimize the footprint of the project to protect existing riparian habitat.

> Channel maintenance needs to be incorporated into the Project and should minimize the need for in-channel maintenance activities including riparian vegetation removal.

> Design must include habitat features to support life-history requirements of the federally endangered steelhead trout.

The lead agencies are carefully considering maintenance practices that will not require extensive vegetation removal or sediment removal on a regular basis. Maintenance activities based on performance objectives, maintenance protocols/guidelines, and monitoring will be included in an Operation and Maintenance Manual that the SCVWD will develop for the Project. Maintenance practices are evaluated in this EIR. The resource agencies would not permit a maintenance program requiring frequent or extensive removal of vegetation or sediment. Communications are ongoing between the lead agencies

and resource agencies about acceptable maintenance practices to maintain flood capacity of the Project design. These issues will be resolved during the permitting process.

In addition, to implement this Project, an Incidental Take Permit (ITP) for steelhead trout and California tiger salamander will need to be obtained from NMFS and USFWS. Appropriate habitat features will need to be included in the final design for the steelhead. A detailed operation and maintenance plan that minimizes maintenance activities during salamander and fish migration periods and provides safeguards for habitat will also be required. NMFS and USFWS will need to determine that any potential impacts to the federally listed species have been compensated for in order for the ITP to be granted for the construction and operation of the Project.

S.3 Significant and Unavoidable Impacts

To reduce impacts to less than significant in all action alternatives, mitigation measures are proposed for the following resource categories: Geology and Soils, Hydrology and Water Quality, Mineral Resources, Botanical Resources, Wildlife Resources, Aquatic Resources, Agricultural and Forest Resources, Cultural Resources, Traffic and Circulation, Air Quality and Greenhouse Gases, Noise, Aesthetic Resources, Utilities and Public Services, Recreation Resources, and Hazards and Hazardous Materials. However, even with proposed mitigation, some impacts remain significant. Resources with significant impacts only associated with the No Project Alternative include: Aquatic Resources, Land Use and Planning, Utilities and Public Services, Socioeconomic Resources, and Hazards and Hazardous Materials. Summarized by resource area, below are the significant and unavoidable impacts for all alternatives.

S.3.1 Hydrology and Water Quality

As stated in Section 3.2 there is a significant and unavoidable impact associated with alteration of the drainage pattern resulting in substantial erosion and siltation in the Reach 6 Bypass Alternative. This is due to the ongoing processes of channel incision that over time would cause over-steepening of streambanks, bed and bank instability, erosion, and sedimentation in Reach 5 and Reach 6 downstream of the proposed bypass channel location. There is no construction in Reach 5 and 6 because the bypass channel would divert that portion of the high flow which is generated by the upstream flood improvements so that there is no induced flooding in these downstream reaches. As such, the Reach 5 and 6 channel segments do not need to be deepened and widened to accommodate the additional flow from the upstream flood improvements. But as a result, and unlike the other action alternatives, there would be no stable channel form constructed in either reach. Consequently, Reach 5 and Reach 6 would be subject to incision and erosion. Additionally, over time the unstable Reach 5 and 6 channel segments would be subject to degradation of water quality and would have a potential to violate water quality standards as erosion and siltation progressed. These are significant and unavoidable impacts of the Reach 6 Bypass Alternative. The same impact processes described for the Reach 6 Bypass Alternative would occur under the No Project Alternative, in all reaches, and would be significant and unavoidable.

S.3.2 Botanical Resources

As discussed in Section 3.4, all alternatives would have unavoidable significant impacts to California sycamore woodland.

S.3.3 Aquatic Resources

Under the No Project Alternative, warming in Lake Silveira raises downstream temperatures above optimal temperature range for juvenile steelhead (59–65°F). Daily average temperatures in late August exceeded 75°F, which are stressful and potentially lethal to rearing juvenile steelhead. The DO and temperature water quality effects under the No Project alternative are significant ongoing impacts to steelhead rearing.

S.3.4 Agricultural and Forest Resources

Section 3.7 states that all of the alternatives, except the No Project Alternative, have significant unavoidable impacts to agricultural resources. The potential impact to agricultural resources is the conversion of Important Farmlands, lands zoned for agricultural use, and lands under Williamson Act contract within to flood management purposes. A mitigation measure is recommended to protect other agriculturally productive land; however, as construction of the Project would result in a net loss of agricultural land, this impact would be significant after mitigation.

S.3.5 Land Use and Planning

Ongoing operations under the No Project Alternative conflicts with at least two county policies: *Health and Safety Policy C-HS 34* and *Health and Safety Policy C-HS (i) 32*; and a City of Morgan Hill policy (General Plan 4i), as cited above. The benefits of reduced flooding would not be realized for the No Project Alternative; thus, the local agency goals and policies related to flood protection would not be realized. This impact would be significant since it does not provide for flood protection which conflicts with local jurisdictions' policies designed to avoid an environmental effect.

S.3.6 Traffic and Circulation

Significant impacts associated with the No Project Alternative would occur because the Project would not be implemented, which in turn would not alleviate current flooding and would create temporary, significant impacts to emergency vehicle access, obstruct access to nearby uses, and conflict with adopted policies and plans associated with alternative transportation during storm events.

Temporary rerouting of traffic on U.S. 101 for construction of three new bridges is planned for construction activities related to the Reach 6 Bypass Alternative. The detour of U.S. 101 traffic would be a temporary, significant impact on the regional roadway network (U.S. 101). A Traffic Control Plan would be prepared and implemented to maintain access to the extent possible and provide public noticing and safety measures. However, given the extent of use of U.S. 101 as part of a regional commute network and the likelihood of slow-downs for the detour over a three-quarter-year period, this impact would be significant and unavoidable.

S.3.7 Air Quality and Greenhouse Gases

Section 3.11 discusses impacts to air quality, which are summarized below.

Natural Resources Conservation Service (NRCS) Alterative

Peak Daily NO_X emissions (260 lbs/day) exceed the Bay Area Air Quality Management District (BAAQMD) threshold (54 lbs/day), which would be a temporary significant and unavoidable impact. Emissions would permanently cease upon Project completion.

Tunnel Alternative

Peak Daily NO_X emissions (303 lbs/day) exceed the BAAQMD threshold (54 lbs/day), which would be a temporary significant and unavoidable impact. Emissions would permanently cease upon Project completion.

Culvert/Channel Alternative

Peak Daily NO_X emissions (260 lbs/day – same as Natural Resources Conservation Service) exceed the BAAQMD threshold (54 lbs/day), which would be a temporary significant and unavoidable impact. Emissions would permanently cease upon Project completion.

Reach 6 Bypass Alternative

Peak Daily NO_X emissions (278 lbs/day) exceed the BAAQMD threshold (54 lbs/day), which would be a temporary significant and unavoidable impact. Emissions would permanently cease upon Project completion.

S.3.8 Noise

Significant impacts on noise would remain for all action alternatives - exceedance of noise standards for construction and operation/maintenance (also significant under the No Project Alternative); excessive groundborne vibration for construction, and temporary noise level increases from construction. As outlined in Section 3.12, even with proposed mitigation, impacts would remain significant, primarily due to the limited distance from the work areas to the nearest sensitive receptors.

S.3.9 Utilities and Public Services

Under the No Project Alternative, a substantial portion of the urbanized area of Morgan Hill, including areas in and around downtown, are susceptible to flooding under the 100-year flood scenario. Under this scenario, existing utility infrastructure would likely be damaged in downtown Morgan Hill due to periodic flooding and would be a significant impact.

S.3.10 Socioeconomic Resources

The No Project Alternative results in a significant and unavoidable impact to socioeconomics resources, due to displacement or substantial disruption of business operations in downtown Morgan Hill caused by periodic flooding. In the absence of the proposed Project, damages similar to those sustained by local business in an around Morgan Hill during the floods of 2008 and 2009 would continue.

S.3.11 Hazards and Hazardous Materials

Under the No Project Alternative, no improvements would be made to creeks in the Project area to minimize known flooding risks. Flooding in the residential areas of Morgan Hill and San Martin would continue and may potentially impede emergency response or evacuation efforts during flooding events. The unimproved operations of the existing flood management system would result in an impact that would be significant.

1 Introduction

1.1 Introduction

The Santa Clara Valley Water District (SCVWD) has prepared this draft Environmental Impact Report (EIR), referred to hereafter as the EIR, to address the Proposed Upper Llagas Creek Project (Project). The Draft EIR has been prepared consistent with the California Environmental Quality Act (CEQA) of 1970. This Draft EIR will be released and circulated for a 45-day public review and comment period.

This EIR is an informational document covering the environmental effects of the Proposed Project for the review of lead agency decision-makers, responsible permitting agencies, and the public. The Draft EIR itself does not determine whether the Project will be implemented; it serves only as an informational document in the local planning and decision-making process. Following public review of this Draft EIR, the SCVWD will use the information it contains, together with comments submitted by other agencies and the public during the Draft EIR review period to evaluate if, and how, the Project should proceed. The SCVWD is the lead agency responsible for certifying the EIR under CEQA.

This chapter provides the foundation for the Proposed Project, with its lengthy history and a considerable amount of information associated with the evolution of this effort, up to the present, to help establish the purpose and need. Figure 1.1-1 is a regional map of the Project area. This chapter also provides a brief overview of the information and regulatory requirements, which are discussed in more detail in Chapter 3, Affected Environment and Environmental Setting. This chapter is divided into the following sections:

> Section 1.1 – Introduction

> Section 1.2 – Project Purpose and Objectives

> Section 1.3 – Approvals, Permits, and Regulatory Requirements

> Section 1.4 – Related Authorizations, Plans, and Projects

> Section 1.5 – Public Scoping Process

> Section 1.6 – CEQA Process

> Section 1.7 – Terminology Used in the EIR

> Section 1.8 – Organization of the EIR

1.1.1 History

The Llagas Creek Watershed Project Plan (LCWPP) was originally proposed by the SCVWD in 1968 and was approved by three local sponsoring agencies: Santa Clara County, the City of Gilroy, and the City of Morgan Hill. The State of California and Congress both approved the Project in 1969 and directed the Natural Resources Conservation Service (NRCS), formerly the U.S. Department of Agriculture (USDA) Soils Conservation Service (SCS), to construct the Project under the Watershed Protection and Flood Prevention Act of 1954[1]. The first construction work began in 1973, but stopped in 1974 to re-evaluate environmental impacts of the LCWPP under the newly authorized National Environmental Policy Act (NEPA) of 1969 and the California Environmental Quality Act (CEQA of 1970). The original LCWPP was revised by the NRCS, local sponsors, and citizen groups several times over for a period of nearly a decade before a joint Environmental Impact Statement (EIS)/EIR was completed in 1982 on the revised LCWPP.

The revised LCWPP subdivided the entire Project into 14 different reaches for the 1982 EIS/EIR analysis (Figure 1.1-2). The NRCS completed about half of the authorized lower Project reaches, from Buena Vista Avenue to the confluence with the Pajaro River (consisting of Reaches 1, 2, 3, 9, 10, 11, 12, and 13) between 1973 and 1994. The upper reaches (Reaches 4, 5, 6, 7A, 7B, 8, and 14) were not constructed by NRCS due to funding constraints. The SCVWD and the Project sponsors made a Congressional request to transfer the remaining unconstructed, upper Project reaches to the USACE. Through the Water Resources Development Act (WRDA) of 1999[2], Congress authorized the USACE San Francisco District to complete the remaining project elements.

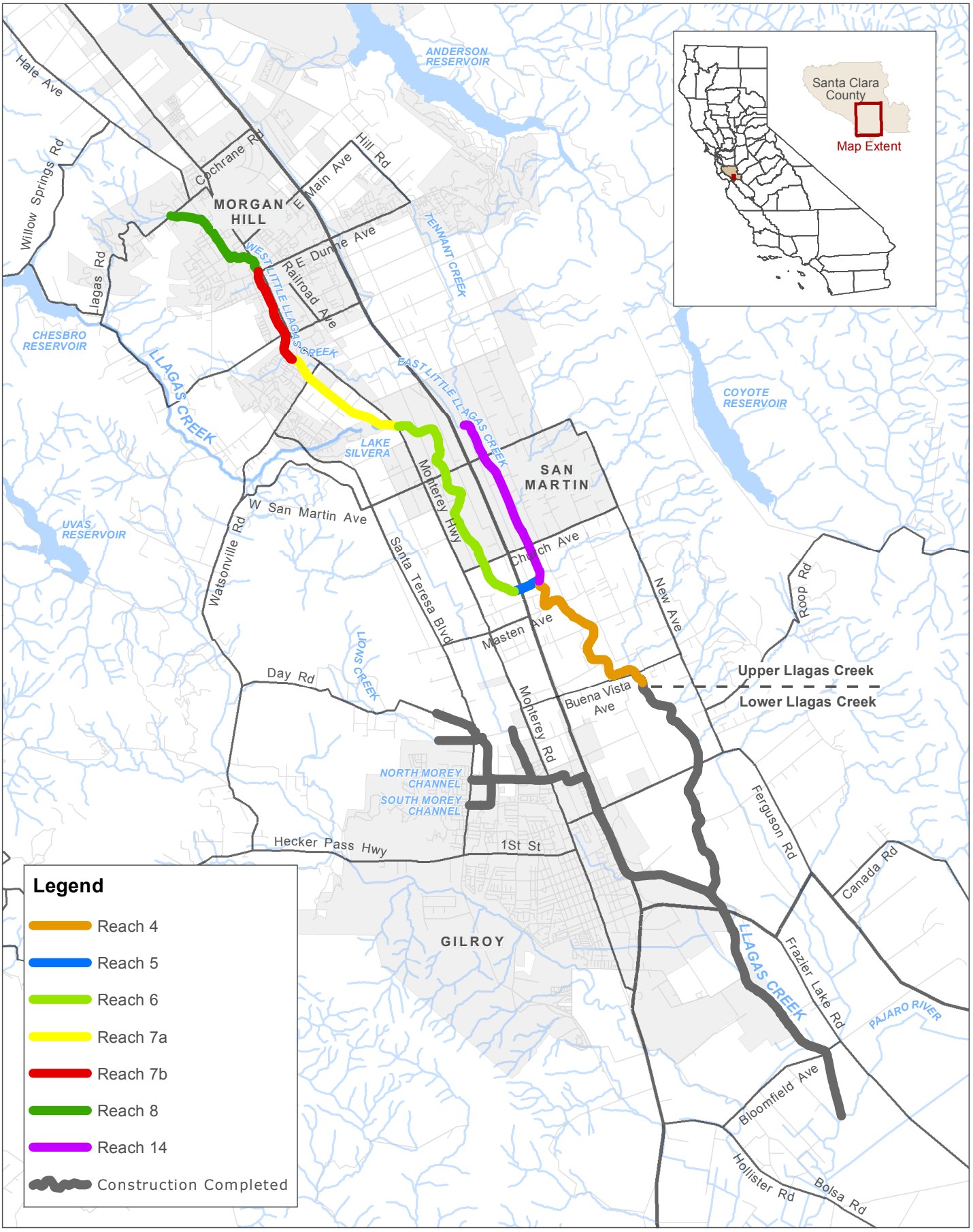
1.2 Project Purpose Objectives

CEQA Guidelines Section 15124(b) states that the project description must include, “a statement of objectives sought by the proposed project” and that the objectives are intended to help the lead agency develop a reasonable range of alternatives to evaluate in an EIR (in this way “objectives” are similar to the NEPA need). Objectives also aid decision-makers in preparing findings and if necessary statements of overriding considerations. The CEQA Guidelines further include, “the statement of objectives should include the underlying purpose of the project”. CEQA requires that an EIR consider a reasonable range of potentially feasible alternatives that attain most of the basic objectives of the project, but that would also avoid or substantially lessen any of the significant effects of the project.

The Upper Llagas Creek has flooded the San Martin to Morgan Hill communities repeatedly, as documented between 1937 and 2009. The Proposed Project is needed to manage flood risk within the Upper Llagas Creek watershed.

[1] PL 83-566, Stat. 666 authorizes the Secretary of Agriculture to cooperate with state and local agencies in planning and carrying out works of improvement for soil conservation and for other purposes.

[2] PL 106-53

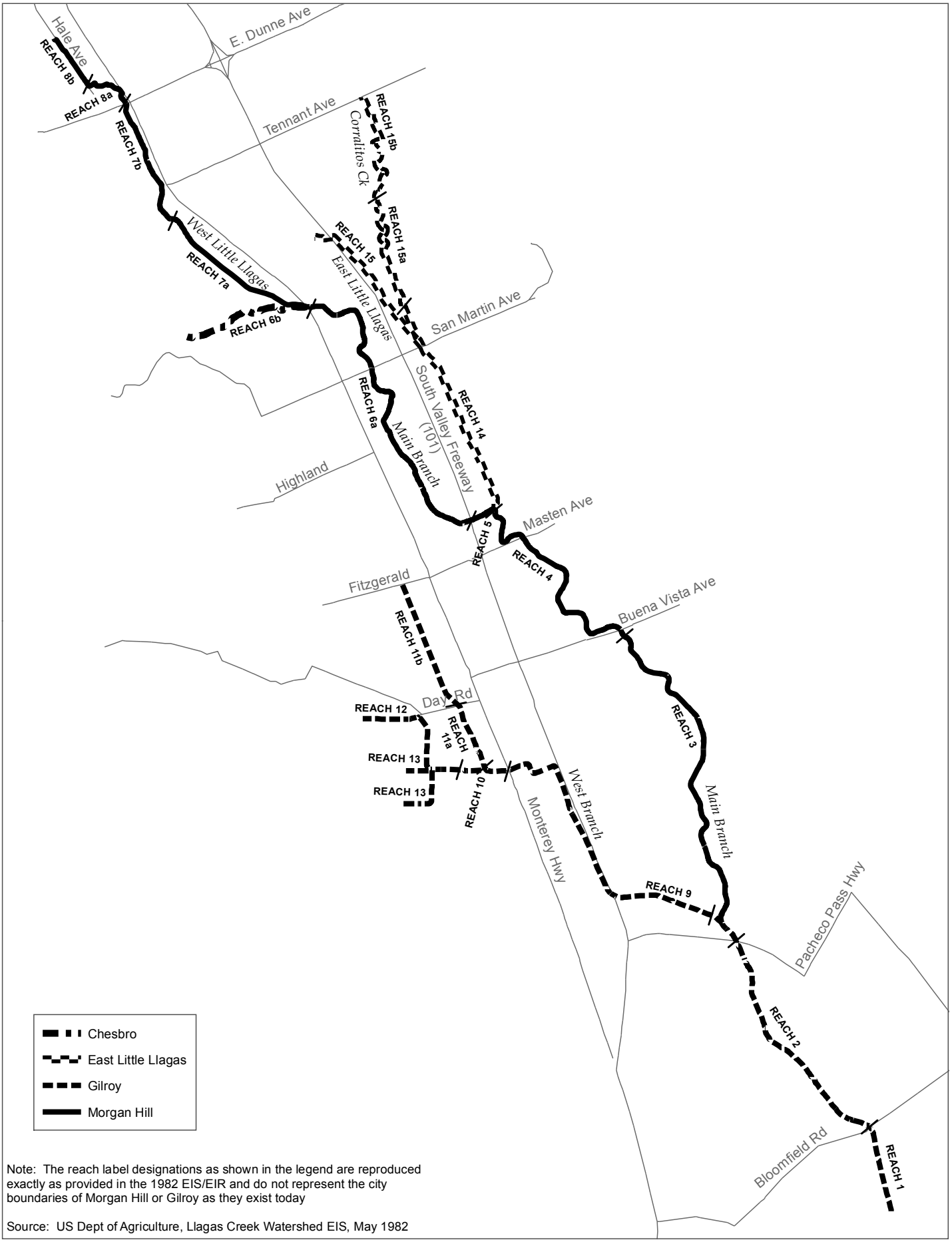


Upper Llagas Creek Project EIR

FIGURE 1.1-1

Regional Area Map

Cardno ENTRIX



Note: The reach label designations as shown in the legend are reproduced exactly as provided in the 1982 EIS/EIR and do not represent the city boundaries of Morgan Hill or Gilroy as they exist today

Source: US Dept of Agriculture, Llagas Creek Watershed EIS, May 1982

0 0.425 0.85 1.7 Miles

N

Upper Llagas Creek Project EIR

FIGURE 1.2-1

Llagas Creek Watershed Project from 1982 EIR/EIS

Cardno ENTRIX

The purpose of the Proposed Project is to:

> Contain the 1-percent flood exceedance[3] (i.e., 100-year flood) on West Little Llagas Creek through the community of Morgan Hill;

> Assure that no additional flooding is induced on Llagas Creek by the upstream improvements along the reaches downstream from Morgan Hill; and

> Provide a 10-percent flood exceedance[4] capacity (10-year flood) on East Little Llagas Creek.

Project-specific objectives include:

> Improve public safety;

> Adhere to the WRDA for completion of the Project in accordance with the NRCS watershed plan for Llagas Creek;

> Minimize Project footprint;

> Design a horizontally and vertically stable channel that will neither widen or narrow, down-cut, or aggrade on a large scale over the long-term;

> Provide for adequate maintenance access throughout the Project, while minimizing maintenance needs of the Project, especially due to sedimentation; and

> Preserve and enhance desirable vegetation, fish, and wildlife habitat present in Llagas Creek and connected water bodies.

1.3 Approvals, Permits, and Regulatory Requirements

As cited in Section 1.1.1, the WRDA, enacted by Congress on August 17, 1999, addresses various aspects of water resources including environmental, structural, navigational, flood protection, and hydrology and is typically administered by the USACE. The WRDA is the authorization for the USACE to proceed with the Project. The scope of the Project, as described in the WRDA, must be adhered to utilize federal funding. Specifically, the WRDA of 1999, Title V, Section 501, authorized the USACE to complete the remaining upper reaches of the Project substantially in accordance with the NRCS watershed plan for Llagas Creek. The WRDA of 2007, (Public Law [PL] 110-114), November 8, 2007, modified the total cost for the Project for both the USACE and the SCVWD.

The SCVWD is the primary water resources agency for Santa Clara County businesses and residents. It serves as the county's water wholesaler and oversees flood protection programs and resources, such as the National Flood Insurance Program (NFIP) within the county.

Table 1.3-1 lists the federal, state, regional, and local agencies that have regulatory authority over the Project.

[3] The 1-percent flood is a flow event that statistically has a 1 percent chance of happening in any given year. It is sometimes referred to as the “100-year” flood. This is a flood that might occur once every 100 years on average over the long term.

[4] The 10-percent flood is a flow event that statistically has a 10 percent chance of happening in any given year. It is sometimes referred to as the “10-year” flood. This is a flood that might occur once every 10 years on average over the long term.

Table 1.3-1 Overview of Permits, Approvals, and Consultations Required for the Upper Llagas Creek Project

Jurisdiction	Permits, Approvals & Consultations	Project Action Associated with the Permit, Approval, or Consultations
Federal Agencies		
U.S. Army Corps of Engineers (USACE)	> Section 10 of the Rivers and Harbors Act	> Excavation and fill, in any manner that would alter or modify the course, location, condition, or capacity of waters identified as navigable waters of the United States.
	> Section 404 of the Clean Water Act (CWA); and, Section 404(b)(1) in particular	> Anticipated discharge of fill or dredged material into waters of the United States and adjacent wetlands that hold the potential for significant impacts. Also known as the "404 Permit Process".
National Marine Fisheries Service (NMFS)	> Section 7(a) of the Federal Endangered Species Act (ESA)	> USACE must consult with NMFS regarding potential impacts to anadromous fish species. Issues a Letter of Concurrence or a Biological Opinion (BO). Triggered by the 404 Permit Process.
	> Section 305(b)(4) of the Magnuson-Stevens Act	> NMFS is required to provide Essential Fish Habitat (EFH) conservation consultations with federal agencies.
U.S. Fish and Wildlife Service (USFWS)	> Section 7(a) of the Federal Endangered Species Act	> USFWS to evaluate potential impacts to special-status plant and animal species. Issues a Letter of Concurrence or a BO. Triggered by the 404 Permit Process.
	> Migratory Bird Treaty Act (MBTA)	> USFWS has responsibility for protecting nearly all species of birds, their eggs, and nests.
	> Fish and Wildlife Coordination Act (FWCA)	> The FWCA provides authority for USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects.
State Agencies		
California Department of Fish and Wildlife (CDFW)	> Streambed Alteration Agreement (Fish and Game Code Sections 1600–1616)	> Required for channel improvements including reconfiguration, deepening, and widening. Issues agreement with conditions to protect resources whenever a bed or bank of a stream, lake, or reservoir is altered.
	> Incidental Take Permits for state-listed species (Fish and Game Code Section 2081)	> CDFW may issue if specific criteria are met, the species continued existence is not jeopardized, and impacts of the authorized take are minimized and fully mitigated.

Table 1.3-1 Overview of Permits, Approvals, and Consultations Required for the Upper Llagas Creek Project

Jurisdiction	Permits, Approvals & Consultations	Project Action Associated with the Permit, Approval, or Consultations
California Department of Transportation (Caltrans)	> Encroachment permit is required for construction within the Caltrans Right-of-Way (ROW).	> Construction of channel modifications to pass floodwaters under a highway.
	> Transportation Permit.	> Delivery of materials and equipment to the Project area. Required for transport of oversized loads on state highways (This permit is usually obtained by the construction contractor or subcontractors).
State Historic Preservation Office (SHPO)	> Section 106, National Historic Preservation Act (NHPA).	> Identification of cultural resources, provisions for Native American consultation and preparation of a Memorandum of Agreement (MOA) for adverse effects on resources listed in, or eligible for listing on the National Register of Historic Places (NRHP). Triggered by the Section 404 Permit Process.
Regional Agencies		
Bay Area Air Quality Management District (BAAQMD)	> As required by the California Clean Air Act (CAA) and Amendments (Health and Safety Code [HSC] Section 40910 et seq.) and the Federal CAA and Amendments (42 U.S.C. Section 7401 et seq.). Responsible for air monitoring, permitting, enforcement, long-range air quality planning, regulatory development, education, and public information activities related to air pollution encompassing Santa Clara County and the Peninsula from the Santa Cruz Mountains to South San Francisco.	> Possible permits for use of portable generators during Project construction that are not exempt from permit requirements.
Central Coast Regional Water Quality Control Board (CCRWQCB)	> Porter-Cologne Water Quality Control Act. Overseen by the State Water Resources Control Board (SWRCB), the CCRWQCB issues certification or waiver for construction-related degradation of water quality.	> Triggers the National Pollutant Discharge Elimination System (NPDES) permitting. for channel improvements including reconfiguration, deepening and widening.
	> 401 Water Quality Certification (401 Certification) required for any project that needs a Federal 404 Permit. The 401 Certification is a verification by the state that the project will not violate water quality standards	> Required for channel improvements including reconfiguration, deepening and widening

Table 1.3-1 Overview of Permits, Approvals, and Consultations Required for the Upper Llagas Creek Project

Jurisdiction	Permits, Approvals & Consultations	Project Action Associated with the Permit, Approval, or Consultations
	> Construction General Permit for stormwater discharges associated with construction activity.	> This applies to all construction projects that would disturb one or more acres of soil. Requires filing a Notice of Intent (NOI), as well as preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP).
Local Agencies		
Santa Clara Valley Water District (SCVWD)	> California Environmental Quality Act (CEQA) compliance	> Evaluation of potentially significant impacts is required for all projects, as defined by the California Public Resources Code, Section 21065.
	> SCVWD Well Ordinance 90-I	> Regulates the classification, construction, and destruction of wells and other deep excavations; requiring the destruction of abandoned or unused wells; adopting water contamination hazard standards.
Santa Clara County Department of Environmental Health Local Oversight Program (LOP)	> The County of Santa Clara, in contract with the SWRCB, oversees investigation and cleanup of underground storage tanks.	> The LOP is the Certified Unified Program Agency (CUPA) for hazardous materials plans and spill prevention plans if stored hazardous materials are stored onsite.
	> Hazardous Materials Business Plan and Spill Prevention Control and Countermeasures Plan.	> The LOP oversees petroleum spill cleanup through Spill Prevention, Control, and Countermeasure Plans (SPCC).
County of Santa Clara	> Issues encroachment and grading permits under the Santa Clara County Ordinance No. 1203.109	> Triggered by the grading activities.
	> Sell real estate or develop Land Use Agreement	> Restoration of Llagas Creek through Lake Siveira owned by County Parks Department.
City of Morgan Hill	> City encroachment permits	> An encroachment permit is required for activities such as construction within the public ROW.
	> Tree Removal Permit	> Required for tree trunks with a circumference of 40 inches or more for nonindigenous species and 18 inches or more for indigenous species measured at 4.5 feet vertically above the ground or immediately below the lowest branch, whichever is lower. An indigenous tree includes oaks (all types); California Bays, Madrones, Sycamore, and Alder.

1.4 Related Authorizations, Plans, and Projects

1.4.1 Federal Reports and Authorizations

The following reports and studies pertinent to the Project have been prepared by the USACE (San Francisco District). The reports are listed in chronological order; however, the Water Resources Development Act of 1999 is mentioned in Section 1.1.1, since it is the federal authorization for this Project.

1.4.2 Regional Studies, Reports, and Other Documents

The following reports are for projects that are relevant to this Project through location or activity, and the documents were utilized throughout this EIR, as necessary.

> **Final Subsequent Environmental Impact Report Santa Clara Valley Water District Stream Maintenance Program Update 2012–2022**. The Stream Maintenance Program (SMP) is intended to support permitting for the next 10-year planning period beginning in 2012 and ending in 2022. SMP Update prioritizes and administers maintenance activities to achieve the following objectives: (A) remove sediment to maintain the hydraulic, safety, and habitat functions of the creek systems; (B) manage vegetation to maintain the hydraulic, safety, and habitat functions of the creek systems, and to allow for levee inspections and maintenance access; (C) stabilize beds and banks of creeks and canals to protect existing infrastructure, maintain public safety, reduce sediment loading, protect water quality, and protect habitat values; and (D) avoid, minimize, or mitigate impacts on the environment by incorporating stream stewardship measures into maintenance activities. The SMP Update also seeks to obtain and maintain multi-year programmatic permits to regulate maintenance activities. Many of the Stream Maintenance Best Management Practices (BMPs) would be utilized for maintenance related activities for this project.

> **Pajaro River Project**. The USACE is the lead agency for this joint EIS/EIR mandated under the Rivers and Harbors Act of 1966 (PL 89-789). The project area consists of the main stem of the Pajaro River, from its mouth to Highway 101 (U.S. 101), continuing from U.S. 101 to Murphy's Crossing and includes Salsipuedes Creek. The primary project objective is to reduce the potential for flooding and associated damage along the lower Pajaro River and its tributaries in the vicinity of Santa Cruz and Monterey counties, as well as the City of Watsonville.

> **Lower Llagas Creek Capacity Restoration Project**. The project area runs from Highway 152 to Pajaro River, is a partially-funded (planning phase only) project that plans, designs, and constructs improvements on approximately 3.35 miles of Lower Llagas Creek to accomplish the following objectives: restore flood capacity in Lower Llagas Creek; coordinate with South County Wastewater Authority as a principal stakeholder and water resource co-planner; and integrate flood protection with habitat protection to satisfy Endangered Species Act regulations. This project is funded by the SCVWD's watershed and stream stewardship fund. It was started in July 2008 and is scheduled to be completed in December 2016 (SCVWD 2010a,b).

> **Butterfield Boulevard South Extension Project (City of Morgan Hill)**. Since the Notice of Preparation,this project extended Butterfield Boulevard from Tennant Avenue to Watsonville Road and include a grade separation over the Union Pacific Railroad tracks. The extension would impact a short segment of West Little Llagas Creek. The project would include outlets to West Little Llagas Creek from a planned detention pond and an additional local detention pond southeast of the new intersection that would collect runoff from the area of the Butterfield Boulevard extension between the Union Pacific Railroad (UPRR) tracks and Monterey Road. A Final EIR for the Sutter Boulevard Extension & Flood Protection Facilities was completed for the project in 1992. Since that time, Sutter Boulevard was renamed Butterfield Boulevard and project changes have required an addendum in 2005, an addendum in 2011, and an Initial Study/Mitigated Negative Declaration in 2010 for shifting of

Butterfield Boulevard alignment to the south near Monterey Road and widening Watsonville Road further to the southeast resulting in impacts to West Little Llagas Creek (City of Morgan Hill 2011). The project received a grant from Santa Clara Valley Transportation Authority and is near completion.

1.5 Public Scoping Process

1.5.1 Previous Environmental Review

> **USDA Soil Conservation Service distributed the LCWPP Draft EIS for public review in July 1979.** A public hearing on the draft was held in September 1979. The SCS developed a Finding of No Significant Impact/Negative Declaration for impacts to geomorphology, visual resources, aquatic resources, and wildlife habitat for the project (USDA 1982). During the public review period, strong citizen opposition developed along with objections from several public agencies. Therefore, the project sponsors agreed to restudy the proposed project.

> **Llagas Creek Watershed Draft Environmental Impact Statement/Report prepared for the USDA NRCS was distributed for public comment in September 1982.** Local sponsoring agencies for the draft report were the Loma Prieta Resource Conservation District, the Gavilan Water District, and the SCVWD. The EIR was certified, permits were obtained, and the lower reaches of Llagas Creek were constructed.

> **Notice of Intent and Notice of Preparation to Prepare a Joint Supplemental Environmental Impact Statement (SEIS)/Supplemental Environmental Impact Report (SEIR) for the Llagas Creek Flood Control Project (Federal Register: August 7, 2001 and State Clearinghouse No. 2001082034, August 8, 2001).** This document was started but not completed.

1.5.2 Scoping Meeting

The Upper Llagas Creek Project Scoping Meeting was conducted on October 25, 2012. The meeting was held at the Morgan Hill Community and Cultural Center, Morgan Hill, California. SCVWD officials and staff provided a summary of the Project. Individuals spoke on behalf of themselves or local government agency representatives; and a total of 29 unique Project related questions were received related to project components, alternatives and miscellaneous concerns regarding: eminent domain, Project funding, coordination with county roads and airports regarding maintenance, and how the Project boundaries were determined. SCVWD received five comment letters from state and local agencies during the comment period, which are included in Appendix A. A summary of environmental concerns raised by agencies during the scoping period include:

> Impacts to wastewater treatment systems and groundwater, and surface water;

> Potential impact to county parklands, park resources, recreational facilities, public access, and countywide trail routes;

> Impacts to vegetation differentiating between native and nonnative species;

> Reduction of future maintenance;

> Reduction of channel modifications;

> Consider Project objectives that balance flood management needs with environmental protection; and

> Impacts to bridges, trestles, and culverts from upstream modifications.

1.6 CEQA Process

One of the objectives of CEQA is to encourage public involvement in project planning and government decision making. Through the scoping and document comment processes, the members of the public and

responsible and interested agencies can voice their concerns, request clarification, and make recommendations that can ultimately alter the originally Proposed Project.

Under CEQA, once the Draft EIR is complete, the SCVWD must notify agencies and the public that it is available for review. The required notification, referred to as a Notice of Completion (NOC), will be submitted to the State Clearinghouse: CEQA also requires that the lead agency provide written notice of the draft document's availability to the County Clerk's office for posting and to any other interested parties who have requested it. The NOC must also be published in a general-circulation newspaper, or mailed to residents of properties adjacent to the Project site. Issuance of the NOC initiates a public review period during which SCVWD will receive and respond to public and agency comments on the Proposed Project and the document. Under NEPA, the USACE will consider information in the Draft EIR and comments on the Draft EIR to help refine the scope and content of an EIS to be prepared for the Proposed Project. The comment period of 45 days, January 6, 2014 through February 20, 2014, started after the NOC was submitted to the State Clearinghouse. Comments can be sent to SCVWD via mail, email, or hand delivered, or provided verbally at public meetings if a transcriber is present.

Prior to approving the Project, SCVWD must respond in writing to every comment received during the public review period, certify that the Final EIR has been completed in compliance with CEQA, that it has reviewed and considered the information in the Final EIR, and that the Final EIR reflects its independent judgment and analysis. If SCVWD approves the project, it will file a Notice of Determination (NOD) with the County Clerk and State Clearinghouse.

It is not the purpose of an EIR to recommend either approval or denial of a project. Although an EIR does not control the lead agency's ultimate decisions on the project, the lead agency must consider information in the EIR, including comments received, during the approval process. Under CEQA, the lead agency must respond to each significant impact identified in the EIR. If significant, adverse environmental impacts are identified in the EIR, approval of the project under CEQA must be accompanied by written findings, determining the following, as appropriate:

> Changes or alterations have been required in, or incorporated into, such project that mitigate or avoid the significant environmental effects thereof as identified in the completed EIR.

> Such changes or alterations are within the responsibility and jurisdiction of another public agency and such changes have been adopted by such other agency, or can and should be adopted by such other agency.

> Specific economic, social, or other considerations make infeasible the mitigation measures or project alternatives identified in the EIR.

If mitigation measures are to be made a condition of the approval of the Project, a Mitigation Monitoring and Reporting Program (MMRP) must be adopted before the Project is approved. CEQA requires the decision-making agency to balance, as applicable, the economic, legal, social, technological, or other benefits of a proposed project against its unavoidable environmental risks when determining whether to approve a project. When an agency approves a project that will result in significant and unavoidable impacts, it must make a Statement of Overriding Considerations.

1.6.1 Significance

CEQA requires California agencies to identify each "significant effect on the environment" that a project may have, and ways to mitigate each significant effect. A significant effect on any environmental resource triggers the preparation of an EIR. Each and every significant effect on the environment must be disclosed in the EIR and mitigation measures identified and adopted, if feasible. In addition, CEQA Guidelines list a number of mandatory findings of significance. At the end of the CEQA process, the lead agency must determine whether the project, as approved, would have a significant effect on the environment.

The Proposed Project has been determined to require an EIR under CEQA. This EIR has been prepared to meet CEQA requirements for disclosing and identifying feasible mitigation for every significant effect.

1.7 Terminology Used in the EIR

The EIR uses the following terminology, consistent with CEQA Guidelines, to denote the significance of potential environmental impacts.

> A finding of "**no impact**" is made when the analysis concludes that the Project would not affect the particular environmental resource or issue.

> A "**less than significant**" impact or an impact that is "not significant" would cause no substantial adverse changes in the environment; no mitigation is needed.

> A "**significant"** or "**potentially significant**" impact could, or would cause substantial physical changes in the environment. Mitigation is recommended to reduce the impact to a less-than-significant level.

> A "**significant and unavoidable**" impact is one that could, or would, cause a substantial adverse change in the environment that cannot be avoided if the project were to be implemented. Mitigation may be recommended, but would not reduce the impact to a less-than-significant level.

> An impact is "**beneficial**" if the analysis concludes that there would be a positive change in the environment. Although CEQA does not consider positive impacts, beneficial is used in this document and is equivalent to No Impact under CEQA.

> "**Mitigation**" refers to specific measures or activities adopted to avoid an impact, reduce its severity, or compensate for it.

Impacts for each resource or issue are analyzed and evaluated based on the following factors:

> **Extent** considers whether the impact would be local or regional in nature;

> **Duration** considers whether the impact is short-term (typically construction-related) or long-term (typically described in terms of years);

> **Seasonality/Timing** considers variation in impact based on timing of effects;

> **Intensity** considers whether the impact would be negligible (imperceptible or not detectable); minor (slightly perceptible and generally localized); moderate (apparent and having the potential to become larger); or major (substantial, highly noticeable, and possibly permanent);

> **Type** considers whether the impact would be beneficial or adverse.

1.8 Organization of the EIR

The Draft EIR is organized into seven chapters, which conform to the required contents of an EIR established in CEQA (Article 9, Contents of Environmental Impact Reports). Accordingly, this document has been organized as follows:

> Summary

> Table of Contents

> Chapter 1 – Introduction. This chapter describes the objectives of the Project.

> Chapter 2 – Description of Alternatives. This chapter describes alternatives considered but for stated reasons not brought forward in the analysis; alternatives brought forward and analyzed fully for each alternative regarding their respective impacts, including the No Project Alternative; and, description of the Proposed Action (i.e., Project).

- Chapter 3 – Affected Environment and Environmental Consequences. This chapter provides a description of the Project study area, the environmental and regulatory setting, and an analysis of the potential for impacts on resources with the Project area.
- Chapter 4 –Other CEQA Considerations
- Chapter 5 – Agency Consultation and Public Outreach
- Chapter 6 – List of Preparers
- Chapter 7 – References
- Appendix A, 2012 Scoping Letters
- Appendix B, 2012–2022 Stream Maintenance Program BMPs
- Appendix C, Upper Llagas Creek Project Comprehensive BMPs
- Appendix D, Instream Aquatic Habitat Features
- Appendix E, Impacts to Vegetation Types and Habitats for the Tunnel (Preferred) Alternative
- Appendix F, Potential Jurisdictional Waters and California Sycamore Woodland
- Appendix G, Special-status Plant Species Potentially Occurring in the Project Vicinity
- Appendix H, CNDDB Occurrences in the Project Vicinity
- Appendix I, USFWS Species List for the Project Vicinity
- Appendix J, Special-status Wildlife Species Potentially Occurring in the Project Vicinity
- Appendix K, Air Quality Tables
- Appendix L, Upper Llagas Creek Baseline Noise Measurements

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2 Description of Alternatives

The Upper Llagas Creek Project Environmental Impact Report (EIR), Chapter 2, is organized as follows:

> Section 2.1 – Project Location;

> Section 2.2 – Alternatives Considered, Eliminated, and Brought Forward;

> Section 2.3 – No Project Alternative;

> Section 2.4 – Project Elements Common to All Action Alternatives;

> Section 2.5 – NRCS Alternative;

> Section 2.6 – Tunnel Alternative (Preferred Alternative);

> Section 2.7 – Culvert/Channel Alternative;

> Section 2.8 – Reach 6 Bypass Alternative; and

> Section 2.9 – Summary of Project Alternatives.

Chapter 2 includes a description of the Project location and existing landmarks and channel features (Section 2.1) followed by a description of the alternatives previously considered and eliminated from further analysis (Section 2.2). Section 2.3 is a description of the No Project Alternative. Section 2.4 describes the Project components common to all of the action alternatives. Detailed descriptions of the four action alternatives are presented in Sections 2.5 through 2.8, with a summary and comparison of all Project alternatives (Section 2.9).

2.1 Project Reach Location and Characteristics

The Project is located in southern Santa Clara County, approximately 25 miles southeast of San Jose, in the communities of Morgan Hill, San Martin, and Gilroy (Figure 1.1-1). The Project consists of the upper seven reaches (4, 5, 6, 7A, 7B, 8 and 14) of Llagas Creek, East Little Llagas Creek, and West Little Llagas Creek above Buena Vista Avenue (Figure 2.1-1).

The original Llagas Creek Flood Watershed Project Plan (LCWPP) was developed by the United States Department of Agriculture (USDA) Soils Conservation Service (SCS) in the late 1960s. The LCWPP addressed flooding on both the upper reaches of the watershed, and a set of lower reaches along the West Branch of Llagas Creek in Gilroy and mainstem Llagas Creek below Buena Vista Avenue. Flood control measures on the lower reaches were constructed beginning in the 1970s. This EIR considers proposed measures that address flooding in the upper reaches.

The total length of the Project area is approximately 13.1 miles; 6.1 miles of which are along the main branch of Llagas Creek, 3.3 miles along West Little Llagas Creek; and, 2.4 miles along a tributary of Llagas Creek, known as East Little Llagas Creek. An additional 1.3 miles of new channel would also be constructed along West Little Llagas Creek to Llagas Creek. On the north, the physical limits of the Project are at the creek's intersection with Llagas Road on West Little Llagas Creek in Morgan Hill; and, in the south, approximately 1,000 feet downstream of the creek's intersection with Buena Vista Avenue in Gilroy. A summary description of each of the seven Project reaches (from upstream to downstream) identified in this EIR is provided below.

Project Reach 8 (West Little Llagas Creek)

Reach 8 is approximately 1.6 miles long and is located along West Little Llagas Creek in downtown Morgan Hill between West Dunne Avenue in the south and just upstream of Llagas Road in the north (Figure 2.1-2). The existing channel conveyance capacity is less than a 10-percent flood event (<400 cubic feet per second [cfs] at Hillwood Lane). Reach 8 is highly urbanized and constrained by development with homes or other buildings built next to the channel. The existing creek consists of a trapezoidal earthen channel with top widths varying between eight and 20 feet, and an average depth of 5 feet. Some sections of the channel are open concrete, and other sections are underground passing through 10 single box culverts, eight of which are currently undersized for the 1-percent exceedance flow[1]. The 10 culverts are located at: West 5th Street; West 4th Street; West 3rd Street; the West 2nd Street/Del Monte Avenue intersection; Warren Avenue; Main Street; the Wright Avenue/Hale Avenue intersection; and Llagas Road, Llagas Creek Drive, and Hillwood Lane. The Llagas Road culvert has a constricted opening that would be removed to pass the 1-percent exceedance flow.

Project Reach 7B

Reach 7B is a trapezoidal earthen channel, approximately 1.4 miles long, located along West Little Llagas Creek in an urban, and residential suburban, area of Morgan Hill between South La Crosse Drive in the south, and West Dunne Avenue in the north (Figure 2.1-3). The existing creek passes through 18 reinforced concrete box (RCB) culverts at seven locations (Table 2.1-1), three of which (Spring Avenue, Cosmo Avenue, and Edes Street) are currently undersized for the 1-percent flow. Existing culverts include: a quadruple box culvert at South La Crosse Drive; triple box culverts at North La Crosse Drive; West Edmundson Avenue; Edes Street and Cosmo Avenue; and a culvert at Spring Avenue. A 674-foot long single box culvert conveys flows under the Morgan Hill Plaza Shopping Center from West Dunne Avenue to Ciolino Avenue. A paved pedestrian/bike path meanders alongside approximately 2,000 feet of the south side of the West Little Llagas Creek channel between Edes Court and South La Crosse Drive.

Project Reach 7A

This reach extends approximately 1.55 miles from Reach 6 just above the Monterey Road Bridge in the south, to South La Crosse Drive in the north. The majority of land adjacent to Reach 7A is currently agricultural fields (Figure 2.1-4); there is no existing channel here except for a short 0.3-mile length of trapezoidal shaped constructed channel at the north end of the reach. Each of the alternatives would excavate a proposed earthen diversion channel approximately 1.25 miles long through Reach 7A to divert flows from West Little Llagas Creek upstream of Watsonville Road to Llagas Creek downstream of Lake Silveira at Monterey Road (see Figure 2.1-4). Vegetation consists of row crops or annual, non-native grassland on fallowed lands. There are two buried (and therefore currently inoperable) bridges in this reach (Table 2.1-1) constructed by the SCVWD at Watsonville Road and West Middle Avenue that would be exhumed when the diversion channel is constructed.

[1] The 1-percent flood is a flow event that statistically has a 1-percent chance of happening in any given year. It is sometimes referred to as the “100-Year” flood. This is a flood that might occur once every one hundred years on average over the long term. Similarly a 10-percent flood is a flow event that statistically has a 10-percent chance of happening in any given year, and is sometimes referred to as the “10-Year” flood.

Table 2.1-1 Existing Channel Crossings, Reaches 7A and 7B (West Little Llagas Creek)

Reach 7 Location	Type of Crossing	Roadway Width (ft)	Existing Culverts		Existing Bridges
			Culvert Size w (ft) x h (ft)	Number of Culverts	Number of Piers
Middle Ave.	Bridge (buried)	37	--	--	2
Watsonville Rd.	Bridge (buried)	75	--	--	2
S. La Crosse	RCB*	70	13 x 8	3	--
			12 x 11	1	--
N. La Crosse	RCB	70	16.5 x 9	2	--
			16.5 x 12	1	--
Edmundson Ave.	RCB	80	12 x 10	3	--
Edes Ct.	RCB	48	10 x 9	1	--
			10 x 7	2	--
Cosmo Ave.	RCB	48	10 x 9	1	--
			10 x 7	2	--
Spring Ave.	RCB	58	10 x 9	1	--
Ciolino/Dunne	RCB	674	15 x 8	1	--

*RCB – Reinforced concrete box culvert.

Project Reach 6

Llagas Creek Reach 6 is a natural earthen channel, approximately 3.2 miles long from 700 feet upstream of U.S. Highway 101 (U.S. 101) in the south, to Monterey Road in the north (Figure 2.1-5). Reach 6 meanders between Monterey Road and South County Airport. The southern portion of this reach is adjacent to SCVWD percolation ponds between Church Avenue and Murphy Avenue. Reach 6 is a perennially-flowing stream segment over a 6,600-foot-long segment from below Lake Silveira to about San Martin Avenue, with flow continuously supported by releases from Chesbro Reservoir, which is located outside of the project area on Llagas Creek (see Figure 1.1-1). Downstream from San Martin Avenue, Reach 6 is an intermittent channel as flow percolates through the streambed to groundwater.

Land use adjacent to the creek varies from commercial and residential in the north to agricultural in the south. There are five, existing bridge crossings: Monterey Road; the Union Pacific Railroad tracks; Llagas Avenue; San Martin Avenue; and Church Avenue. There is a mix of native and non-native vegetation along the stream banks. Patchy tree canopy is provided both by native oaks, cottonwood (*Populus fremontii*), sycamore (*Platanus racemosa*), and willows (*Salix* spp.), as well as by exotic eucalyptus, particularly red gum (*Eucalyptus camaldulensis*).

Project Reach 5

Llagas Creek Reach 5 is a natural earthen channel approximately 0.5 mile long from the Llagas Creek/ East Little Llagas Creek confluence in the east to 700 feet upstream of U.S. 101 in the west (Figure 2.1-6). Two bridges cross Llagas Creek along the north and south lanes of U.S. 101.

Reach 5 is ephemeral, typically dry in the summer and fall months, and, as a consequence, riparian vegetation is limited along this segment of Llagas Creek. Where tree canopy is present, it consists of a combination of planted exotic trees and native trees, particularly red gum and introduced Monterey pine (*Pinus radiata*). Additionally, the stream channel bed supports riparian species such as mule fat (*Baccharis salicifolia*). The banks and the undisturbed areas beyond the top of the banks support annual grassland species.

Project Reach 4

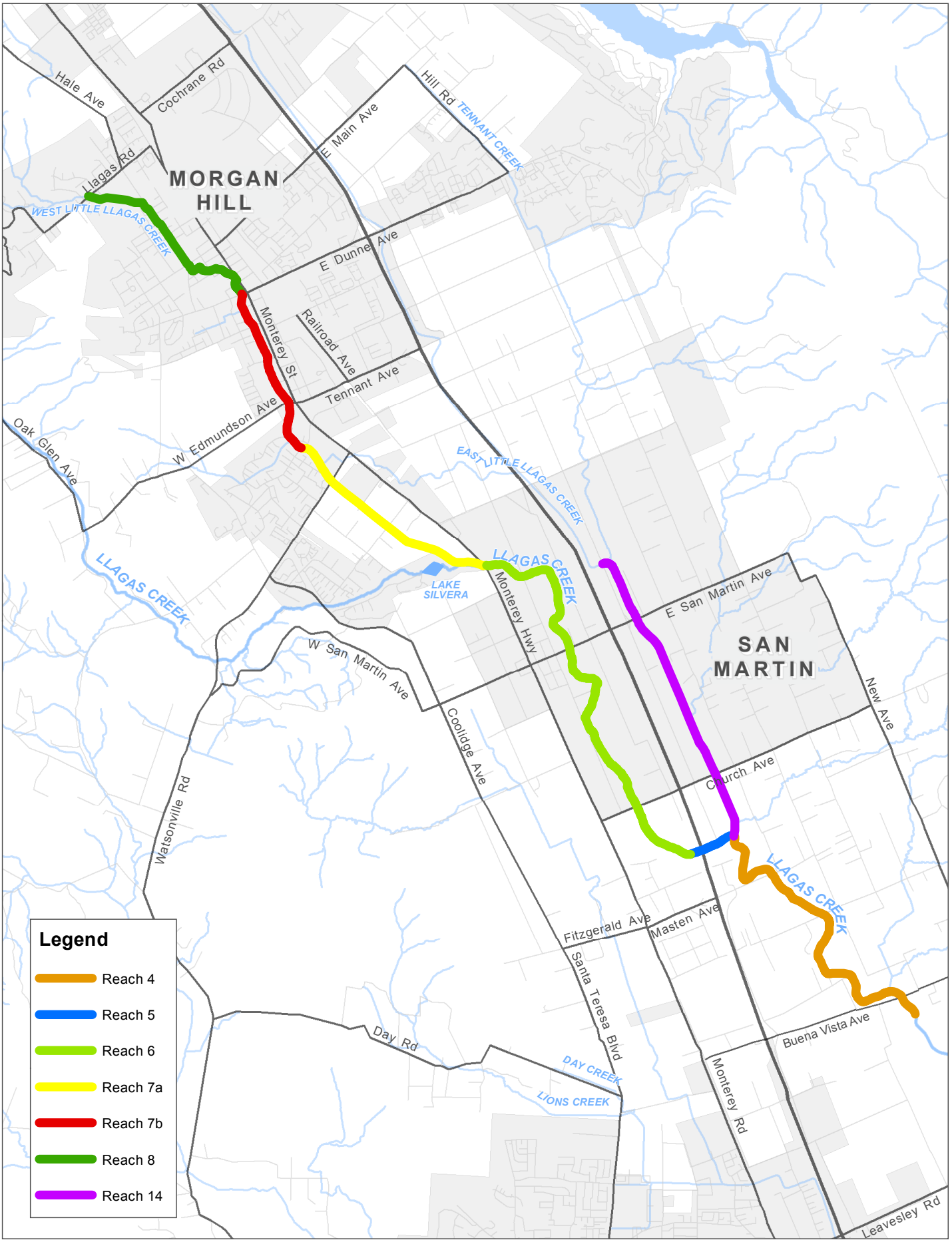
Reach 4 is the downstream-most reach of the Project. It is a natural earthen channel, extending approximately 2.4 miles along Llagas Creek from approximately 1,000 feet downstream of Buena Vista Avenue in the south to the East Little Llagas Creek/Llagas Creek confluence in the north (Figure 2.1-7). There are three existing bridge crossings at Masten Avenue, Rucker Avenue, and Buena Vista Avenue. There is an existing fish ladder and grouted concrete rock downstream of Buena Vista Avenue that would be removed so as to not induce flooding due to upstream Project improvements.

Reach 4 contains sinuous bends, particularly near Masten and Buena Vista Avenues; and, is ephemeral, typically dry in the summer and fall months and flowing only in the winter months after rainfall generates sufficient runoff. The stream channel bed supports sparse mature vegetation such as mule fat. The banks support a mixture of riparian and non-riparian species. Tree canopy is patchy but it some locales tree cover is dense, including extensive stands of red gum.

Project Reach 14

Reach 14 is a constructed channel that extends approximately 2.4 miles along East Little Llagas Creek from the Llagas Creek confluence in the south, to just downstream of the Corralitos Creek confluence in the north (Figure 2.1-8). It is an excavated earthen channel that was straightened and realigned by Caltrans in the 1970s during the construction of U.S. 101. Above the upstream boundary of Reach 14, between Sycamore Avenue to about Middle Avenue, East Little Llagas Creek is parallel to U.S. 101 for approximately 5,400 feet. U.S. 101 in this area is located atop an embankment, which also acts as the right bank of East Little Llagas Creek.

Agricultural and rural residential land uses, and commercial buildings are present in the area surrounding Reach 14. Reach 14 is ephemeral, typically dry in the summer and fall months, only flowing in the winter months after sufficient rainfall generates runoff. The channel contains box culverts where the creek crosses East San Martin Avenue and Church Avenue. The bottom of the channel banks contains a combination of annual grassland species and bare ground. Vegetation on the stream banks is primarily annual grassland with a few scattered trees (mostly native).



Upper Llagas Creek Project EIS

FIGURE 2.1-1

Upper Llagas Creek Project Reaches

Cardno ENTRIX

Upper Llagas Creek Project EIR

FIGURE 2.1-2
Reach 8

Cardno ENTRIX

Upper Llagas Creek Project EIR

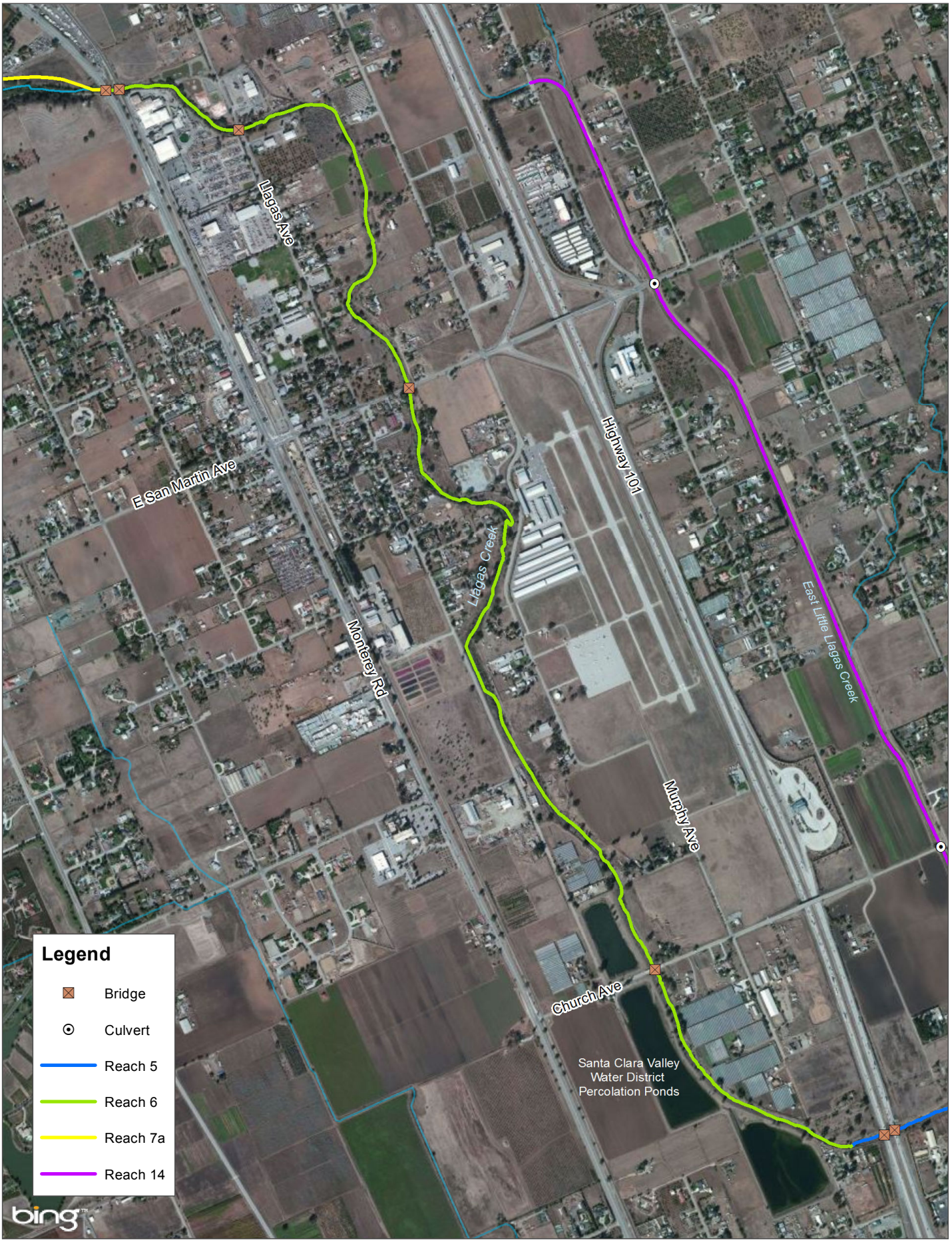
FIGURE 2.1-3
Reach 7B

Cardno ENTRIX

Upper Llagas Creek Project EIR

FIGURE 2.1-4
Reach 7A

Cardno ENTRIX



Upper Llagas Creek Project EIR

FIGURE 2.1-5
Reach 6

Cardno ENTRIX

Upper Llagas Creek Project EIR

FIGURE 2.1-6
Reach 5

Cardno ENTRIX

Upper Llagas Creek Project EIR

FIGURE 2.1-7
Reach 4

Cardno ENTRIX

Upper Llagas Creek Project EIR

FIGURE 2.1-8

Reach 14

Cardno ENTRIX

2.2 Alternatives Considered, Eliminated, and Brought Forward

2.2.1 1982 EIS/EIR Alternatives Evaluation

The LCWPP was proposed by the SCVWD in 1968. In 1969, the proposed project received federal and state approval, and as part of the Watershed Protection and Flood Prevention Act of 1954. Congress authorized the NRCS, formerly the SCS, to move forward with project construction, which commenced in 1973. Project construction for the first phase was suspended in order to evaluate potential impacts as required by the National Environmental Policy Act (NEPA) signed into law in 1973 and enacted in 1974. The LCWPP was revised several times by the NRCS, local sponsors, and citizen groups over a period of nearly a decade before a joint EIS/EIR was completed in 1982. The scope of the 1982 EIS/EIR considered a broad range of alternatives, including an assessment of flood control measures in the entire Llagas Creek watershed. The alternatives included: the No Project Alternative; a Nonstructural Plan Alternative that included flood proofing individual buildings and elevating homes and other structures in the floodplain and six different Structural Plan Alternatives identified below as Alternatives A, B, C, D, E, and F.

The 1982 EIS/EIR determined that structural measures would be necessary to reduce flooding in agricultural and urban areas in Santa Clara County. The six alternatives evaluated in 1982 EIS/EIR considered Project reaches that were part of the larger LCWPP (Figure 1.2-1) and included lower Llagas Creek and the West Branch Llagas Creek through Gilroy (Reaches 1, 2, 9, 10, 11, 12, 13, and 15). Flood management facilities in these reaches were constructed by 1994 and, therefore, are not part of the Upper Llagas Creek Flood Protection Project addressed in this EIR.

All of the alternatives evaluated in the 1982 EIS/EIR included construction of a new channel segment to bypass East Little Llagas Creek (Reach 7A), allowing flow from West Little Llagas Creek in Morgan Hill to be redirected into the main branch of Llagas Creek near the present-day location of Lake Silveira[2]. The bypass channel would eliminate flooding along the section of West Little Llagas Creek from La Crosse Drive to East Little Llagas Creek (Reach 14). This design avoids having to excavate the existing West Little Llagas Creek channel segment to increase flow capacity, avoids construction of a bridge to accommodate an enlarged channel where it crosses U.S. 101, and reduces the amount of excavation needed to prevent induced flooding and would provide a 10-percent exceedance flow capacity through Reach 14.

Other design features that were proposed which are common to all of the 1982 alternatives include: a rectangular concrete channel in Morgan Hill (Reach 8); selective channel widening and deepening throughout the other reaches to prevent induced flooding from the improvements in Morgan Hill; and protection from the 1-percent flood event (100-year flood) on the upper urbanized reaches of West Little Llagas Creek (Reaches 7A, 7B, and 8).

Alternative A—Raise Chesbro Dam and Channel Modifications

As a key feature of this alternative, Chesbro Dam and the spillway would be raised by at least 2 feet to add 550 acre feet of storage to the reservoir. Operational agreements would require outflow to be limited to 2,900 cfs. In combination with measures to excavate channels downstream of the dam to increase flood capacity, the dam raise under this alternative would provide 1-percent flood protection in all reaches. The flood management measures included:

[2] Lake Silveira was formed when an illegal levee breach was made separating a rock quarry pit from Llagas Creek sometime in the 1980s.

> Raising Chesbro Dam and spillway;

> Excavating 26 miles of earthen channel (Reaches 2, 3, 4, 5, 7A, 7B, 8B, 9, 11A, 11B, 12, 13, 14, 15A, 15B, and 16);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A);

> Constructing 4.1 miles of new channel (Reaches 10, 12, 13, and 7A); and

> Constructing 4.2 miles of levee on Llagas Creek (Reaches 6A and 6B).

Twenty-seven grade stabilization structures were proposed, to be designed as concrete drops and rock chutes that would provide fish passage. Thirty-eight existing bridges and 25 box culverts would be replaced. An 18-footwide maintenance road would be constructed on either side of the channel. Alternative A would have required purchase of 547 acres of right-of-way (ROW), and removal of nine residences. Thirty-four acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 3,020 acres would be protected during the 1-percent flood. The installation cost was $61.99 million, with an estimated $913,000 in annual average damages avoided[3].

Alternative B—Channel Modifications on Corralitos Creek and West Branch Llagas Creek

This alternative would be similar to Alternative A, except that Chesbro Dam would not be raised. Additionally, two reaches of channel modification work would be added; one reach on Corralitos Creek (Reach 15C) from Tennant Avenue to East Dunne Avenue, and one reach on West Branch Llagas Creek (Reach 11C) from Fitzgerald Road to Highland Avenue, providing 1-percent flood protection. This alternative would provide 1-percent flood protection in all reaches. The flood management measures included:

> Excavating 24.8 miles of earthen channel (Reaches 2, 3, 4, 5, 7A, 7B, 8B, 9, 11A, 11B, 11C, 12, 13, 14, 15A, 15B, 15C, and 16);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A);

> Constructing 4.1 miles of new channel (Reaches 7A, 10, 12, and 13); and

> Constructing 4.2 miles of levee on Llagas Creek (Reaches 6A and 6B).

Twenty-eight grade stabilization structures were proposed, to be designed as concrete drops and rock chutes that would provide fish passage. Forty existing bridges and 25 box culverts would be replaced. An 18-footwide maintenance road would be constructed on both sides of the channel. Alternative B would have required purchase of 573 acres of ROW, and removal of nine residences. Thirty-eight acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 3,120 acres would be protected during the 1-percent flood under this alternative. The installation cost was $63.02 million, with an estimated $916,000 in annual average damages avoided.

[3] All costs and estimated damages avoided for alternatives A, B, C, D, E, and F are referenced from the 1982 EIS/EIR.

Alternative C—One-percent Flood Protection for Morgan Hill and Gilroy Urban Areas and Llagas Creek below Urban Areas

Flood protection under this alternative would be similar to Alternative B, except there would be no flood management improvements along East Little Llagas (Reaches 14 and 16), Corralitos creeks (Reach 15), and West Branch Llagas Creek between Highland Avenue and Fitzgerald (Reach 11C). The flood management measures included:

> Excavating 15.8 miles of earthen channel (Reaches 2, 3, 4, 5, 7A, 7B, 8B, 9, 11A, 11B, 12, and 13);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A);

> Constructing 4.1 miles of new channel (Reaches 7A, 10, 12, and 13); and

> Constructing 4.2 miles of levee on Llagas Creek (Reaches 6A and 6B).

Twenty-one grade stabilization structures were proposed, to be designed as concrete drops and rock chutes that would provide fish passage. Thirty-six existing bridges and 13 box culverts would be replaced. An 18-footwide maintenance road would be constructed on either side of the channel. Alternative C would have required purchase of 370 acres of ROW and removal of eight residences. Thirty-two acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 2,420 acres would be protected during the 1-percent flood. The installation cost was $51.95 million, with an estimated $889,000 in annual average damages avoided.

Alternative D—One-percent Flood Protection for Morgan Hill and Gilroy Urban Areas with 10-percent Protection in all Other Areas Described under Alternative B

This alternative would provide 1-percent flood protection in Morgan Hill (Reaches 7 and 8), Gilroy and downstream (Reaches 2, 9, 10, 11A, 11B, 12, and 13). Ten-percent protection would be provided along Corralitos (Reach 15) and East Little Llagas creeks (Reach 14), and downstream from Morgan Hill (Reaches 3, 4, 5, and 6). The flood management measures included:

> Excavating 29 miles of earthen channel (Reaches 2, 3, 4, 5, 6A, 6B, 7A, 7B, 8B, 9, 11A, 11B, 11C, 12, 13, 14, 15A, 15B, 15C, and 16);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A); and

> Constructing 4.1 miles of new channel (Reaches 7A, 10, 12, and 13).

Twenty-eight grade stabilization structures were proposed, to be designed as concrete drops and rock chutes that would provide fish passage. Thirty-eight existing bridges and 24 box culverts would be replaced. An 18-footwide maintenance road would be constructed on both sides of the channel. Alternative D would have required purchase of 397 acres of ROW and removal of seven residences. Thirty-eight acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 1,810 acres would be protected during the 1-percent flood. The installation cost was $50.38 million, with an estimated $887,900 in annual average damages avoided.

Alternative E—One-percent Flood protection for Morgan Hill with No Induced Flooding Downstream and 1-percent Protection in Gilroy and Downstream Reaches

This alternative would provide 1-percent flood protection in Morgan Hill (Reaches 7 and 8), with channel modifications downstream to prevent induced flooding (Reaches 4, 5, and 6). One-percent flood protection would be provided in Gilroy and downstream (Reaches 2, 3, 9, 10, 11, 12, and 13). No work would occur on Corralitos or East Little Llagas creeks. The flood management measures included:

> Excavating 7.8 miles of earthen channel (Reaches 2, 3, 4, 7A, 7B, 8B, 9, 10, 11A, 11B, 12, and 13);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A);

> Constructing 4.1 miles of new channel (Reaches 7A, 10, 12, and 13); and

> Selective clearing of vegetation and debris removal on 5.2 miles of stream (Reaches 4 and 6A).

Installation of 11 grade stabilization structures was proposed to be designed as concrete drops and rock chutes to provide fish passage. Nineteen existing bridges and 15 box culverts would be replaced. An 18-foot-wide maintenance road would be constructed on both sides of the channel. Alternative E would have required purchase of 335 acres of ROW and removal of four residences. Nineteen acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 720 acres would be protected during the 1-percent flood. The installation cost was $24.1 million, with an estimated $842,400 in annual average damages avoided.

Alternative F—Same Level of Protection as Alternative E with Similar Flood Management Features in the Same Reaches, except no Work on West Branch Llagas Creek in Reach 11B, Elimination of one Maintenance Road and Levee in Reach 9 below Gilroy

This alternative would apply to the same reaches. Except there would be no work on West Branch Llagas Creek in Reach 11B and one maintenance road and levee in Reach 9 below Gilroy would be eliminated. It would provide 1-percent flood protection in Morgan Hill (Reaches 7 and 8), with minor channel modifications downstream to prevent induced flooding (Reaches 4, 5, and 6). One-percent flood protection would be provided in Gilroy and downstream (Reaches 2, 3, 9, 10, 11A, 12, and 13). No work would occur on Corralitos (Reach 15) or East Little Llagas creeks (Reach 14). The flood management measures included:

> Excavating 5.5 miles of earthen channel (Reaches 2, 4, 7A, 7B, 8B, 9, 10, 11A, 12, and 13);

> Constructing a rectangular concrete channel for 1.0 miles in Morgan Hill (Reach 8A);

> Constructing 4.1 miles of new channel (Reaches 7A, 10, 12, and 13);

> Selective clearing of vegetation and debris removal on 5.2 miles of stream (Reaches 4 and 6B); and

> Constructing levee on 0.9 mile of West Branch Llagas Creek channel (Reach 9).

Design differences from Alternative E to reduce Project costs would include eliminating the maintenance road on one side of the channel to reduce the ROW needed, and instead constructing access ramps to the channel bottom. A levee would be constructed in Reach 9 instead of excavating a channel. Fencing would also be eliminated along the concrete channel reach in Morgan Hill.

Installation of ten grade stabilization structures was proposed, to be designed as concrete drops and rock chutes that would provide fish passage. Eighteen existing bridges and 15 box culverts would be replaced. Alternative F would have required purchase of 171 acres of ROW, and removal of two residences. Nineteen acres of riparian habitat would be removed for construction.

Out of an estimated 3,300 acres of cropland susceptible to flooding at that time, approximately 480 acres would be protected during the 1-percent flood. Flooding from the 1-percent event would be eliminated on 946 acres of urban land. Five hundred and fifty-six buildings would receive protection. The installation cost was $21.97 million, with an estimated $834,300 in annual average damages avoided.

The 1982 EIS/EIR discussed the rationale for selection of Alternative F. The economic, environmental, and social factors for the six alternatives are illustrated in Table 2.2-1 (excerpted from the 1982 EIS/EIR). Only Alternatives E and F had a net positive cost-benefit (1.1:1 and 1.2:1), and, of the six alternatives studied; only Alternative F had a favorable cost-benefit specifically within the Morgan Hill area. Comparison of the alternatives found that the footprint of Alternative F was the smallest, requiring the least amount of land acquisition, fewest residential relocations, smallest loss of riparian habitat, minimized adverse effects on cultural resources, and had the least need for replacement of bridges and culverts.

Due to past California Department of Transportation (Caltrans) channel excavation for construction of U.S. 101, the Project sponsors and the NRCS recommended that mitigation to manage for induced flooding along East Little Llagas Creek (Reach 14), as well as to reduce erosion along the channel, be incorporated with Alternative F. Reach 14 is an excavated channel that was straightened and realigned by Caltrans in the 1970s while constructing U.S. 101. Public workshops later provided consensus for selection of Alternative F with mitigation along Reach 14.

Project measures on Reaches 2, 9, 10, 11A, 12, and 13 were subsequently completed by the Project sponsors and the NRCS. In 1999 the United States Army Corps of Engineers (USACE) was authorized to assume the Project and the objectives of protection from a 1-percent flood event for the upstream urban reaches (Reaches 7 and 8) were retained from Alternative F. As a result of the project's authorization history, Alternative F has been referred to as the "NRCS" Project design. Consequently, the designation "NRCS" Alternative, instead of Alternative F, is carried forward throughout the remainder of this EIR.

2.2.2 West Little Llagas Instream Detention

West Little Llagas instream detention was an alternative considered by the USACE following authorization by Congress to lead the Project in 1999. This alternative would involve construction of a detention facility upstream of the Project reaches on West Little Llagas Creek. Detention storage of flood water could potentially provide some flood peak reduction that would, in turn, reduce the size of the channel modification needed in Reach 8 to carry the 1-percent flood. In the 1990's the City of Morgan Hill investigated a 15-acre detention pond located on Llagas Avenue at Hale Avenue.

The City investigation (MH Engineering, 1991) determined that the U-shaped channel in Reach 8 would still have to be constructed, with only a slightly smaller cross-sectional area, regardless of the detention storage basin. While the detention pond could reduce the 1 percent flow just downstream from the pond at Hale Avenue (from 626 to 290 cfs), its benefit diminished progressing downstream as additional runoff from the watershed contributed to the discharge in the flood channel (Table 2.2-2). Although an instream detention basin would reduce the size of the flood conveyance channel needed through Reach 8, and therefore a smaller ROW would be needed along the creek, the cost-benefit ratio was determined to make the alternative infeasible. Even if this were not the case, this property is no longer available for the construction of detention facilities.

The conclusion drawn from the study remains useful because it demonstrates that more than 15 acres would be required in order to provide adequate flood reduction benefit to make an instream detention basin upstream of Morgan Hill a viable element in any of the alternatives. Even if detention storage is included in the design, it would only benefit the uppermost reaches of the project. Improvements would still be necessary further downstream in Morgan Hill. Therefore, the concept of providing detention storage upstream of Morgan Hill was subsequently dropped.

A West Little Llagas Creek Detention Pond Study (Study) and Flood Protection Measure analysis and report was prepared in May 1997 by SCVWD staff (SCVWD 1997). The Study evaluated the feasibility of

a detention facility above the upstream reach of the Project, near Llagas Road, approximately 500 feet west of Hale Avenue. Two conceptual plan alternatives were developed to determine the feasibility of upstream detention.

> Case I, also known as a Shallow Pond alternative, maximized the off-creek detention storage at an elevation that could drain the floodwaters by gravity flow into an existing adjacent channel invert, thus no channel improvements. The maximum storage volume capacity for the shallow pond was determined to be 42 acre-feet (AF) at its weir and spillway elevation.

> Case II, also known as a Deep Pond alternative, the detention facility was to be excavated deeper such that it would drain by gravity, compatible with the excavated channel design per the PL 83-566 proposed Project improvements, a deeper and wider creek invert. This alternative would not avoid PL 83-566 creek improvements, thus in-creek impacts would still occur. Under Case II, the detention facility had a maximum capacity to store a volume of 84.1 AF at its weir and spillway elevation. Case II represented a detention facility that approximately doubled the Case I storage capacity.

The Study concluded that the reduction in required channel improvements for both Case I and Case II was greatest immediately downstream of the proposed detention facilities, but diminished to insignificant at the proposed confluence with Llagas Creek near Monterey Road. In summary, detention storage of the upstream flows would not prevent downstream inflows from causing flooding. The Study concluded that constructing a detention facility upstream of the Proposed Project limits would not prevent downstream flooding. Downstream in-creek improvements would still need to be constructed to meet Project objectives. Therefore, an upstream detention facility was eliminated as an alternative because it could not avoid the need for creek improvements and associated environmental impacts.

The concept of off-stream storage was recently re-examined (SCVWD 2013a). SCVWD staff reviewed the inflow hydrograph for West Little Llagas Creek downstream of Edmundson Avenue within the City of Morgan Hill. Based on this hydrograph, the peak 1-percent exceedance flow expected for West Little Llagas Creek downstream of Edmundson Avenue (i.e., Reaches 7B and 8) is 2,093 cfs.

West Little Llagas Creek has an existing capacity of approximately 80 cfs. Therefore a detention facility would have to be designed to contain approximately 2,013 cfs to avoid flooding during a peak storm event along West Little Llagas Creek with a detention storage capacity of approximately 1,170 AF. Assuming a detention facility was designed with a depth of 8 feet, approximately 150 acres of land would be needed.

A detention facility not adequately sized to store 1,170 AF would allow flooding downstream. Constructing a smaller detention facility would therefore still require channel modifications such as widening to prevent flooding. Widening the channel a limited amount, for example 5 feet or so, would result in construction related ground disturbance and likely environmental effects that would be similar to widening the channel by a greater amount. The existing riparian vegetation and existing top of bank vegetation would be similarly impacted. Therefore, a detention facility of insufficient size to store the upstream peak flow is not considered a feasible option that reduces environmental effects.

Table 2.2-1 Comparison of Alternatives Presented in the 1982 EIS/EIR

Economic, Environmental, or Social Factor	A	B	C	D	E	(Selected Plan) F
Preventing Induced Flooding						
Federal Installation Cost ($)	0	0	0	0	497,400[1]	497,400[1]
Other Installation Cost ($)	0	0	0	0	1,340,000[1]	1,340,000[1]
Average Annual O&M Cost ($) [2]	--	--	--	--	6,000[1]	6,000[1]
Additional Flood Prevention						
Federal Installation Cost ($)	41,857,500	42,178,500	37,147,100	33,621,200	15,168,000	13,347,000
Other Installation Cost ($)	20,134,600	20,838,900	14,807,600	16,756,500	8,930,000	9,020,400
Average Annual Installation Cost ($)	2,100,300	2,135,000	1,760,200	1,706,800	816,400	744,200
Average Annual O&M Cost ($)	83,900	88,600	66,500	88,600	47,300	43,200
Total Average Annual Cost ($)	2,184,400	2,223,700	1,826,700	1,795,400	863,700	787,400
Percent Damage Reduction						
Urban	99.9	99.9	97.8	99.2	97.5	97.1
Agricultural	94.9	99.9	97.1	20.9	33.5	24.0
Average Annual Benefits ($)	1,056,600	1,062,900	1,027,700	1,074,200	965,400	941,100
Net Benefits ($)	-1,125,500	-1,600,700	-799,000	-781,200	101,700	153,700
Benefit/Cost Ratio	0.5:1	0.5:1	0.6:1	0.6:1	1.1:1	1.2:1
Level of Protection	1 % urban and agricultural	1 % urban and agricultural	1 % urban; 1 % main branch	1 % urban; 10 % agricultural	1 % urban	1 % urban
Number of Remaining Buildings Flooded	7	7	65	93	139	152
Remaining Floodplain (1 %) (acres)	200	180	860	1,490	2,500	2,020
Additional ROW Needed (acres)	547	573	370	357	335	171
Residences Relocated	9	9	8	7	4	2
Riparian Habitat Removed (acres)	34	38	32	38	19	19
Riparian Habitat	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation

Table 2.2-1 Comparison of Alternatives Presented in the 1982 EIS/EIR

Economic, Environmental, or Social Factor	A	B	C	D	E	(Selected Plan) F
Steelhead Migration	Maintain with mitigation	Maintain with mitigation	Maintain with mitigation	Maintain with mitigation	Maintain with mitigation	Maintain with mitigation
Visual[3]	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation	Replace with mitigation
Cultural Resources Affected	CA-SCI-402 CA-SCI-452 Gilman Road Bridge Chesbro Reservoir sites	CA-SCI-402 CA-SCI-452 Gilman Road Bridge	CA-SCI-402 CA-SCI-452 Gilman Road Bridge	Gilman Road Bridge	Gilman Road Bridge	Gilman Road Bridge
Linear Park	Possible	Possible	Possible	Possible	Possible Morgan Hill and Gilroy	Possible Morgan Hill and Gilroy

[1] Costs are charged to benefits accruing from work already installed.

[2] No costs are provided in the USDA 1982 EIS/EIR.

[3] Visual refers to loss of mature existing trees and shrubs along an enlarged, linear channel alignment that would increase channel visibility and cause visual impact. Trees and shrubs would be replaced as mitigation for loss of visual/aesthetic resources.

Source: USDA Soil Conservation Service 1982.

Table 2.2-2 Flow Rate and Costs for Channel Detention Storage above Reach 8

Channel Location	Length (Feet)	Flow Rate without Pond Q100 [1] (cfs)	Flow Rate with Pond Q100 (cfs)	Cost without Pond	Cost with Pond	Total Cost Savings (cost without pond – cost with pond)
Llagas Rd.	437	585	585	$130,171	$130,171	$ 0
Pond	902	608	608	$282,709 [2]	$1,785,827 [3]	$ -1,503118
Pond at Hale	1,605	626	290	$382,808	$370,913	$11,895
Wright Ave.	2,121	688	355	$698,830	$599,025	$99,805
W. Main Ave.	2,994	823	596	$876,793	$657,275	$219,518
Dunne Ave.	4,760	1,047	856	$1,080,769	$825,397	$255,372
Edmundson Ave.	12,819		1,275			
Total	**N/A**	**N/A**	**N/A**	**$3,452,080**	**$4,368,608**	**$ -916,528**

[1] Q100 is the 100-year discharge, same as the 1-percent exceedance flow, or 100-year flood, these are just different notations describing the same flood frequency

[2] Includes 1.40 acres In right-of-way (ROW) land cost

[3] Includes 13.60 acres Land Cost

N/A = not applicable

Above costs include ROW at $2.50/sq.ft (square feet), 15-acre pond land acquisition cost at $100,000/acre, concrete box culverts and box channels and channel excavations. Concrete structures were priced using $375/cubic yard complete and in place. Not included in above cost are removal of structures, houses, temporary construction easements, and existing ROW, since these items would be a constant.

Source: adapted from MH Engineering report for City of Morgan Hill (Undated).

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Additionally, there are several challenges to design and construct a detention facility of this size and magnitude:

> The detention facility inlet and outlet works would need to be properly sized and designed to capture excess flows and later release this water to West Little Llagas or Llagas Creek;

> The effort and resources to maintain such a facility to efficiently function long term may be significant;

> The area is known to have a high groundwater table that could result in standing water within the detention facility, thus further reducing capacity of the detention facility;

> Potential standing water could result in public concerns for West Nile Virus and,

> A total detention facility footprint of 150+ acres in size is not practical, would face its own environmental issues, and would likely not receive favorable public support.

A supplemental analysis of instream detention storage (SCVWD 2013b) was recently performed to adjust the analysis presented above using current flow conditions (as of 2006) rather than using future build-out conditions (represented by the year 2050). The analysis using the current flow conditions found that the results differed insignificantly from the previous 2050 build-out results. Based on this additional analysis for a detention facility constructed within Reach 7A, the concept of off-stream storage is eliminated for the following reasons:

> A detention facility lesser in size than needed to prevent the 1-percent exceedance flood would result in the need for downstream channel modifications, thus resulting in similar environmental impacts to the recommended design;

> A detention facility constructed to capture upstream flows to avoid induced flooding in the downstream Reaches of 4, 5, and 6 would not address the Project's objective of providing a stable channel that will neither widen or narrow, down-cut or aggrade, on a large scale over the long-term;

> A detention facility would result in additional impacts to natural resources, such as taking agricultural lands out of production, loss of upland habitat for California tiger salamander, and potential entrainment issues for steelhead.

2.2.3 Raise Chesbro Dam

To attenuate flows downstream of Chesbro Reservoir, Chesbro Dam could be raised. The USACE considered raising Chesbro Dam, along with other dams in the region, as a flood protection alternative (RMC 2003) in the larger Pajaro River watershed. In this alternative, Chesbro Dam would be raised 15 feet in order to store the 1-percent flood event. This would detain floodwater in the upper watershed, thereby delaying the peak flood flows downstream. By delaying the peak, this detention would attenuate flows from Llagas Creek into Reach 6. However, Reach 7A would also be diverting flow from Reaches 8 and 7B in Morgan Hill into Llagas Creek in Reach 6. The attenuation from raising Chesbro Dam could reduce the needed channel size enlargements downstream of where Llagas Creek crosses Monterey Highway (Reaches 4, 5, and 6), but some improvements will still be necessary to convey flows[4]. This alternative would not create a benefit for the Morgan Hill (Reaches 7B and 8) area, nor would it provide any flood benefit in East Little Llagas Creek (Reach 14), so the other channel improvements associated with the NRCS Alternative would still be necessary.

[4] The Alternative A Chesbro Dam raise of 2 feet described as part of the 1982 EIS/EIR (see Section 2.2.1) also included flood conveyance features such as channel excavation and levees in Reaches 4, 5, 6 downstream from the dam. As such, that alternative was configured differently than the 15-foot-high dam raise considered later by the USACE.

The existing reservoir surface area is about 236 acres. The newly expanded reservoir behind a 15-foot higher dam would cover about 296 additional acres, bringing the total lake surface to about 531 acres. The enlarged lake would flood several thousand feet of Llagas, Tilton, and Heron creeks. A rerouting and reconstruction of approximately 5.0 miles of roadways, including Oak Glen Avenue and Willow Springs Road would most likely be required, as would a new bridge over the enlarged reservoir embayment extending upstream on Llagas Creek.

The reservoir would need to be empty or nearly so before a flood to maximize protection from the 1-percent event. This could present a problem under existing operational requirements of the reservoir, which include maintaining flow releases for downstream fish habitat. The dam would be raised 15 feet in the upstream direction to preserve the existing outlet facility. The raise would require a new crest length of about 1,025 feet compared with the existing crest length of about 690 feet. The new left (east) abutment would be located on the east side of Oak Glen Avenue.

Raising the dam or constructing a new dam would require approval from the State of California Department of Water Resources (DWR), Division of Safety of Dams (DSOD). Due to the seismic activity of the area, the design and approval process would be complex. Special engineering studies would be necessary to determine the seismic vulnerability of the raised dam. In addition, removal of sediment from the upstream area of the new dam raise would be a very extensive project.

Expanding Chesbro Dam would have significant regulatory issues. Permits would be required from USACE, United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and potentially other county agencies. In addition, raising the dam opens up questions of water utility management that are beyond the scope of the Project. Depending on the costs of acquisition of land for the enlarged reservoir and for the realigned roads, the cost to raise the dam was projected to approach $100 million in 2004 dollars (USACE 2010a). The estimated construction cost for Reaches 4, 5, and 6 is conservatively $15 million (USACE 2010a). Even if the attenuation of flow was able to eliminate construction in the downstream reaches, the savings is not more than the cost to enlarge the reservoir.

The environmental costs of the project construction are likely to be significant, even assuming that the dam could be raised without emptying the reservoir. There is most likely an impact and consequently a mitigation cost from conversion of creek habitat to open water habitat flooded by the dam raise. There could be loss of the small steelhead gene pool that is currently found in the upper watershed. This area is considered to have high-quality habitat for spawning and rearing. Dewatering downstream of the dam would result in significant impacts to existing steelhead populations[5].

While raising the dam could be considered costly in terms of environmental effects and dollars, it is feasible. However, the benefit in terms of flood protection is not significant. The primary benefit would be that less excavation would be required in Reaches 4, 5, and 6. Raising the dam would provide no benefit to upstream areas including the City of Morgan Hill. Because the 7A reach would deliver approximately 2,000 cfs to Reaches 4, 5, and 6 during the 1-percent flood, additional channel capacity would still be needed in the downstream reaches. Because of high cost, limited flood protection benefit, and the potential cost of mitigation for loss of riparian and aquatic habitat, the dam raising alternative was not further studied.

[5] Steelhead were listed as a threatened species in 1997 by NMFS. Llagas Creek was designated Critical Habitat for the South Central California Coast steelhead trout by NMFS in 2005.

2.2.4 Design Refinements Considered and Brought Forward

Since 1999, refinements have been periodically incorporated into the (Alternative F) NRCS design to address and better adapt the Project to increasing urbanization, changes in runoff conditions, riparian habitat[6], and to the federal listing of steelhead and the California red-legged frog. The following design objectives have been incorporated since 1999[7]:

> Provide for appropriate flood protection;

> Provide a better balance between flood control and habitat;

> Create a stable channel form (i.e., not aggrading or degrading) requiring less maintenance;

> Allow only limited impact to mature riparian corridor trees;

> Restore natural conditions to the extent feasible; and

> Provide improved access for steelhead (federally threatened species) to upstream spawning.

After the USACE assumed the Project, a design workshop was held in 2001[8], and public meetings were held in 2001 and 2002[9], which resulted in several modifications to the NRCS design. Changes in the Project features after the workshop and public meetings include:

> Setback levee between the right bank of Reach 7A (diversion channel) and the left bank of Reach 6 where the two channels join near Lake Silveira;

> Giant Reed (*Arundo donax*) eradication in the upstream reaches to be replaced with native riparian vegetation[10],

> Removal of six rock chute drop structures from the 1982 design to provide free passage for steelhead migration.

> Construction of two grade control structures in Reaches 7A and 14 to prevent steelhead migration into reaches that do not provide adequate habitat;

> Reach 4 designed as a trapezoidal channel form instead of conducting selective sediment and vegetation removal;

> Reach 6 designed as a two-stage flood channel instead of selective widening;

> Reach 8 designed as a trapezoidal vegetated gabion instead of a concrete channel; and

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6 The re-operation of Chesbro Reservoir (in 2009) increased flow releases to Reach 6, thereby establishing a perennial stream along the upstream portion of this reach, which also caused a change in the presence of riparian vegetation.

7 Upper Llagas Creek Project - Alternative and Design History, Memorandum for Record (USACE 2010a)

8 Workshop held between USACE, USFWS, California Department of Fish and Game (CDFG), NMFS, NRCS, and the SCVWD on May 30, 2001 to discuss restoration and enhancement features that could be part of the new project design.

9 Following the 2002 public meeting in Morgan Hill the USACE and SCVWD prepared a study to determine: the extent of the flood control problem in Downtown Morgan Hill; the most feasible option for preventing further flooding and loss of businesses and homes; and, if the plan would be acceptable to the citizens of the surrounding areas of the creek. During this process, public, regulatory agency, and team meetings all played a part in narrowing down alternatives to satisfy the needs for all parties (Office Report [USACE 2002 and 2003]).

10 This also was a mitigation obligation for the SCVWD's Stream Maintenance Program (SMP), authorized by the Biological Opinions from National Oceanic and Atmospheric Administration (NOAA) Fisheries (July 31, 2002, 151422-SWR-01-SR-408:ME) and USFWS (July 5, 2002, PN 22525S). In 2005, a giant reed (*arundo donax*) control program was started on Upper Llagas Creek. As of 2009, about 8 acres of giant reed have been removed from the Project area and treatment of regrowth was scheduled to continue through 2012 (Upper Llagas Creek Project - Alternative and Design History, Memorandum for Record [USACE 2010a]).

> Minimize use of riprap to protect channel from erosion.

Based on comments received at these meetings, three design alternatives for Reach 8 were considered, including using a vegetative gabion lining to simulate a natural channel, a bypass channel to divert high flows constructed under the existing roadways, and a reinforced concrete box culvert to enclose the existing creek. The USACE and SCVWD recommended a hybrid of the vegetative gabion lining and the reinforced concrete box culvert to be used in Reach 8.

The USACE and SCVWD have continued to refine the Project design elements since 2002. In 2007 the USACE considered four additional options for alignments of the Reach 7A diversion channel, and a final evaluation of these alternatives was completed in 2010[11]. The 2010 evaluation considered channel stability and sediment transport criteria in the alignment, dimensions, and design of the 7A diversion channel as well as all of the other Project reaches. A final alignment of the Reach 7A diversion channel downstream from the Lake Silveira outlet to connect with Llagas Creek immediately upstream from Monterey Road was adopted from the 2010 analysis. The NRCS diversion alignment had Reach 7A entering Llagas Creek at Lake Silveira, approximately 2,250 feet upstream of Monterey Road.

Since 2010, additional sediment transport and hydraulic studies have been conducted by the SCVWD to assist with determining stable channel dimensions and form that would not result in channel aggradation (i.e., sediment deposition), or degradation (i.e., scour and incision), and that would reduce potential long-term maintenance and would continue to meet flood capacity objectives. Other refinements to the channel design included: eliminating the setback levee along the right bank of Reaches 7A and 6; eliminating the two grade control structures to prevent steelhead migration; and replacing the vegetated gabion channel with three other channel forms. These channel forms were a vegetated trapezoidal channel; a vertical-walled concrete channel, or a hybrid trapezoidal channel with vegetation on one bank; and concrete vertical wall on the other bank in Reach 8.

In late 2012, the SCVWD held a Public Scoping Meeting in Morgan Hill to discuss the latest progress in the Proposed Project design and environmental studies and to receive public input related to the Project. During this meeting, several comments were made by attendees that upstream from the Project there has been a persistent, long-term flooding problem at Llagas Road. The public requested SCVWD to consider whether the flooding could be addressed under the Proposed Project design. As a result of the meeting and the stated public concerns, the SCVWD incorporated measures into the Project design to address flooding at Llagas Road. The measures include removing a cinder block/plate wall constriction at the existing Llagas Road culvert to allow maximum flow capacity through the culvert and thereby eliminate backwater induced flooding. Downstream from the Llagas Road culvert, the channel would be widened and deepened to accommodate the new flow capacity through the bridge so as not to induce flooding along the approximately 2,500-foot channel length between Llagas Road and Hillwood Lane.

In 2003, the USFWS issued a Draft Coordination Act Report[12] (CAR), which USFWS is in the process of providing a letter of concurrence for the CAR and Project based on the updated Project design and technical studies. The CAR provides federal input on potential mitigation measures to protect or conserve fish and wildlife resources. The 2003 CAR recommended inclusion of 40 conservation and mitigation measures. Many of these measures are related to providing instream aquatic habitat features and they have been incorporated by the SCVWD into the current Project.

Section 2.4 summarizes the NRCS Alternative Project description and a set of new alternatives developed by the SCVWD, which are analyzed in this EIR.

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[11] Upper Llagas Creek Flood Control Project, Santa Clara County, California with Project Hydraulic Analysis (USACE 2010a).

[12] Fish and Wildlife Coordination Act Report, Fish and Wildlife Service, U.S. Department of Interior, and Llagas Creek Flood Control Project, May 2003.

2.3 No Project Alternative

The No Project Alternative serves as a basis for comparison with the Project alternatives. Under the No Project Alternative, the Project would not be built, and no new land purchases or construction activities would occur. Flooding in the residential areas of Morgan Hill and San Martin would continue. Figure 2.3-1 shows the extent of the 1-percent exceedance flood (100-year flood) under the No Project Alternative. Currently, the West Little Llagas Creek channel through the City of Morgan Hill has less than a 10-percent flood capacity (<400 cfs at Hillwood Lane and <720 cfs at Spring Avenue).

There has been extensive historic engineering of the West Little Llagas Creek, East Little Llagas Creek, and Llagas Creek channels, including construction of bridges, culverts, and channelization in response to agricultural and urbanized land use changes in past decades. Storm runoff would continue through these channelized reaches. The proposed channel in Reach 7A would not be constructed under the No Project Alternative. Historic rates of channel streambed incision[13] of 0.4 to 0.8 feet per decade, (Balance Hydrologics 2012a) and resultant channel bank erosion and widening would likely continue. Under the No Project Alternative there would be no fish habitat improvement features installed.

The SCVWD implemented the first SMP (stream management plan) in 2002. The SMP established procedures for routine maintenance of stream channels involving ongoing sediment removal, vegetation management, bank protection, and associated minor activities. The SMP incorporated a wetland and riparian mitigation program, a series of resource protection policies, and Best Management Practices (BMPs) to reduce environmental impacts from the aforementioned maintenance activities. In April 2011, the SCVWD published a Draft EIR evaluating an update to the SMP (SCVWD 2011a) and the Final EIR was certified in January 2012. The SMP Update addresses bank stabilization, sediment removal, vegetation management, management of animal conflicts, and minor maintenance. Under the No Project Alternative, maintenance of the Upper Llagas Creek facilities would be conducted in accordance with the guidelines established in the SMP Update. Implementation of the SMP renewal project began in late 2012 and is reauthorized for the next 10 years (2012–2022). The SMP includes various BMPs (Appendix B) that guide how maintenance work is performed to protect biotic and other resources.

Work within the SMP can be divided into two general categories: regularly-scheduled work (most vegetation management, trash pick-up) that occurs in the same place and the same manner with a predictable frequency; and other routine work that is not undertaken on a regular annual schedule, but is done as the need arises. This latter type of work (e.g., sediment removal and bank protection) has a less predictable frequency and location. Therefore, selection of BMPs are managed differently for these two types of work. In the Project area, SCVWD maintenance staff conducts annual inspections of fee-owned and easement areas. Once the inspection process is complete, SCVWD staff evaluates what work should be conducted. Maintenance activities are performed in accordance with the SCVWD established Maintenance Guidelines (1992) for Llagas Creek as updated in 2012, which includes West and East Little Llagas Creeks.

Instream sediment removal and bank protection work is carried out from June 15 to October 30, or the first significant rainfall (≥ 0.5 inch of rain in a 24-hour period) after October 15, whichever occurs first. Typical maintenance activities include the following:

> Channels—Remove trash and obstructions to flow that collect in the channels, and removal of instream blockages (routine). Removal of large woody debris (that meets minimum size criteria of 1-foot diameter and 6-feet length) in anadromous streams requires mitigation.

[13] Causes of historic and ongoing channel incision are identified as the cumulative effects of decades of changes in land use, the increase in impervious surfaces from urbanization, sediment supply loss associated with Chesbro Reservoir, water diversions, hydrograph modifications, and past channelization (Balance Hydrologics 2012a; Schaaf & Wheeler 2012).

> Stream bank protection—Repair slopes damaged by scour and erosion (as needed). Geomorphic studies have shown that historically the Llagas Creek channels have been incising at the rate of 0.4-0.8 feet per decade and is ongoing (see discussion Section 3.2, Hydrology and Water Quality). This channel incision is likely to result in over-steepening of streambanks leading to instability and erosion that will require bank protection and repair.

> Sediment management—Routine sediment maintenance that is currently being performed within the Project reaches under the SMP would continue. Sediment removal has historically been conducted in a couple of areas on regular intervals. Removal of sediment on Reach 14 to the confluence with Llagas Creek occurs approximately every 5 years while sediment in front of the Church Ponds inlet structure (Reach 6) occurs approximately every 4 years. Since Reaches 4 and 5 tend to go dry at the end of the summer season, sediment management would be restricted in these two reaches to periods when there is no in-channel flow. Reaches 7 and 8 have intermittent flow, tend to go dry in the summer, and steelhead do not access these upstream reaches. As such, sediment maintenance in Reaches 7 and 8 can be performed any time during low flows. Reach 6 is supported by year-round flows due to releases at Chesbro Dam. Reach 6 provides steelhead habitat during the entire year and, therefore, would require a sediment maintenance approach that would continue to protect steelhead habitat. Sediment maintenance in Reach 6 is limited to occur only between June 15 and October 30 or the first significant rainfall after October 15, whichever occurs first. No sediment removal has been performed in Reach 6 in the past 10 years under the previous SMP. However if sediment removal is needed, the appropriate BMPs to dewater the channel, protect anadromous fish, and restore channel habitat features, would be implemented (Appendix B).

> Vegetation management—Ongoing management of vegetation in and adjacent to creeks is necessary to maintain the channel flood conveyance capacity. Most channels require some type of periodic vegetation control. The SCVWD also manages vegetation for other purposes including the protection of concrete linings from plant roots; meeting local fire codes requiring the control of combustible weeds and grasses; providing visual clearance to inspect the condition of a facility; and providing access along maintenance roads. Removal of vegetation occurs by the use of herbicide, hand pruning, hand removal, mowing, or by discing. Removal of vegetation by hand can be undertaken between July 1 and March 1. Vegetation control and removal in channels, on stream banks, as well as maintenance roads is limited to that necessary for facility inspection purposes, to meet regulatory requirements, required to comply with fire codes, and that is required to meet capacity requirements per SMP guidelines.

  Removal of trees larger than 6-inch diameter at breast height (dbh) is not considered a routine vegetation activity and is not included in the SMP. As such, no trees greater than 6-inch dbh would be removed from the flood conveyance channels except, if substantially leaning, diseased, or dead, and their removal is needed to meet the hydraulic characteristics of the channel with separate environmental review.

  Specific vegetation activities performed within the Project reaches where the SCVWD has fee or easement on the mainstem of Llagas Creek from Buena Vista to upstream of Church Avenue (Reaches 4, 5, and a portion of 6) include pre- and post-emergent herbicide application on roadways/firebreaks; mowing of slopes; and removal of instream woody vegetation. The SCVWD has limited ROW on the rest of the Llagas Creek mainstem; therefore, no work is conducted there.

  For West Little Llagas (Reach 7) on the SCVWD ROW, vegetation management activities include: pruning of overhanging growth for access into roadways and bridges, removal of instream woody and aquatic vegetation, mowing of slopes and pre/post emergent herbicide application on roadways/firebreaks. For East Little Llagas (Reach 14) the SCVWD maintains the ROW and conducts the following activities: removal of stream woody vegetation, mowing of slopes, and pre/post emergent herbicide application on roadways/firebreaks.

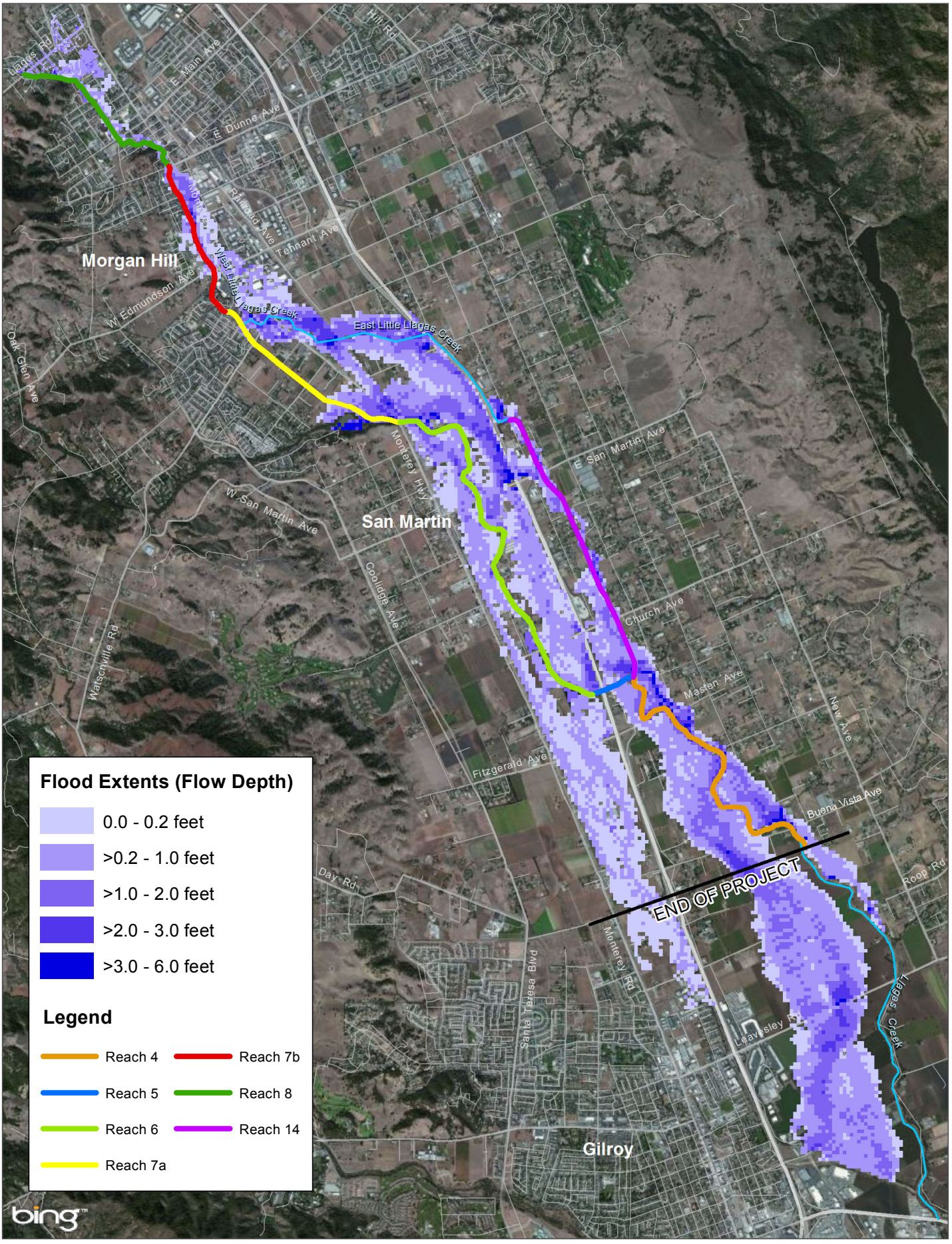

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FIGURE 2.3-1

Existing 1 Percent Flooding Extents
No Action Alternative

> Minor maintenance activities are small in size that results in removing less than 0.05 acre (2,178 square feet) of wetland or riparian vegetation. The minimum size for any minor vegetation work to be notified in SCVWD's Nationwide Permit (NWP) is 0.01 acre (436 square feet) per project, which includes any vegetation work necessary for access or staging. These activities include cleaning debris and minor sediment removal from culverts; removal of trash or debris that could impede flows; trash rack cleaning; clearing debris from bridge pilings/piers; repair and installation of gates and fences; repair of maintenance roads, and graffiti removal. These activities are (and would be) done in a manner that is sensitive to protection of aquatic resources.

> Giant Reed Control—The SCVWD also conducts a Giant Reed (Arundo donax) Control Program as mitigation for impacts associated with SMP vegetation management activities. Control of Arundo in the Llagas Creek watershed began in 2005 and continues today. Under that program, the SCVWD has completed 8.2 acres of Arundo control on Llagas Creek with the majority of that work (~5 acres) occurring in the reaches between the Church Avenue Percolation Ponds to upstream of Llagas Avenue. Arundo has been persistent within the watershed and has required numerous re-treatments to control new growth. However, the density of Arundo stands has been reduced overall by approximately 80 percent. All previously treated areas were re-treated, or were scheduled for re-treatment, during the 2011–2012 SMP season.

2.4 Project Elements Common to All Action Alternatives

There are four action alternatives identified and analyzed in this EIR:

> Tunnel Alternative (Preferred Alternative)

> NRCS Alternative

> Culvert/Channel Alternative

> Reach 6 Bypass Alternative

Project features that are common to each of the alternatives are described in Section 2.4. Subsequent sections discuss in greater detail each of the alternatives and the project features that are pertinent to each alternative. The Tunnel Alternative is identified as the Preferred Alternative by the SCVWD. From hereon the Tunnel Alternative is referred to as the Preferred Alternative.

A 65-percent engineering design prepared for the SCVWD in March 2013 is the basis for the flood risk management elements that comprise the action alternatives evaluated in this EIR (RMC 2013). All of the action alternatives provide flood management for a 1-percent flood in Morgan Hill (Reaches 8, 7A, and 7B); 10-percent flood management for the semi-urban area around East Little Llagas Creek (Reach 14); and avoid induced flooding elsewhere on Llagas Creek (Reaches 6, 5, and 4) due to upstream modifications. The post-Project flood extents for all alternatives is shown in Figure 2.4-1. The existing 1-percent exceedance flood inundates approximately 3,074 acres. The action alternatives reduce flood extents to approximately 1,365 acres.

Most of the differences between all of the action alternatives are focused on the project alignment for flood routing and the type of flood management features used in areas in Reach 8. All of the action alternatives depend on a newly constructed 1.25-mile-long channel segment in Reach 7A that will direct flow from West Little Llagas Creek at Watsonville Road to Llagas Creek just downstream from Lake Silveira. Most of the flood management features that would be implemented in Reaches 7A, 7B, 4, 5, 6, parts of Reach 8, and 14 are the same in each of the alternatives, except the Reach 6 Bypass Alternative would not require channel widening, deepening or other flow capacity improvements in Reach 5 and most of Reach 6. The common flood management features and activities for all of the action alternatives include:

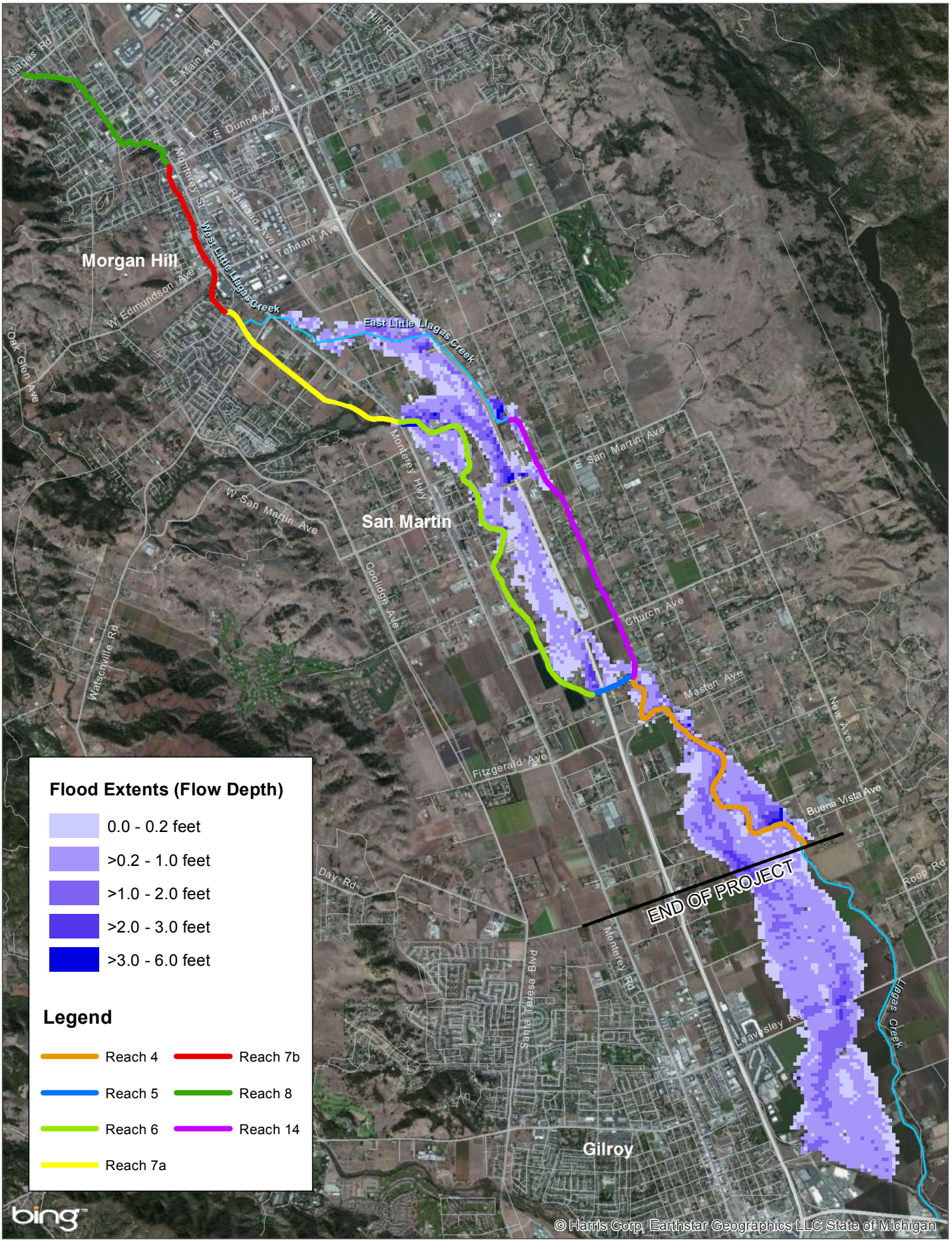
- Widening (generally by constructing against one bank) and deepening the channel in all reaches (except a portion of Reach 8 under the Tunnel and Reach 6 Bypass alternatives);
- Construct sinuous low-flow channel, with benches at bankfull elevation (except for some areas in Reach 8);
- Permanent access roads at top of both banks in all reaches, (except for some areas in Reach 8);
- Aquatic habitat enhancements Reaches 4, 5, 6, and 7A (except for Bypass Alternative in Reach 5 and most of Reach 6, which have no planned enhancements);
- Grade control structures constructed of natural boulders, in all reaches;
- Culverts at two tributary drainages where they confluence with Reach 6 and three drainages in Reach 14 to provide for maintenance access;
- 1.25-mile-long channel on West Little Llagas Creek Reach 7A;
- Exhume buried bridge crossings in Reach 7A at Watsonville Road and West Middle Avenue;
- Replacing and/or modifying culverts at four road crossing locations in Reach 7B;
- Replacing culverts in Reach 8 (culvert replacement locations vary by alternative);
- Removal of a cinder block/brick wall that constricts flows at the Llagas Road culvert; cleaning of rocks, dirt and debris for all culverts and under the Hillwood Lane bridge in Reach 8;
- Relocation/replacement of some homes and other structures within the Project ROW;
- Replacement of the existing pedestrian footbridge on the private property at the corner of Llagas Creek Drive and Marianna Court;
- Installation of a stream gage upstream of the Church Avenue percolation ponds in Reach 6;
- Relocation/replacement of utilities within the Project construction footprint; and
- Acquisition of fee title and easements of adjacent land needed for Project construction and maintenance.

In addition to the common flood conveyance features listed above, all of the action alternatives would require the same type and extent of vegetation and sediment maintenance activities to provide the design flood capacity, as well as maintenance of other features such as roads, culverts, and grade-control structures. The following sections provide information on the Project design elements.

2.4.1 Channel Design Features Common to All Action Alternatives

Channel modifications in Reaches 4, 5, 6, 7B, and 14 would consist of widening and deepening, and would result in a cross section with a low-flow channel, bankfull channel, benches, and engineered banks that are 3H:1V slope. Figure 2.4-2 is a typical cross-section. The channel would be properly sized for sediment transport, geomorphic stability[14] and to allow for unimpeded fish passage. A low flow channel conveying approximately 2 cfs, would meander along the channel bottom within the bankfull channel.

[14] A geomorphically stable channel is over the long-term, neither aggrading or incising, and is neither widening or narrowing. However, localized sediment deposition, incision, or localized changes in channel width can occur in a stable channel form.



0 0.25 0.5 1 Miles

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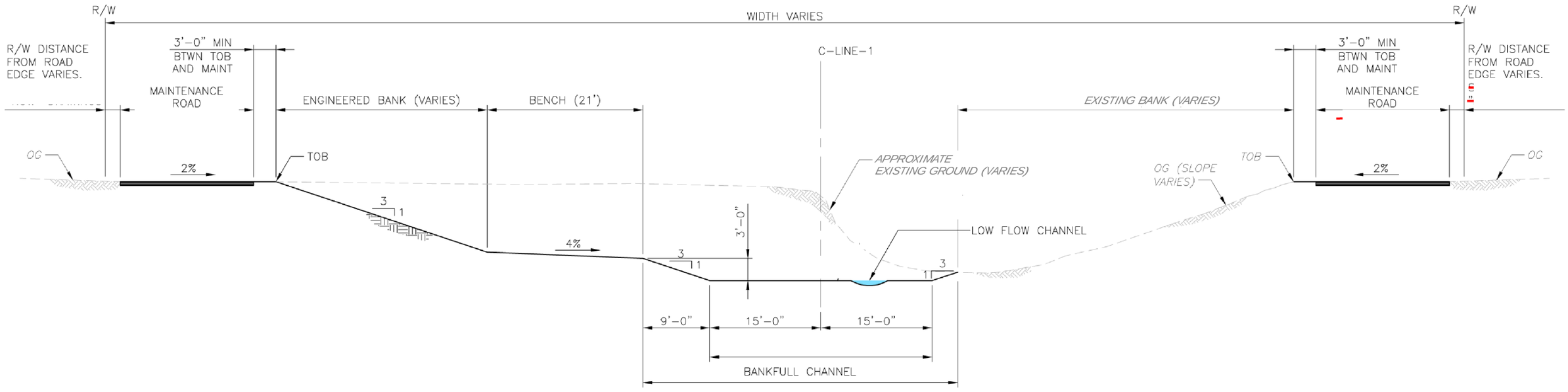
FIGURE 2.4-1

All Alternatives Post-Project 1 Percent Flood Exceedance Extents



TYPICAL SECTION

NOT TO SCALE

Channel benches would typically be on at least one side and sometimes both sides of the channel, ranging from 9 to 21 feet wide. The channel bench is set at approximately the 2-year flow elevation. The channel benches would provide opportunities for natural deposition of sediments during runoff events and also potentially provide a surface for revegetation by way of natural recruitment and, if appropriate, for active plantings. In some areas e.g. where large meanders, crossings, and confluences occur, the benches would be eliminated to allow for additional capacity and/or to allow natural deposition patterns to form. The total top width of the channel is on the order of 125 feet, (excluding the maintenance road itself), but actual widths at any given location are variable depending upon the existing ground topography. This is about 30 to 60 feet wider than the existing channel. Channel depths would range up to approximately 14 feet, which is typically about 4 to 5 feet deeper than they are today. Channel widening would be limited to one bank, where possible, to avoid and preserve existing stands of mature vegetation.

In Reach 7A there is no existing channel; most of this reach is agricultural farmland. A new channel would be constructed (Reach 7A) that connects to the upstream Reach 7B; diverting flows from West Little Llagas Creek (Figure 2.1-4). West Little Llagas Creek would be disconnected from the newly constructed diversion channel at a location 0.2 mile south of South La Crosse Drive. By diverting flows at this junction, the flow in West Little Llagas where the existing channel turns east toward U.S. 101 would be limited only to local runoff where its confluence with East Little Llagas Creek includes approximately five local storm drain outlets. This will reduce flooding along the 1.9-mile-long segment of West Little Llagas Creek between La Crosse Drive and U.S. 101. The Reach 7A channel would also reduce flow in the East Little Llagas Creek channel along Reach 14 since this portion of the channel would no longer be connected to West Little Llagas Creek.

The design flow for Reach 7A is to provide capacity for the 1-percent flood (2,090 cfs). Reach 7A would receive flows from the upstream Reach 7B at La Crosse Drive and collect runoff from adjacent agricultural fields. The downstream end of Reach 7A is the confluence with Llagas Creek just upstream of Monterey Road. This alignment and point of confluence with Llagas Creek was extensively evaluated (Noble Consultants and Northwest Hydraulics 2008) to optimize channel sediment transport through the reach; to ensure channel stability, and to thereby reduce maintenance.

The Reach 7A channel segment would be designed similar to the channel cross section shown in Figure 2.4-2. The channel top width would range from 80 feet to 120 feet and excavated about 12 feet to 16 feet deep with 2H:1V or 3H:1V side slopes. Channel bottom width would be about 12 feet. Benches would be predominantly on one side of the channel, with a varying range of widths from 10 to 30 feet. A grade control structure constructed as a series of pools would be installed at the downstream end of Reach 7A / upstream portion of Reach 6 on Llagas Creek to transition the channel gradient where the new channel confluences with Llagas Creek below Lake Silveira.

The design flow for Reach 8 is to provide capacity for a 1-percent exceedance flood (410 cfs at Llagas Road and 640 cfs at Hillwood Lane). Channel modifications along Llagas Road to Hillwood Lane would be similar in concept to those described for the other reaches, and would involve widening and deepening the channel. The slope of the engineered banks in this upstream section of Reach 8 would be designed at a 2H:1V. The channel benches vary up to 10 feet. The channel benches, set at approximately the 2-year flow elevation, would provide opportunities for natural deposition of sediments during runoff events and also potentially provide a surface for revegetation by way of natural recruitment and, if appropriate, for active plantings. The total top width of the channel ranges from 30 to 80 feet (excluding the maintenance road), with the actual widths at any given location variable depending on the existing ground toporgraphy. Channel depths would be a maximum of 9 feet. The flow constricting plate on the culvert located at Llagas Road would be removed to reduce upstream flooding. This culvert would be cleared of rocks, dirt, and other debris. In addition, other culverts along this reach and the bridge at Hillwood Lane would also be cleared of rocks, dirts, and other debris. Another feature of this channel is replacement of an existing

pedestrian bridge on private property with a 35-foot-long, 10-foot-wide pedestrian bridge constructed on concrete abutments.

The channel design for Reach 8 would be one of three types: a trapezoidal vegetated channel (Figure 2.4-3, a channel with two vertical walls (Figure 2.4-4), or a hybrid channel cross-section (Figure 2.4-5). Selection of the appropriate cross-sectional form would be based on local ROW constraints. The channel design with two vertical walls would be used where the ROW is most narrow; and the trapezoidal and hybrid channel forms would be used where there was a wider ROW that could accommodate those channel shapes. Note that these three channel forms in Reach 8 are applicable only to the NRCS and the Culvert/Channel alternatives. The Tunnel and the Reach 6 Bypass alternatives do not require modifying the existing West Little Llagas Creek channel through downtown Morgan Hill, but instead depend on a long section of underground culvert and a tunnel to divert high flows from the existing channel. For all action alternatives, the flow constricting plate at the Llagas Road culvert at the upstream boundary of the Project will be removed to reduce upstream flooding. The channel will be deepened and widened downstream from Llagas Road to Hillwood Lane to accommodate the 1-percent exceedance flow.

Maintenance/access roads would be provided along each reach, with roads at the top of the bank on one or both sides of the channel for winter flood management, maintenance, and inspection activities. The maintenance road would be 18 feet wide, designed for all-weather access, and would be aggregate-based. This 18-foot maintenance road width is needed to allow equipment to fully swing around and reach out as far as the center line of the channel bed for cleaning.

The maintenance road is to be constructed of aggregate base and involves some limited excavation. Access ramps would be constructed at various locations along the Project alignment to provide access to the channel bottom. Construction of access ramps and construction access areas within the Project site would be positioned to minimize the need for vegetation removal.

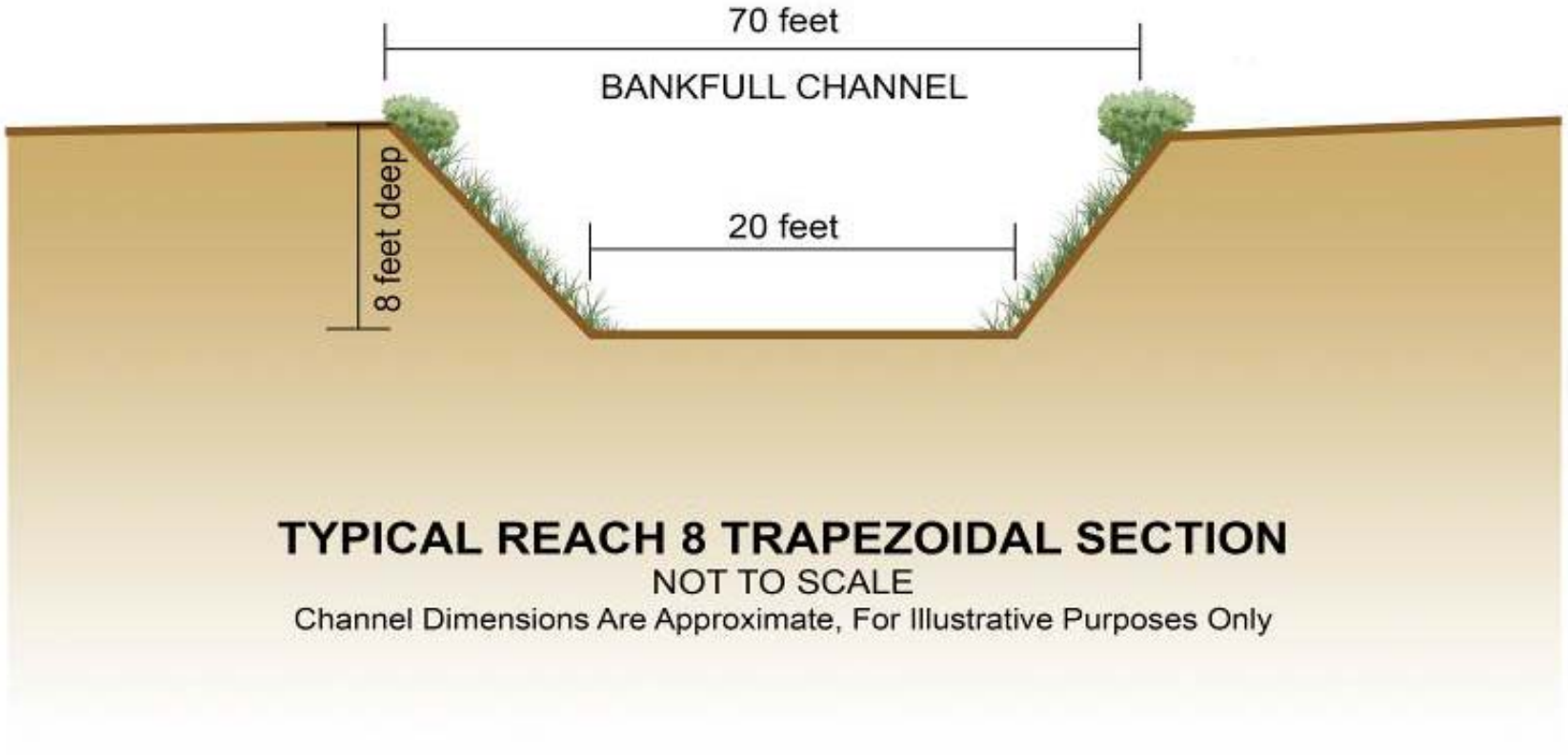


Figure 2.4-3 Reach 8 Trapezoidal Channel

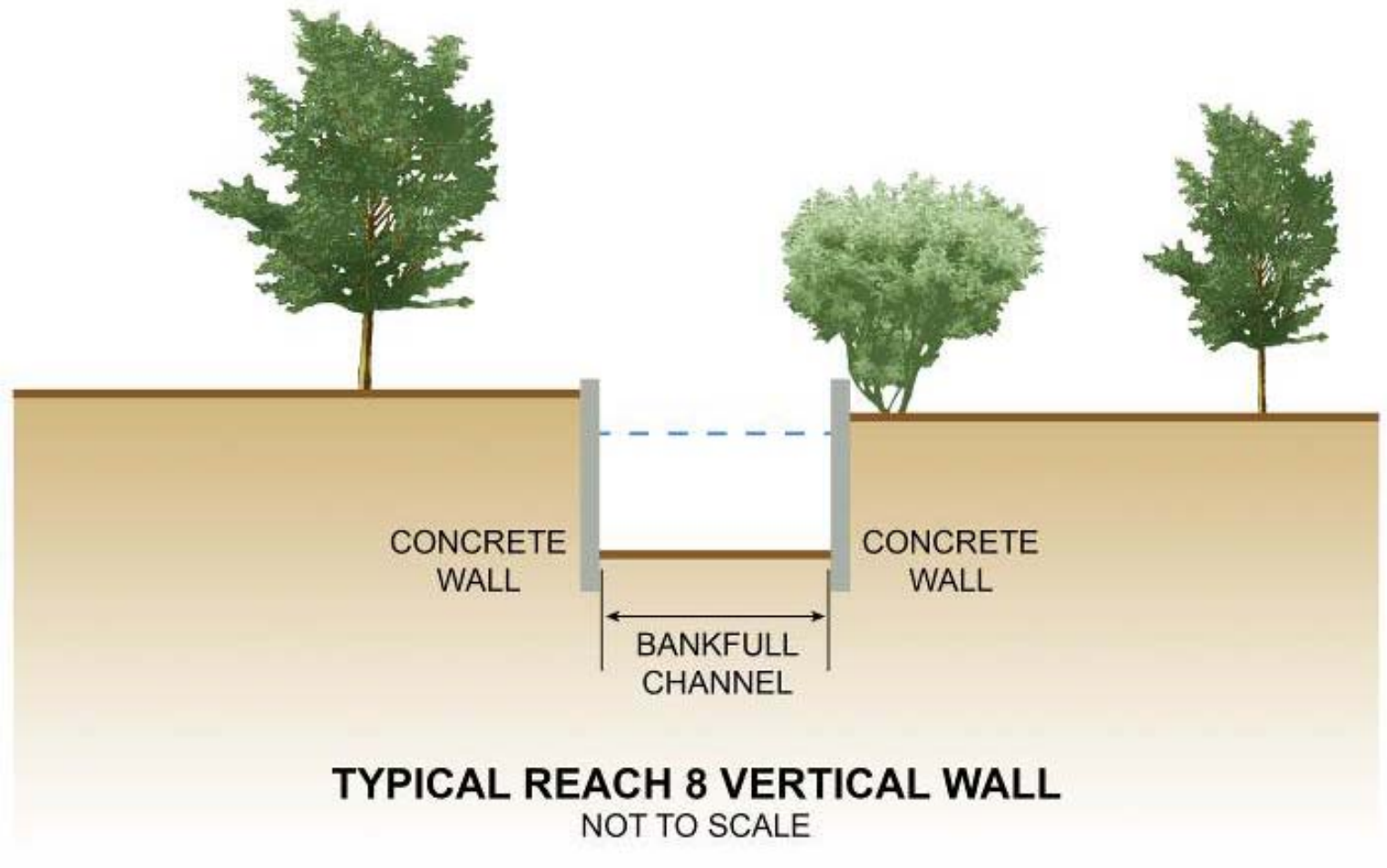


Figure 2.4-4 Reach 8 Channel with Vertical Concrete Wall

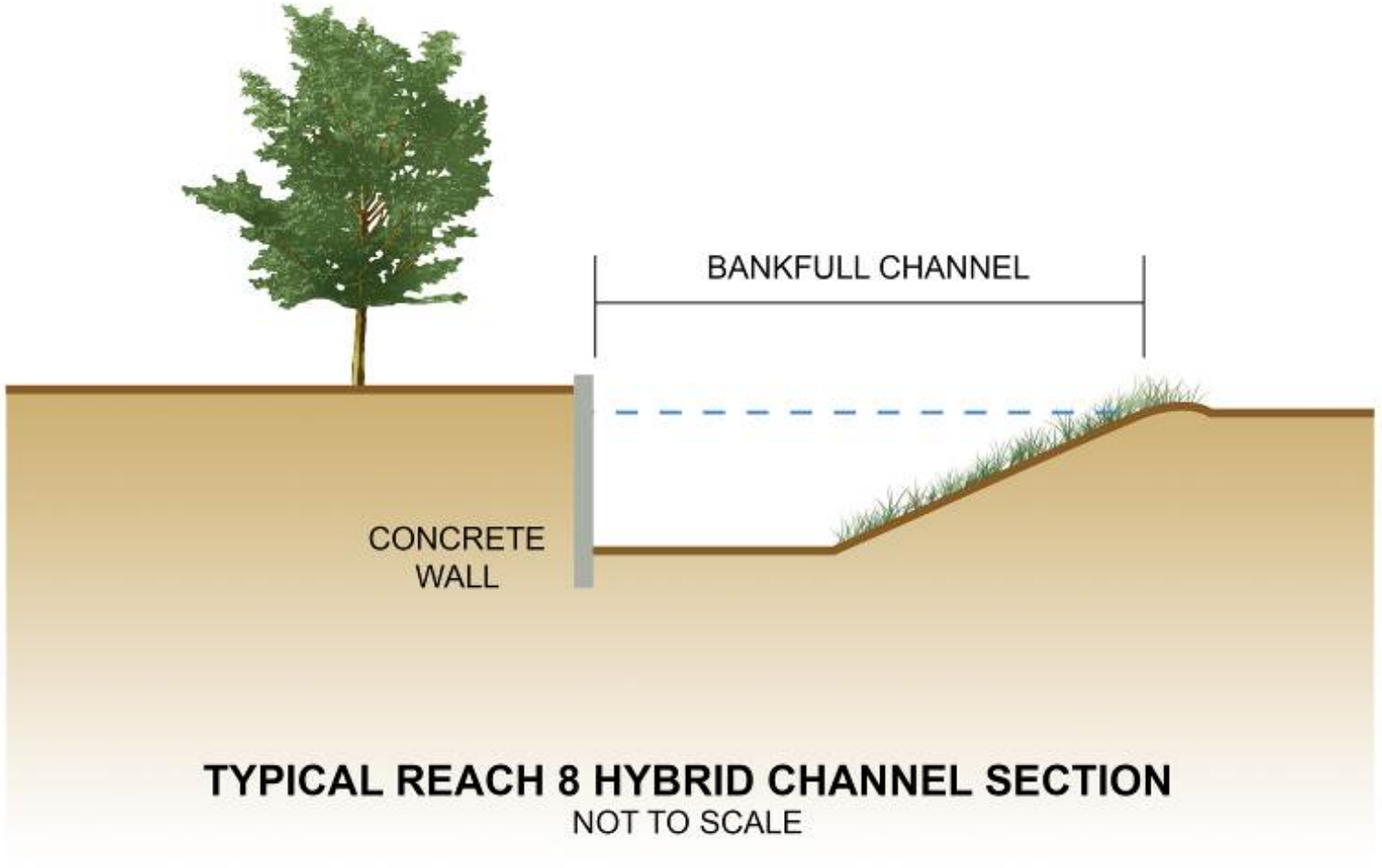


Figure 2.4-5 Reach 8 Hybrid Channel

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2.4.2 Easements and Land Requirements

Prior to construction, SCVWD would acquire ROW from landowners along the Project reaches. In general, most ROW would be acquired in undeveloped farmland or undeveloped portions of residential or commercial parcels, so existing structures would be minimally affected. However, some commercial and residential structures would be affected by temporary and permanent easements and the Project footprint. These structures would require relocation or removal.

Structures that are located within the construction footprint may have to be relocated or otherwise compensated. The structures identified within the construction footprint for each of the alternatives are listed in Table 2.4-1, which lists the Preferred Project first, organized by reach and followed by the number of each type of structure. The other alternatives list only those reaches where there is a difference from the Preferred Project. For example, the NRCS Alternative has the same number of residential homes, greenhouses, outbuildings and miscellaneous structures in Reaches 4, 5, 6, 7A, 7B, and 14 as the Preferred Alternative. Only Reach 8 is different with six residential homes under the NRCS Alternative rather than zero residential homes under the Preferred Alternative in that reach.

Based on Table 2.4-1 for the Preferred Alternative there are 6 residential homes, 11 greenhouses, 21 outbuildings, and 5 miscellaneous/unknown structures that are located with the Project construction footprint. For the NRCS Alternative there are an additional 6 residential homes and for the Culvert/Channel Alternative there are an additional 4 residential homes within the construction footprint compared with the Preferred Alternative, and these homes are all located in Reach 8. The Reach 6 Bypass Alternative has a total of three fewer residential homes inside the construction footprint than the Preferred Alternative. The Reach 6 Bypass Alternative also has nine fewer greenhouses, 18 fewer outbuildings, and one fewer miscellaneous/unknown buildings in the construction footprint than the Preferred Alternative.

Table 2.4-1 Structures Located within Project Construction Footprint

Alternative	Reach	Residential Homes	Greenhouses	Outbuildings (sheds, storage)	Miscellaneous/ Unknown
Tunnel (Preferred Alternative)	4	2	1	3	1
	5	0	0	3	0
	6	3	9	15	3
	7A	0	0	0	0
	7B	1	0	0	1
	8	0	0	0	0
	14	0	1	0	0
	Total	**6**	**11**	**21**	**5**
NRCS [1]	8	6	0	0	0
	Total	**12**	**11**	**21**	**5**
Culvert/Channel [1]	8	4	0	0	0
	Total	**10**	**11**	**21**	**5**
Reach 6 Bypass [2]	5	0	0	0	0
	6 bypass	0	0	0	2
	Total	**3**	**2**	**3**	**4**

[1] For the NRCS and the Culvert/Channel alternatives, the only difference compared with the Preferred Alternative is in Reach 8.

[2] For the Reach 6 Bypass Alternative, there is no construction in Reach 5 and no construction in most of Reach 6, except for the segment 0.5 mile above the point of the Reach 6 bypass channel; all the other reaches are the same as the Preferred Alternative.

2.4.3 Construction

Project construction would include channel modifications such as constructing and/or replacing culverts; installing maintenance roads and/or access ramps; constructing temporary (Reaches 6 and 14) and permanent (Reaches 7A and 7B) grade control structures, and upgrading bridge crossings. Revegetation work would be developed as part of a mitigation plan. An overview of a potential construction schedule listing construction activities, construction materials and disposal, equipment and crew needs, staging areas, and best management practices (BMPs) is provided in this section.

2.4.3.1 Construction Schedule

Construction would take place year-round. In-channel work would occur during the dry season, typically between May 1 and October 15. During this time flows are low or, in most reaches, the channel is dry. Revegetation and work in upland areas adjacent to the creek channel could occur outside the dry season. Construction in residential areas will take place Monday through Friday from 7:00 a.m. to 8:00 p.m. and Saturdays from 9:00 am to 6:00 p.m. Construction work outside of residential areas may go until 10:00 p.m. Night work activities may include construction on bridges, roadways, utility relocation, mobilization and demobilization, preparatory work, traffic control, clearing and grubbing, excavation, and tunneling. Emergency work, for example sewer main breaks, flooding, loss of utilities, and public safety issues, could require construction activities at later hours. All construction activities within residential areas, including work hours, would be governed by local noise ordinances (the City of Morgan Hill and Santa Clara County). City of Morgan Hill Municipal Code Chapter 18.48.040 D.1.d exempts public works projects from noise standards and indicates the public works director can set construction hours for these types of projects.

Phase 1 of the Project would be construction of the new channel in Reach 7A, the channel improvements in Reach 4, and part of Reach 5 up to U.S. 101. Temporary roads would be built for access for construction and for providing construction of channel modifications. After the completion of the Reach 7A channel there would be a temporary berm upstream of the Watsonville Avenue Bridge to direct flow through Reach 7B and thence into East little Llagas Creek so it would remain hydraulically disconnected from Reach 7A to avoid inducing flooding in Reaches 4, 5, and 6. After completion of Phase 1, it is anticipated that Phase 2 channel construction would be sequenced from downstream to upstream to avoid induced flooding. Estimates of time periods needed for construction by reach are shown in Table 2.4-2 for each of the alternatives. Table 2.4-2 shows the Tunnel Alternative (Preferred Alternative) first, organized by reach and followed by timeframes. The other alternatives list only those reaches where there is a difference from the Preferred Project.

Table 2.4-2 Construction Periods and Duration by Reach

Alternative	Reach	Begin Construction	End Construction	Duration (days)
Tunnel (Preferred Alternative)	4	Year 1	Year 3	497
	5[1]	Year 2	Year 3	223
	6[1]	Year 2	Year 6	1,003
	7A	Year 1	Year 2	290
	7B	Year 3	Year 4	496
	8	Year 2	Year 5	735
	14	Year 2	Year 3	345
NRCS	8	Year 2	Year 5	735
Culvert/Channel	8	Year 2	Year 5	735

Table 2.4-2 Construction Periods and Duration by Reach

Alternative	Reach	Begin Construction	End Construction	Duration (days)
Reach 6 Bypass [1]	Reach 6 (bypass channel) and Reach14	Year 2	Year 5	730

[1] No construction would be required in Reaches 5 and 6 of the Reach 6 Bypass Alternative, however the bypass segment itself and Reach 14 would be constructed.

2.4.3.2 Construction Activities

To the extent possible, construction would take place when the stream channel is dry, but some dewatering may be necessary in either reaches where flows persist during the summer months or where the groundwater table is above the design channel excavation depth, notably in the downstream portion of Reach 7A near Lake Silveira. Dewatering would be temporary and would be limited to the area in which active construction was occurring. Dewatering would be accomplished using a variety of methods identified in the SCVWD BMPs (see Section 2.4.3.6).

Channel modifications would entail widening, deepening and grading to increase capacity. Instream complexity features such as root wads, boulders and boulder clusters, and digger logs, would be installed in the channel as appropriate to improve instream conditions for aquatic species. Vegetation and soil would be removed (clearing and grubbing), with topsoil (where suitable) being salvaged before the start of earthwork. Large woody debris salvaged during clearing and grubbing will be re-used for fish habitat where possible within the construction footprint. Bank slopes would be graded, whenever possible, to a 3H:1V. Some areas would be graded to a 2H:1V slope (i.e., Reach 8). Stockpiled topsoil resulting from the channel modifications would be spread on Project design slopes to achieve the final grade. Storm drain outlets to the Project channel would be modified, as required, to adjust to the reconstructed channel banks. For erosion control purposes, riprap would be installed at the reconstructed storm drain outlets.

Construction would use conventional equipment such as backhoes, excavators, loaders, cranes, tractors, water tankers, paving breakers, graders, and compactors to achieve the required design criteria. Soil compaction during construction would be limited to facilitate revegetation. To facilitate revegetation infill plantings associated with vegetation/habitat mitigation, some minor grading, removal of debris and trash, will be necessary at some locations that are not proposed for channel flood capacity improvements. Construction activities and locations associated with vegetation mitigation are discussed in the Botanical Resources, Section 3.4.

All concrete box culverts would be pre-cast and delivered to the site, ready for installation with minimal preparation. The box culverts would be designed to be capable of supporting truck traffic loads. Installation of new culverts would require temporary road closures, which would be managed through a detour plan. Culverts to convey flows from tributaries under maintenance roads would be installed before construction of the maintenance road, and would be designed for loading consistent with maintenance vehicles. The prefabricated culverts would be either corrugated metal pipe or concrete cylinders.

Temporary grade control structures would be installed on Reaches 5 and 14 during Phase 1 of construction to allow for the change in grade that would be created by constructing the Phase 1 improvements. These temporary structures would be removed during Phase 2 of construction. A grade control structure designed as a series of rock pools would be constructed at the bottom of Reach 7A in Llagas Creek, located immediately upstream from the confluence with the Reach 7A channel to accommodate the change in grade where the two channels come together. Another permanent grade control structure would be constructed in Reach 7B on Edmundson Creek where the channel confluences with West Little Llagas Creek. Grade control structures, constructed primarily from rock materials would be installed at various locations along the channel. These structures would be buried into the subsurface, with the top of the structure located at the surface of the streambed.

Existing stream gages along the Project alignment will be temporarily removed and re-installed as construction is completed. A new stream gage will be installed near the Church Street percolation ponds in Reach 6.

2.4.3.3 Construction Materials and Disposal

Imported materials that might be required would be obtained from local suppliers. To the extent possible, excavated materials would be reused as fill in suitable locations. The primary disposal area would be to stockpile excavated earth material at Anderson Dam where it would eventually be used for an earthquake retrofit of the dam. A portion of the excavation material, approximately 275,000 cubic yards (CY) predominantly from Reach 7A will be used for the Lake Silveira mitigation element of the Project. Some of the excavated material may be reused on-site where fill or soil materials are needed. Suitable sites for disposal of any hazardous materials would be identified, as would specification language for handling of any hazardous materials consistent with state and local regulations. Disposal of clean material and soil would be done in accordance with SCVWD BMPs for handling and disposal of material. Preliminary estimates of earthwork quantities are shown in Table 2.4-3 for each of the alternatives by reach, beginning with the Preferred Alternative. For each of the other alternatives, only those reaches that have different excavation and disposal quantities from the Preferred Alternative are shown. For example, the NRCS Alternative has the same amount of excavation and disposal in Reaches 4, 5, 6, 7A, 7B, and 14 as the Preferred Alternative, only Reach 8 differs with 66,000 bcy to be disposed under the NRCS Alternative rather than 73,000 bcy under the Preferred Alternative.

Table 2.4-3 Estimated Excavation, Fill, and Disposal Volumes

Reach	Excavation (bcy) [1,2]	Fill (bcy) [1,2]	Disposal (bcy) [1,2]
Tunnel (Preferred) Alternative			
4	300,000	5,000	295,000
5 and 6	455,000	7,500	447,500
7A	400,000	50,000	350,000
7B	98,000	3,000	95,000
8	71,000	5,000	73,000
14	100,000	5,000	95,000
Total Tunnel (Preferred) Project Alternative	**1,424,000**	**75,500**	**1,348,500**
NRCS Alternative			
8	76,000	3,000	66,000
Total NRCS Project Alternative	**1,429,000**	**73,500**	**1,355,500**
Culvert/Channel Alternative			
8	79,000	3,500	75,500
Total Culvert Project Alternative	**1,432,000**	**74,000**	**1,358,000**

Table 2.4-3 Estimated Excavation, Fill, and Disposal Volumes

Reach	Excavation (bcy) [1,2]	Fill (bcy) [1,2]	Disposal (bcy) [1,2]
Reach 6 Bypass Alternative[3]			
5 and 6	0	0	0
6 Bypass Channel segment	27,730	0	27,730
14	169,520	8220	161,300
Total Reach 6 Bypass Alternative	**1,066,250**	**68,220**	**997,030**

[1] volumes are for the flood conveyance aspect of the Project only and do not include utility or roadwork

[2] bcy = bank cubic yards

[3] no excavation would be required in Reaches 5 and 6 of the Reach 6 Bypass Alternative, however the bypass segment itself and Reach 14 would be constructed.

2.4.3.4 Construction Equipment

Construction equipment would vary by reach, depending on the type of facilities to be constructed.

The number of estimated crews required for excavation and other related work would also vary by reach. There would be small differences based on the alternative and in relation to the amount of potential excavation required, the length of the reach, and access restrictions. Table 2.4-4 lists the estimated crew size by reach, along with the estimated construction duration and equipment to be used during construction.

Table 2.4-4 Construction Duration, Crew Size and Equipment

Construction Duration (months)	Crew Size (non-excavation)	Crew Size for Excavation Work [1]	Large Equipment to be Used by Excavation and Non-Excavation Crews	
Reach 4				
23	> Project manager & superintendent > 2 office staff > 1 foreman > 4 equipment operators > 12 laborers > 4 carpenters > 1 arborists > 6 landscapers > 6 roadway workers > 4 traffic control workers > 12 truck drivers	2 (for channel excavation and loading: > 1 equipment operator > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6-3.75 CY Bucket) > 2 Hydraulic Excavators (0.5–2CY) > Tractor Crawler/ Dozer > Paving Breaker > Air Hose and Compressor	> Backhoe (0.8 CY) > Grader (135 HP**) > Asphalt Compactor Roller (6 tons) > Water Tanker (5,000 Gal) > Hydraulic Crane > Hydroseeder (3,000 Gal) > Flatbed Trucks

Table 2.4-4 Construction Duration, Crew Size and Equipment

Construction Duration (months)	Crew Size (non-excavation)	Crew Size for Excavation Work [1]	Large Equipment to be Used by Excavation and Non-Excavation Crews	
Reaches 5 and 6				
10 (Reach 5) 46 (Reach 6)	> Project manager & superintendent > 2 office staff > 1 foreman > 4 equipment operators > 12 laborers > 3 carpenters > 1 arborists > 4 landscapers > 4 roadway workers > 4 traffic control workers > 9 truck drivers	3 (for channel excavation and loading: > 2 equipment operators > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6-3.75 CY Bucket) > 3 Hydraulic Excavators (0.5–2CY) > Tractor Crawler (Dozer) > Backhoe (0.8 CY) > Grader (135 HP) > Asphalt Compactor Roller (6 tons)	> Water Tanker (5,000 Gal) > Hydraulic Crane > Hydroseeder (3,000 Gal) > Flatbed Trucks *For Reach 6 Bypass Alternative Add:* > Pumps > Shotcrete Truck > Compressor > Vibratory and Impact Pile Drivers
Reach 7A				
13	> Project manager & superintendent > 1 office staff > 1 foreman > 4 equipment operators > 12 laborers > 3 carpenters > 1 arborists > 4 landscapers > 6 roadway workers > 4 traffic control workers > 12 truck drivers	2–3 (for channel excavation and loading: > 1–2 equipment operator(s) > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6-3.75 CY Bucket) > 2-3 Hydraulic Excavators (0.5–2CY) > Tractor Crawler (Dozer) > Backhoe (0.8 CY)	> Grader (135 HP) > Asphalt Compactor Roller (6 tons) > Water Tanker (5,000 Gal) > Hydraulic Crane > Hydroseeder (3,000 Gal) > Flatbed Trucks
Reach 7B				
22	> Project manager & superintendent > 2 office staff > foreman > 4 equipment operators > 12 laborers > 3 carpenters > 1 arborists > 4 landscapers > 4 roadway workers > 4 traffic control workers > 9 truck drivers	2 (for channel excavation and loading: > 1 equipment operator > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6–3.75 CY Bucket) > 2 Hydraulic Excavators (0.5–2 CY) > Tractor Crawler (Dozer) > Backhoe (0.8 CY)	> Grader (135 HP) > Asphalt Compactor Roller (6 tons) > Water Tanker (5,000 Gal) > Hydraulic Crane > Hydroseeder (3,000 Gal) > Flatbed Trucks

Table 2.4-4 Construction Duration, Crew Size and Equipment

Construction Duration (months)	Crew Size (non-excavation)	Crew Size for Excavation Work [1]	Large Equipment to be Used by Excavation and Non-Excavation Crews	
Reach 8				
36	> Project manager & superintendent > 2 office staff > 1 foreman > 8 equipment operators[2] > 24 laborers[2] > 3 carpenters > 1 arborists > 4 landscapers > 4 roadway workers > 4 traffic control workers > 9 truck drivers	2–3 (for channel excavation and loading: > 1–2 equipment operator(s) > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6–3.75 CY Bucket) > 2-3 Hydraulic Excavators (0.5–2 CY) > Tractor Crawler (Dozer) > Backhoe (0.8 CY) > Grader (135 HP) > Asphalt Compactor Roller (6 tons) > Water Tanker (5,000 Gal) > Hydraulic Crane (90 Ton) > Hydroseeder (3,000 Gal) > Flatbed Trucks	For Tunnel and Reach 6 Bypass Alternatives, add: > Vibratory Sheet Pile Driver > Impact Pile Driver > Dril Jumbo > Roadheader > LHD Unit > Wheel Loader (4.88 CY) > Spader > Compressor > Shotcrete Truck > Pumps > Ventilation Fan
Reach 14				
16	> Project manager & superintendent > 2 office staff > 1 foreman > 2-3 equipment operators > 12 laborers > 3 carpenters > 1 arborists > 4 landscapers > 4 roadway workers > 4 traffic control workers > 9 truck drivers	2 (for channel excavation and loading: > 1 equipment operator > 1 equipment grade checker)	> Dump Trucks (12–20 CY) > Vibratory and Static Roller (Single Drum) > Front End Loader (2.6–3.75 CY Bucket) > 2 Hydraulic Excavator (0.5–2CY) > Tractor Crawler (Dozer) > Backhoe (0.8 CY)	> Grader (135 HP) > Asphalt Compactor Roller (6 tons) > Water Tanker (5,000 Gal) > Hydraulic Crane (90 Ton – for culvert) > Hydroseeder (3,000 Gal) > Flatbed Trucks

*CY=cubic yards

** HP = horse power

[1] crew size shown is to run excavation equipment only, therefore, does not include all construction laborers, foremen, and supervisors, etc.

[2] For the NRCS and Culvert/Channel Alternatives, 4 equipment operators and 12 laborers is the Reach 8 construction crew size.

2.4.3.5 Staging Areas

Approximately 25 acres would be used in each of the actions alternatives for staging during Project construction. The proposed staging areas are shown in Figure 2.4-6. Parking for construction workers would be provided within SCVWD ROW and approved staging areas only. Staging areas, that are not already paved or covered with compacted aggregate base, would be graded, as required, and surfaced with compacted aggregate base rock over a geo-textile fabric that would maintain separation between native and construction materials. Staging areas would be used for parking vehicles, trailers, workshops, maintenance areas, or equipment, formwork, rebar, and metal product storage. Areas storing soils and sand would not be required to be surfaced with coarse aggregate base. Staging and equipment storage would take place in the following areas:

Reach 4

> *Site I*. 2.3 acres of vacant land along Masten Avenue and No Name Uno near the U.S. 101 interchange on the south side of the channel; and

> *Site J*. 4.6 acres in an agricultural field at the end of Denio Avenue, just north of Buena Vista Avenue, on the south side of the channel.

Reach 5 and Reach 6

> *Site G*. 0.13 acre of SCVWD-owned lands at the Church Avenue percolation ponds on the west side of the channel;

> *Site F.* 1.4 acres in an agricultural field at the southeast corner of San Martin Avenue and Kimble Court on the east side of the channel; and

> *Site D.* 7 acres in an agricultural field between Llagas Avenue and the Union Pacific railroad tracks at Monterey Road, on the north side of the channel, opposite the Nature Quality Inc., food-processing facility with 0.38 acre for an access road from an adjoining parcel.

Reach 7A

> *Site C.* 7 acres along Middle Ave south of Monterey Road.

Reach 7B

> *Site B.* 1 acre of vacant land along La Jolla Drive at Via Navoana upstream from Watsonville Road, on the south side of the channel.

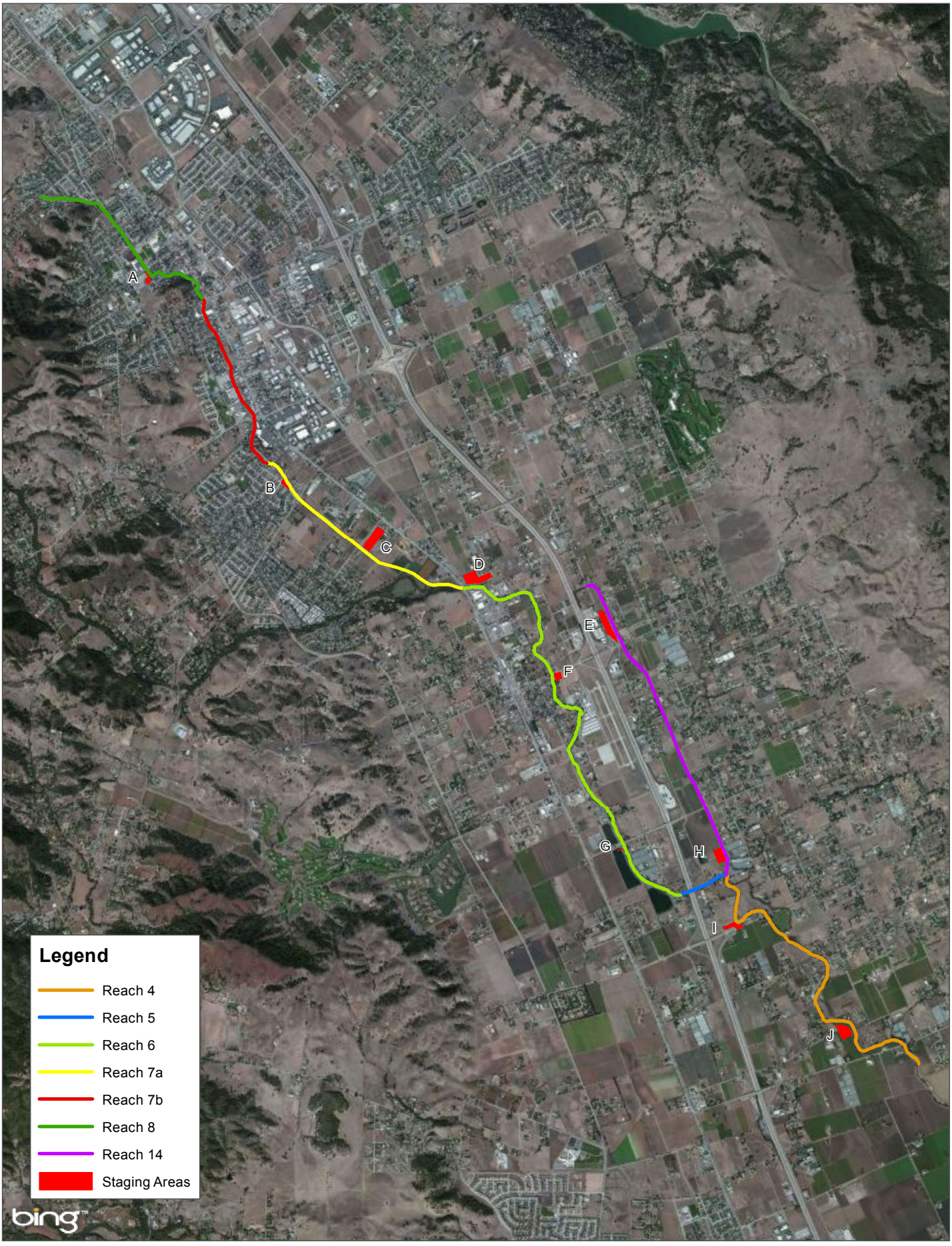
Reach 8

> *Site A.* 1.4 acres of vacant land at the site of the Pacific Gas and Electric Company (PG&E) substation on the southwest of the intersection of Hale Avenue and East Main Avenue on the west side of the channel (APN# 767-05-001). This staging site would be the main location for equipment and materials needed to construct the portal inlet and tunnel for the Preferred Alternative.

Reach 14

> *Site H.* 3.3 acres of vacant SCVWD-owned land east of the southern end of Kannely Lane on the west side of the channel; and

> *Site E.* 5.9 acres of vacant land at the northern intersection of Sycamore Avenue and San Martin Avenue.



Upper Llagas Creek Project EIR

FIGURE 2.4-6
Staging Areas

Cardno ENTRIX

2.4.3.6 Construction BMPs

For compliance with anticipated requirements of federal and state permits, such as, but not limited to, a permit from the USACE pursuant to Clean Water Act (CWA) Section 404 and Water Quality Certification from the Regional Water Quality Control Board (RWQCB) pursuant to CWA Section 401, the SCVWD would require the contractor(s) to develop and implement a site-specific erosion control plan(s). The erosion control plans should consider, at a minimum, scheduling or limiting activities to certain times of the year; installing sediment barriers such as silt fencing and fiber rolls along the perimeter of the construction area; maintaining equipment and vehicles used for construction; tracking controls, such as stabilizing entrances to the construction site; and developing and implementing a spill prevention and cleanup plan.

Because soil surface disturbance for the Project would be greater than one acre, the Project would be required to comply with National Pollutant Discharge Elimination System (NPDES) requirements for control of stormwater discharges from construction sites. Pursuant to the Statewide General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ NPDES No. CAS000002), the SCVWD would require all contractor(s) to file a Notice of Intent (NOI) to comply with the General Permit, and to develop and implement site-specific storm water pollution prevention plans (SWPPPs). In developing a SWPPP, the contractor must identify potential sources of pollution and implement BMPs to reduce pollutants in storm water dischargers. The SWPPPs must also incorporate measures for BMP inspection, maintenance, and recordkeeping.

Dust control plans are required by the Bay Area Air Quality Management District (BAAQMD). Therefore, the SCVWD would require the contractor(s) to develop a dust control plan, which identifies the fugitive dust sources at the construction site and describes all of the dust control measures to be implemented before, during, and after any construction-related activities. Dust control would be managed with spraying from water trucks.

Exclusionary fencing would be installed around facilities and adjacent areas that are to be protected from construction-related disturbance. Construction access ramps and construction access areas within the Project site would be positioned to minimize the need for vegetation removal.

Drinking water for construction workers would be provided in accordance with the Occupational Safety and Health Administration (OSHA) regulations. Portable toilets would also be provided at the worksite by the Contractor.

In addition to state and federal permit requirements, the Best Management Practices Handbook (SCVWD 2013b) provides a list of the SCVWD's BMPs intended to be incorporated into projects or activities to minimize potential environmental effects, including for construction and maintenance.

Applicable construction and maintenance BMPs are fully described in Appendix C, and include the following resource protection measures:

Air Quality	
AQ-1	Use Dust Control Measures for Soil Disturbing Activities
AQ-4	Avoid Stockpiling Potentially Odorous Materials
Biological Resources	
BI-3	Minimize Impacts to Steelhead
BI-4	Minimize Access Impacts
BI-5	Remove Temporary Fills as Appropriate
BI-6	Minimize Adverse Effects of Pesticides on Non-Target Species
BI-8	Avoid Impacts to Nesting Migratory Birds
BI-9	Avoid Impacts to Nesting Migratory Birds from Pending Construction
BI-10	Minimize Impacts to Vegetation From Clearing and Trimming
BI-11	Minimize Root Impacts to Woody Vegetation
BI-13	Choose Local Ecotypes of Native Plants and Appropriate Erosion Control Seed Mixes
BI-15	Restore Riffle/Pool Configuration of Channel Bottom
BI-16	Avoid Animal Entry and Entrapment
BI-17	Minimize Predator Attraction Effects on Wildlife
Cultural Resources	
CU-2	Stop Work and Report if Archaeological Artifacts are Found
CU-3	Stop Work and Report if Burial Remains are Found
Hazards and Hazardous Materials	
HM-1	Comply with All Pesticide Application Restrictions and Policies
HM-3	Minimize Use of Pesticides
HM-4	Post Areas Where Pesticides Will Be Used
HM-5	Comply with All Pesticide Usage Requirements
HM-7	Comply with Restrictions on Herbicide Use in Upland Areas
HM-8	Comply with Restrictions on Herbicide Use in Aquatic Areas
HM-9	Limit Vehicle and Equipment Fueling and Maintenance
HM-12	Ensure Proper Hazardous Materials Management
HM-13	Utilize Spill Prevention Measures
HM-14	Incorporate Fire Prevention Measures
HM-17	Comply with BAAQMD Regulations for Naturally Occurring Asbestos

Hydrology/Water Quality	
WQ-1	Conduct Work From Top of Bank
WQ-2	Evaluate Use of Wheel and Track Mounted Vehicles in Stream Bottoms
WQ-3	Limit Impact of Pump and Generator Operation and Maintenance
WQ-4	Limit Impacts of Sediments on Water Quality
WQ-5	Limit Impacts From Staging and Stockpiling Materials
WQ-6	Stabilize Construction Entrances and Exits
WQ-9	Minimize Erosion From Removal of In-Channel Vegetation
WQ-10	Limit Impact of Concrete Near Waterways
WQ-12	Isolate Work in Non-Tidal Sites With Use of Diversion of Bypass
WQ-14	Use Seeding for Erosion Control, Weed Suppression, and Site Improvement
WQ-15	Manage Exposed Groundwater at Work Sites
WQ-18	Maintain Clean Conditions at Work Sites
WQ-40	Prevent Water Pollution
WQ-41	Prevent Stormwater Pollution
WQ-42	Manage Sanitary/Septic Waste
Noise	
NO-1	Minimize Noise Pollution
NO-2	Minimize Noise Disturbances to Residential Neighborhoods
Transportation/Traffic	
TR-1	Incorporate Public Safety Measures
TR-2	Minimize Impacts on Traffic, Bicycles and Pedestrians

2.4.4 Utilities

A network of underground and overhead utility lines provides water, gas, electricity, sewer, storm drains, cable, phone, fiber optics, and other utility services throughout the Project area. In most cases these utilities are buried underground. Some utilities located within the footprint of the Project easements would be either protected in place, rebuilt in place, abandoned, or demolished and relocated prior to construction. Sewer lines and storm drains may be relocated at the beginning of construction. Although there are utilities in all Project reaches, most of the utilities that would need to be relocated are in the urbanized Reaches 7B and 8. Utilities would be protected in place during construction if they are not to be abandoned or replaced. There are also miscellaneous features such as fences that would need to be removed and potentially relocated. All utilities that are within the Project easements will be identified and their disposition will be determined during preparation of the final engineering design plans.

2.4.5 Operations and Maintenance

SCVWD would be responsible for maintaining all Project features, such as the channel, culverts, and grade control structures consistent with SCVWD and USACE guidelines. Flood conveyance channels would be managed to provide adequate capacity for the design flow. The channels would be regularly inspected for the build-up and removal of trash (non-living material) or other obstruction to flow. Sediment removal and vegetation maintenance are the two main activities that are periodically needed to maintain design flow capacity. Sediment removal and vegetation management generally would be conducted

between June 15 and October 15. However, if the fall season remained dry, work could continue until the first significant rainfall event occurred. A significant rainfall event is defined as local rainfall of 0.5 inch or greater within the watershed over a 24-hour period (SCVWD 2011a).The expected maintenance activities that are common to all the Project alternatives are described below. Analysis of potential impacts and associated mitigations that may be needed due to proposed maintenance activities under each of the action alternatives is addressed within each of the resource sections in Chapter 3, Affected Environment and Environmental Consequences. Maintenance activities that occur under existing conditions were previously summarized and described under the No Project Alternative in Section 2.3.

2.4.5.1 Vegetation Management

Vegetation maintenance in the flood conveyance channels shall be performed to maintain the composite design roughness requirements (hydraulic roughness, or Manning's n-value[15]). The design roughness requirements[16] are shown in Table 2.4-5 and are applicable to all the action alternatives where there will be widening and deepening of the channel to improve flood conveyance.

Table 2.4-5 Target Composite Hydraulic Roughness Coefficients (Manning's n-value) for Maintenance

Reach	Existing Composite Hydraulic Roughness [1],[2]	Design Composite Hydraulic Roughness [2]
8	0.046	0.035
7B	0.045–0.065	0.038–0.069
7A	(no existing channel)	0.038–0.084
6	0.064–0.070	0.064–0.075 [3]
5	0.064	0.065–0.094 [3]
4	0.055	0.064–0.076
14	0.050	0.04

[1] Based on roughness values from USACE.

[2] Ranges reflect different roughness requirements in different portions of a given reach.

[3] For the Reach 6 Bypass Alternative, design composite roughness in Reaches 5 and 6 do not apply since there will be no construction

[15] The flow conveyance capacity of a channel is controlled by the channel slope (gradient), cross-sectional area, and roughness of the bed and banks. Of these three factors, operation and maintenance practices primarily affect roughness, which is created by the shape of the streambank, meandering characteristics of the river, size of the bed sediment materials, presence of debris obstructions, and by vegetation. Channel roughness is represented in flow conveyance equations or hydraulic models by a unit-less factor called Manning's n-values. Manning's n-values can be identified for specific areas of a channel cross-section, or averaged to a composite value that represents their aggregate impact on flow rate. For example, a small area of very dense brush with trees could have a high n-value of 0.10 and adjacent areas of the channel with no vegetation around it having a low n-value of .035, with a composited n-value of .045 for the entire channel.

[16] A narrative description of vegetative conditions associated with a range of Manning's n-values assuming a base condition of n = .03 for a coarse sandy bed with a uniform, straight channel without vegetation or obstructions, is provided by the USGS (Arcement and Schneider 1989) as follows: N = .032-.040 dense growth of flexible turf grass or weeds where depth of flow is at least 2 times height of vegetation; supple tree seedlings such as willow, cottonwood where average depth of flow is three times height of vegetation. N = .040-.055 moderately dense stemmy grass, weeds, or tree seedlings; brushy moderately dense vegetation similar to 1-2 year old willows in dormant season. N = .055-.080 for 8–10 year old willow or cottonwood trees intergrown with weeds and brush. N = .080-0.130 bushy willow trees 1 year old intergrown with weeds on all side slopes with vegetation in full foliage, trees intergrown with weeds and brush with vegetation in full foliage. Note that n-value narrative descriptions for vegetation can be variable, depending upon other factors present in the channel that also contribute to roughness.

Except where specifically allowed, woody vegetation should be removed before the trunk is greater than 3 inches dbh. Over time, vegetation density may increase and flexibility of woody riparian species may decrease as the vegetation matures and becomes well established. This could cause the hydraulic roughness of the channel to increase beyond that originally designed, necessitating thinning or removal of vegetation. Vegetation management is also conducted to maintain access roads clear of vegetation, maintain the ability to visually inspect the channel, and as needed to reduce fire loads as may be required by local fire districts. Vegetation control methods include the following:

> **Herbicide**—The application of herbicide would occur instream and on bank bench areas as well as on maintenance roads, along fence lines, and similar non-instream areas. Herbicide describes a work activity and not the chemical formulation used. This activity consists of using herbicide as the primary abatement tool to kill vegetation and provide subsequent follow up for hand removal activities. On maintenance roads the weed management strategy calls for two herbicide applications, a pre-emergent application and post emergent application.

> **Hand Pruning**—Pruning is the partial removal of any individual plant and includes cutting of tree branches, woody and herbaceous vegetation, and is conducted with mechanized and non-mechanized hand tools. Pruning may occur instream and along banks and bench areas. Pruning of trees and shrubs is a routine activity necessary to provide access to SCVWD facilities, improve visibility to inspect SCVWD facilities, protect SCVWD infrastructure, and maintain the designed hydraulic capacity. Typical woody vegetation pruning takes place along maintenance roads and fences. Tree pruning may include thinning the canopy of an individual tree or shrub. For simplicity, the term “tree” or “trees” will refer to both trees and woody shrubs.

> **Hand Removal**—Complete removal of above ground portions of any individual plant using mechanized or non-mechanized hand tools. This category includes herbicide stump treatment, called 'cut stump' which is follow-up work from the removal of vegetation. Cut stump treatment is a paired activity to Hand Removal. Live, standing trees and shrubs may be removed from SCVWD facilities to meet one of the following program objectives: maintain design flow conveyance capacity, provide facility inspection and access, or maintain the structural integrity of SCVWD facilities. For simplicity, the term “tree” or “trees” will refer to both trees and woody shrubs. Stump treatment of removed trees is included under “Hand Removal” and is not defined as “Herbicide” work.

> **Mowing**—Area-wide cutting of above ground plant material using a tractor mounted flail mower or hand-held equipment (weed-eaters). Work primarily occurs in the bank bench/outboard areas, conducted annually. Mowing provides visual access for facility inspections and may be required for flow conveyance capacity and to meet local fire codes. Local fire codes call for all weeds and grasses to be maintained below 6 inches in height for 10 feet horizontally on both sides of access routes. Vegetation must be cut back 30 feet around any structures and a 30-foot firebreak must be maintained. Parcels up to 1 acre in size must be completely mowed. All work is performed to conform to local fire code requirements.

2.4.5.2 Sediment Management

Sediment management could be required in the flood conveyance channels within the Project area. Sediment removal is the act of mechanically removing sediment deposited within a creek and may be necessary when an accumulation of sediment reduces flow conveyance capacity or prevents facilities or appurtenant structures from functioning as intended. These activities would be done in a manner that is sensitive to protection of aquatic resources. Overall, it is anticipated, based on hydraulic modeling that the Project design would provide for a balanced net transport of sediments and would not result in reach-scale aggradation (USACE 2010a). However, as vegetation develops, and woody debris and other fish habitat enhancements are installed, there remains a potential for sediments to locally deposit reducing flood conveyance capacity. At the confluence of Reaches 14, 4, and 5 the design includes a widened channel area with a mid-channel bar that bifurcates the flow. This site is designed for sediment

accumulation to help reduce the need for sediment removal in downstream locations. A similar sediment depositional site is designed for an over-widened channel area near the top of Reach 6 at the first large meander bend downstream of Llagas Avenue. It is anticipated that sediment removal at both of these sites will be less frequent than once every 10 years. Sediment management would be performed in an adaptive manner, identifying depositional patterns and tendencies and updating management techniques accordingly. This is particularly true for the mid-channel bar at the confluence between Reaches 4, 5, and 14, and widened channel area of Reach 6 near Llagas Road which are designed to be sediment depositional sites.

A sediment detention basin will also be installed in Reach 8 for the Tunnel and Reach 6 Bypass alternatives, only. The detention basin will periodically require sediment removal. Heavier sedimentation may occur after episodic events such as wild fires and large flows. After such an event the Project should be inspected to identify and address large deposits that may impact channel capacity.

2.4.5.3 Bank Erosion

The channel cross-sectional form was designed to be in a stable, dynamic equilibrium with the flow and sediment regime of the Llagas Creek watershed. This does not mean there would be absolutely no erosion, but it does mean that the channel dimensions and planform should, in general, remain about the same over time. It is assumed that any maintenance for bank erosion that might arise would be related to localized erosion that might threaten infrastructure, and that this would be addressed through the SMP. Consequently, the Project does not envision a need for a bank erosion maintenance regime.

2.4.5.4 Culverts

All of the proposed culvert replacements would be reinforced concrete box structures. Any spalling (i.e., splitting or flaking) in concrete culverts would be patched with an appropriate concrete material. Repairs would be made to the bottom of the concrete culvert if they show more than 1 inch of loss due to wear and abrasion. If significant settlement is detected in a culvert or pipe, it should be excavated, the foundation raised, the pipe replaced, the fill material added in 4-inch layers and compacted around the pipe to a density equal to or greater to that of the surrounding undisturbed material, and the area reseeded. Sediment and debris must be removed from culverts to maintain their flow capacity; this is defined as a minor maintenance activity in the SMP.

2.4.5.5 Concrete Grade Control Structures

Grade control structures would be annually inspected for erosion. Erosion of the streambed both upstream and downstream of the structures would be repaired and any debris removed that accumulates on the structures. The integrity of the concrete would be inspected, and if there is any substantial cracking or erosion, the structure would be repaired.

2.4.5.6 Habitat Enhancement Features

Habitat enhancement features including a sinuous low-flow channel, pools, large woody debris placements, boulder placements, root wad structures, and wing log deflectors, are to be installed in Reaches 4, 5, 6, and 7A. Divide logs[17] would also be used, but only in the perennially flowing section of Reach 6. These types of habitat enhancements generally improve fish rearing and migration habitat by providing cover and velocity refuge. The habitat enhancement features would be maintained by the SCVWD to insure they continue to provide their designed environmental benefits.

[17] Divide logs are used to provide cover and are a visual barrier between pairs of spawning fish.

2.4.5.7 Minor Maintenance

Minor maintenance activities would be performed to repair and maintain SCVWD facility functions. Minor maintenance activities may occur anywhere within the Project area. For all of the action alternatives, minor activities are small in size that results in removing less than 0.08 acre of wetland or riparian vegetation at a site. The minimum size for any minor vegetation work to be notified in SCVWD's Nationwide Permit (NWP) is 0.01 acre per project, which includes any vegetation work necessary for access or staging. Yearly minor maintenance activities are limited to less than 0.4 acre of wetland or riparian vegetation impact per year for the combined Countywide maintenance activities under the SMP. Cumulative minor maintenance activities would be limited to 2 acres total wetland or riparian vegetation impact over a 5-year planning period and 4.0 acres over a 10-year planning period for all countywide projects combined. The methodology is consistent with the Countywide Stream Maintenance Program minor maintenance procedures. Cleaning and minor sediment removal at culverts, grade control structures, and other facilities is limited to keep them functioning to as built standards, with a 25 CY total removal per year. The following minor maintenance activities relating specifically to the Project which could occur are described as;

> Removal of wetland/riparian vegetation (less than .08 acre per site);

> Minor in-channel sediment removal (less than 10 CY);

> Trash and debris removal;

> Repair and installation of fences and gates;

> Grading and other repairs to restore the original contour of existing maintenance roads;

> Grading small areas without vegetation above stream banks to improve drainage and reduce erosion;

> Repair of structures with substantially similar materials within approximately the same footprint (i.e., replacement of concrete linings, culverts);

> Graffiti removal;

> Installation and on-going maintenance of mitigation and landscape sites (including irrigation, weed control, and replanting of dead or declining individual plants until success criteria were met);

> Removal of obstructions at structures to maintain function (i.e., bridges, stream flow measuring stations, box culverts, storm drain outfalls, and grade control structures).

2.4.5.8 Application of Maintenance Activities

Each portion of the channel (in cross-section view) will have an applied set of maintenance activities. Figure 2.4-2 shows the relevant sections of the channel for purposes of describing maintenance activities, including:

> Maintenance roads;

> Top of bank (TOB);

> Engineered bank;

> Natural bank;

> Bench;

> Bankfull bank (slope between bench and channel bottom); and

> Channel bottom.

In some cases there may be a second engineered bank instead of a natural bank. Benches may be engineered or naturally formed, but in either case where there are no benches the engineered and natural banks are assumed to be extended to the channel bottom. On any channel side where a portion of the bank is natural and a portion is engineered, it is assumed that maintenance would be performed as if the entire bank is natural. The tables below (Table 2.4-6, 2.4-7, 2.4-8, and 2.4-9) show the type of maintenance activity and frequency of activity as well as the targeted roughness for each portion of the channels in the identified reaches. These roughness values are applicable to all of the action alternatives. Vegetation maintenance, such as grass and weed mowing, would occur once or twice annually. Other vegetation maintenance, such as pruning and removal, is anticipated on about a 5-year frequency, except in Reach 6 where perennial water conditions may require more frequent maintenance of willows on a 3-year maintenance cycle. Sediment maintenance is anticipated on about a 10-year frequency over the long term.

Table 2.4-6 Typical Maintenance Activities, Frequency, and Target Roughness Reaches 4 and 5

Location	Surface / Vegetation	n-value	Maintenance Method	Frequency (years)	Notes
Maintenance Road	Aggregate base and ballast rock	N/A	Herbicide	1	Clear of vegetation for access and reduce fire hazard
Top of Bank	Grasses, Riparian Forest	N/A	Mowing Hand Pruning Hand Removal	1	Facilitate access and observation, reduce fire hazard
Engineered Bank	Planted Riparian Forest	0.10	Hand Pruning Hand Removal	5	Limited understory development is acceptable
Natural Bank	Riparian Forest	0.15	None	N/A	No maintenance
Bench	Grass	0.04	Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments
Bankfull Bank	Reach 4 – Grass Reach 5 – Willow	0.04 0.08	Herbicide [1] Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation (Reach 5), remove excess sediments
Channel Bottom	Gravel, cobble, sand	0.03	Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments, some grass acceptable

[1] No herbicide in Reach 4

N/A = not applicable

Table 2.4-7 Typical Maintenance Activities, Frequency, and Target Roughness Reach 6

Location	Surface / Vegetation	n-value	Maintenance Method	Frequency (years)	Notes
Maintenance Road	Aggregate base and ballast rock	N/A	Herbicide	1	Clear of vegetation for access and reduce fire hazard
Top of Bank	Grasses, Riparian Forest	N/A	Mowing Hand Pruning Hand Removal	1	Facilitate access and observation, reduce fire hazard
Engineered Bank	Planted Riparian Forest	0.10	Herbicide Hand Pruning Hand Removal	5	Limited understory development is acceptable
Natural Bank	Riparian Forest	0.15	None	N/A	No maintenance
Bench	Grass	0.04	Herbicide Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments
Bankfull Bank	Willow	0.08	Hand Pruning Hand Removal Sediment Removal	3 (veg) 10 (sediment)	Prevent spread of willows, remove excess sediments
Channel Bottom	Gravel, cobble, sand	0.03	Herbicide Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments, some grass acceptable

N/A = not applicable

Table 2.4-8 Typical Maintenance Activities, Frequency, and Target Roughness Reaches 7A, 7B, and 14

Location	Surface / Vegetation	n-value	Maintenance Method	Frequency (years)	Notes
Maintenance Road	Aggregate base and ballast rock	N/A	Herbicide Hand Removal	1	Clear of vegetation for access and reduce fire hazard
Top of Bank	Grass	N/A	Mowing Herbicide [2] Hand Pruning [1] Hand Removal [1]	1	Facilitate access and observation, reduce fire hazard
Engineered Bank	Reach 7A - Scrub/shrub Reaches 7B & 14 – Grass	0.06 0.04	Herbicide [2] Hand Pruning Hand Removal	5	Clear of woody vegetation
Natural Bank	N/A	N/A	N/A	N/A	N/A
Bench	Grass	0.04	Herbicide [2] Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments

Table 2.4-8 Typical Maintenance Activities, Frequency, and Target Roughness Reaches 7A, 7B, and 14

Location	Surface / Vegetation	n-value	Maintenance Method	Frequency (years)	Notes
Bankfull Bank	Grass	0.04	Herbicide [2] Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Prevent spread of willows, remove excess sediments
Channel Bottom	Gravel, cobble, sand	0.03	Herbicide [2] Hand Removal Sediment Removal	5 (veg) 10 (sediment)	Clear woody vegetation, remove excess sediments, some grass acceptable

[1] No Hand Pruning or Hand Removal in Reach 7A

[2] No herbicide use in Reach 14 except for the maintenance road

N/A = not applicable

Table 2.4-9 Typical Maintenance Activities, Frequency, and Target Roughness Reach 8

Location	Surface / Vegetation	n-value	Maintenance Method	Frequency (years)	Notes
Maintenance Road	Aggregate base and ballast rock	N/A	Herbicide	1	Clear of vegetation for access and reduce fire hazard
Top of Bank	Grasses	N/A	Mowing Hand Pruning Hand Removal	1	Facilitate access and observation, reduce fire hazard
Engineered Bank	Grasses	0.04	Hand Removal Sediment Removal	1	Limited understory development is acceptable
Natural Bank	N/A	N/A	N/A	N/A	
Bench	N/A	N/A	N/A	N/A	
Bankfull Bank	N/A	N/A	N/A	N/A	
Channel Bottom	Gravel, cobble, sand	0.03	Herbicide Hand Removal Sediment Removal	1	Clear woody vegetation, remove excess sediments, some grass acceptable

N/A = not applicable

2.4.6 Lake Silveira Mitigation Element

The Lake Silveira parcel is a 52-acre wetland and riparian mitigation element designed by the SCVWD to reduce and compensate for environmental impacts associated with other flood protection activities. The Lake Silveira element is not a part of the Project design for flood management in any of the action alternatives. However, it is intended to reduce or compensate for flood reduction actions of the proposed Project. The Lake Silveira mitigation element is included in this section of the EIR, because it entails a substantial amount of construction activity over a relatively large area; and, because, it is equally pertinent to all the action alternatives. Consequently, this section is devoted to describing the key features, construction activities, and operation of the Lake Silveira mitigation element. The various resources sections in Chapter 3 of this EIR address the relationship of the Lake Silveira component to the impacts identified under each alternative and further evaluates the unique potential impacts and additional mitigation measures that may be needed due to implementation of the Lake Silveira element.

Lake Silveira is located just east of where Reaches 7A and 6 come together (Figure 2.1-1). The lake was formed when an illegal levee breach was made separating a rock quarry pit from Llagas Creek sometime in the 1980s. Approximately 2,000 feet of the former Llagas Creek channel around the north side of the lake was abandoned by the illegal breach and diversion into the quarry pit. Flows in Llagas Creek, including those reaching the lake are controlled by releases upstream at Chesbro reservoir. The lake is about 12-feet-maximum depth. Lake Silveira is currently managed by the Santa Clara County Parks and Recreation Department. Lake Silveira is not a sanctioned recreation facility and access is only provided informally.

The USFWS CAR (USFWS 2003) proposed various mitigation measures, including the Lake Silveira element, to address impacts associated with the Upper Llagas Creek Flood Protection Project. The basic Lake Silveira goals identified in the CAR included rewatering the historic channel, filling a portion of the lake to create a wetland mosaic and shallow open water, and enhancing wetland habitat by incorporating large woody debris. This summary description of the Lake Silveira element is based on a preliminary 30 percent engineering design drawings (RMC 2013) and the Lake Silveira Restoration Project Design Development Report (H.T. Harvey & Associates 2013a), which is subject to future refinement. The proposed design would re-water the historic channel, create an adjacent emergent perennial wetland, retain a portion of existing open water habitat, and would include riparian forested plantings along the inlet and outlet channels to and from the wetlands, as well as on uplands surrounding the lake that are part of the area. Figure 2.4-7 shows the area associated with the Lake Silveira, the proposed habitat planting areas, and identifies key features. Design objectives include the following (H.T. Harvey & Associates 2013a):

> Maximize mitigation value and provide for an overall increased ecological function;

> Improve habitat for steelhead, turtles, and other special-status species;

> Reduce suitable habitat for non-native predatory species;

> Provide riparian habitat in Reach 7A on the Lake Silveira property;

> Improve or protect upstream and downstream functions and resources, hydraulic conveyance, groundwater recharge, and ecological resources;

> Contribute to improved sediment supply (which includes spawning gravels) to downstream reaches;

> Ensure geomorphic stability of the rewatered historic channel, downstream reaches, and the Lake;

> Provide a stable low-maintenance confluence with the Lake and historic channel, as well as outlet confluence to Reach 7A;

> Improve water quality including turbidity, temperature, circulation/flushing;

> Provide for public access opportunities, such that if the City of Morgan Hill or County of Santa Clara Parks and Recreation develops passive recreation in the area in the future, the mitigation will be adequately buffered, and

> Minimize design, permitting, construction, monitoring, and maintenance costs.

Portions of the 8-acre lake would be filled to create approximately 4.25 acres of emergent perennial wetlands, approximately 10.8 acres of forested habitat types including riparian and oak woodland, Sycamore forest, willow forest, and with about 3.2 acres of open water remaining of the original 8-acre lake surface. This would be accomplished by constructing a hydraulically roughened open-channel flow split structure that would route some of the Llagas Creek flow back into the historic channel, with a portion of the flows going to the wetland, which would be created by partially filling the lake. When base flows in Llagas Creek upstream of the lake are very low, less than 3 cfs may occur in drought years, most of that flow would be directed into the wetlands. When flows exceed 3 cfs (which is most of the time), the flow would be directed mostly to the historic channel. A lake outlet structure would be installed where the lake ties back into Llagas Creek. The outlet structure would be a weir gate, which would include a grade control structure at or downstream of the lake outlet to prevent incision and destabilization of the bank. The outlet structure would temporarily have a means to control lake elevations; so that if there is settlement of the wetland surface after construction, the water elevation can be adjusted to optimize the wetland viability and function. It is expected that over the long-term, the permanent outlet structure would not need to be adjustable and that the seasonal water surface elevation in the wetland is expected to only fluctuate within a range of about 0.5 foot.

The wetland would be created by partially filling the lake area at depth with coarse earth materials and providing surface soils of clay and sandy loams derived from the channel excavation in Reach 7A. The submerged wetland fill slopes created around the northern margin of the wetlands would be approximately 2:1 grade and would be compacted to about 90 percent to minimize liquefaction potential. The approximately 4 acre wetland marsh created would have an undulating surface so that there are deeper ponding areas punctuated by islands that are elevated between 1 to 4 feet above the water surface of the “marsh plain”. The design is intended to create a habitat mosaic of open water and vegetated marsh. By keeping the islands close to the deeper open water, predation by mammals can be reduced. Willows and cottonwoods would be planted on the islands above the water surface elevation, as well as on the northeastern edge of the marsh plain. The rest of the marsh plain would be seeded and planted with species, such as rushes, bulrush, and flatsedge (see H.T. Harvey & Associates 2013a for planting details), including around the perimeter of the islands. The portion of the lake south of the marsh plain would mostly remain as open water with depths approximately as they are today. There are existing gravel bars extending out from along the southern shoreline of the lake into the open water areas. These bars would remain as they currently exist, as they provide turtle and bird habitat during low water periods.

Approximately 1,980 linear feet of abandoned Llagas Creek would be rewatered. A pilot channel would be excavated starting at the inlet flow split structure downstream for several hundred feet into the abandoned Llagas Creek channel. The pilot channel would help to focus flows when the Project becomes operational to purposely encourage initial scouring and formation of a stable channel at the junction with the split structure. No other grading work is proposed in the abandoned channel. The abandoned channel is heavily over-grown with non-native blackberry, which would be removed manually and with follow-up herbicide sprays over a 3- to 4-year period before planting native understory shrub species. Any understory left bare after blackberry and replanting shrubs would be seeded with an understory mix of mugwort, blue wild rye, and creeping wild rye. The existing channel over-story is well vegetated and it is anticipated that additional natural recruitment would occur once the blackberries are removed and the channel is rewatered. Some in-fill plantings of shrubs, such as mugwort, California blackberry, and snowberry, along with some willows, are proposed.

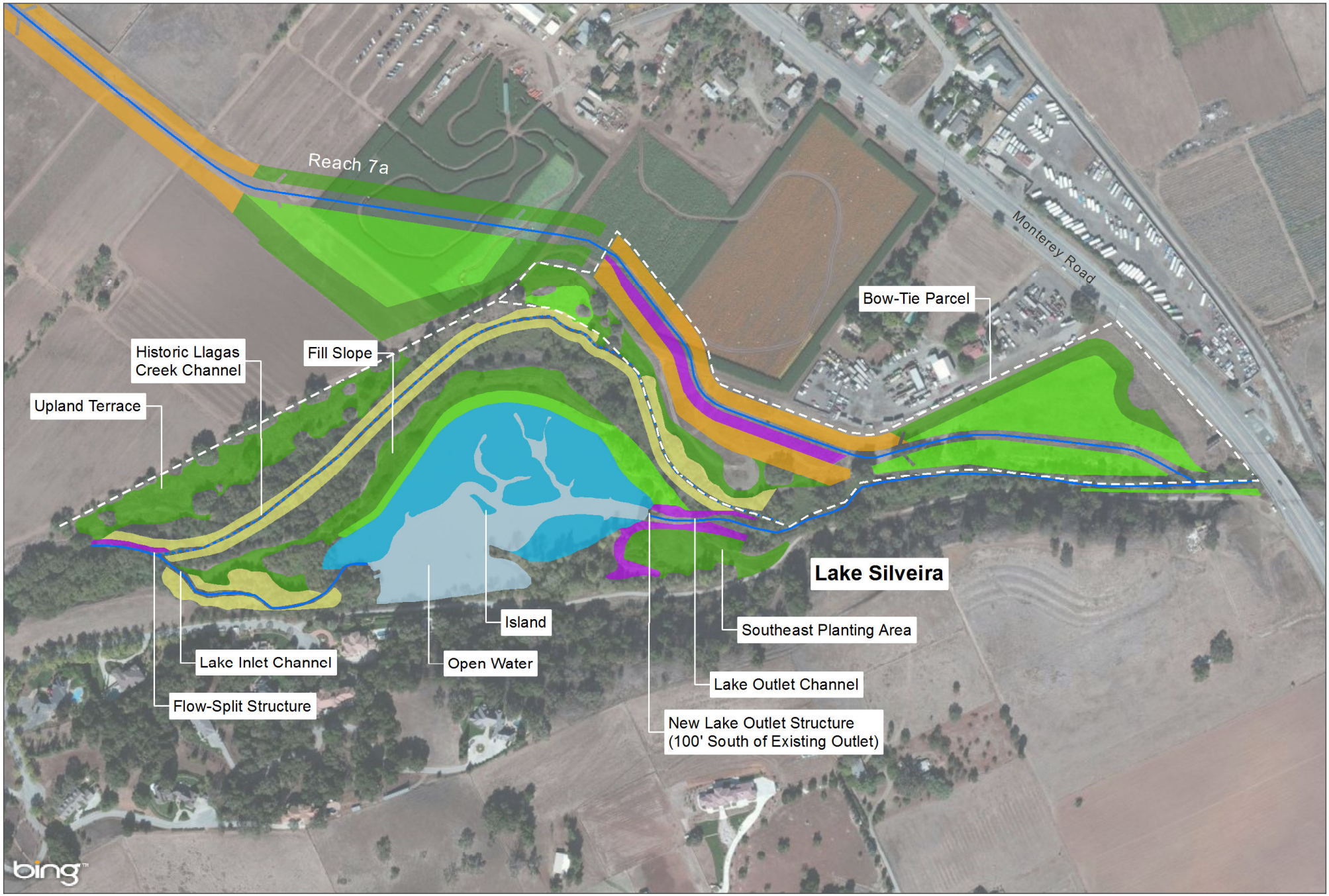


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FIGURE 2.4-7

Lake Silveira Mitigation Element

Along the inlet channel to the wetland, there is a raised berm area that would be planted with oak woodland species. Adjacent to the inlet channel at the level of the floodplain native willow trees are well-established. The existing understory has apparently been completely cleared (by unknown parties). The understory floodplain along the inlet channel would be planted with mugwort, blackberry, snowberry, and a seeding mixture that includes wildrye.

The existing outlet channel would be filled in to reduce the potential of groundwater migrating toward the Reach 7A channel and potentially lowering water levels in the wetland. The new outlet would be excavated 100 feet to the south of the existing outlet. Grade control is likely to be needed in the channel in the vicinity of the outlet structure to prevent channel incision. About 1.5 feet of existing highly compacted soils along the floodplain of the outlet channel would be excavated and replaced with new loam surface soils imported from Reach 7A. Willow forest would be planted along the outlet channel, which includes red, arroyo, and sandbar willow types. Oak woodland forest would be used on higher elevations further away from the channel and lake.

Fill would be placed against an existing soil berm that separates the lake from the historic channel immediately north of the marsh plain (see Figure 2.4-7). The fill slope would be constructed with gradients between 3:1 to 5:1 and will have 2 to 3 feet of imported topsoil, likely from Reach 7A excavation. The fill slope would be planted with riparian and oak woodland forest.

Just north of the historic channel are upland terraces that are situated about nine feet above the channel and border neighboring agricultural fields. A concrete wall would be removed and some grading would occur on a portion of the upland terrace. A sycamore forest planting pallete would be used in this part of the upland terrace. The rest of the upland terrace areas would be planted with the forest pallete including oaks, buckeye, sagebrush, coffeberry, toyon, and others.

The “bow-tie” parcel (informally called as such due to its shape) is adjacent to Lake Silveira along the most downstream portion of the Reach 7A channel. It lies to the north and east of the lake toward Monterey Road, with the Reach 7A channel alignment to be excavated through the property (see Figure 2.4-7). The bow-tie parcel is part of the Lake Silveira element and within the County Parks and Recreation management area. Clay and sandy loams salvaged from the excavation in this reach would be used to provide topsoil with Sycamore forest to be planted on the lower elevations and willow forest to be planted in a strip along part of the channel. Outside the willow forest higher on the bank would be planted with savanna, which is upland herbaceous habitat with a few individual sycamore trees spaced approximately every 200 feet.

A comparison between the existing and preliminary proposed Lake Silveira habitats is provided in Table 2.4-10.

Based on preliminary design, the Lake Silveira wetland and riparian enhancement site would result in a net increase of about 4.11 acres of Sycamore Forest, 8.13 acres of Riparian Forest, and 4.08 acres of wetland. Upland herbaceous habitat would decrease by about 11.46 acres.

Instream channel habitat improvements consisting of large logs in the Lake would be installed to function as basking surfaces for western pond turtles. Approximately 10 turtle-basking logs are proposed. Additionally, instream habitat complexity, such as log-rootwad structures, would be installed in the rewatered Llagas Creek to provide steelhead rearing and refuge habitat.

Table 2.4-10 Lake Silveira Approximate Restoration Areas

Scientific Name	Existing Acreage [1]	Preliminary Proposed Acreage [1]	Net Increase/ Decrease [1,2]
Riparian Forest Native (except Sycamore)	15.56	23.68	8.13
Riparian Forest Non-native	0.78	0.62	-0.15
Riparian Shrub-scrub native	0.33	0.24	-0.09
Riparian shrub-scrub non-native	0.09	0.07	-0.02
Perennial Marsh	0.21	4.29	4.08
Upland Herbaceous	15.51	4.06	-11.46
Aquatic	7.71	3.13	-4.58
Sycamore	1.43	5.54	4.11
Total	41.62	41.62	0.15

[1] Numbers may not add up due to rounding

[2] Negative numbers denote a decrease of the habitat type indicated

Construction of the Lake Silveira element will require approximately three years, taking place during the Phase 1 work at the beginning of the project along with the Reach 7A channel excavation. Construction access roads would be needed for implementing the component; however, the location of the access roads have not been planned at this time. Additionally, access roads to the split flow inlet structure and outlet structure would likely be needed. Irrigation would be required to support successful vegetation establishment. An irrigation layout is provided as part of the 30-percent engineering design (RMC 2013). Irrigation water would be drawn from an existing water main. Temporary access roads for purposes of maintaining the irrigation lines and for monitoring the native plantings until they are established are also depicted on the 30-percent design plans. Dewatering of the lake would be necessary in order to place the fill and topsoils creating the wetland marsh. It is expected that the dewatering would require some type of filtering to minimize turbidity downstream in Llagas Creek.

Maintenance is anticipated to be minor once the construction is completed and vegetation begins to establish. Maintenance would consist of activities to allow the Lake Silveira component to hydrologically function as planned, so that the wetlands thrive and the historic channel is re-watered. No maintenance would be performed for purposes of flood management. Maintenance work would include clearing sediment from the inlet structure, minor vegetation clearing around the inlet and outlet structures, and along the inlet of the channel to keep the flow split structure functioning. Exotic species control would occur over a period of up to 4 years as described above for blackberry, as well as Giant Reed and yellowflag iris at a few locations, in order to improve the habitat value of the site and to allow newly planted natives to establish. Some maintenance in the form of mosquito vector control may also be necessary. During the restoration monitoring period after planting is completed, maintenance for the plantings may be needed to ensure that the success criteria for planting survival is met.

2.5 NRCS Alternative

The NRCS Alternative was initially conceived and evaluated as Alternative F in the 1982 EIS/EIR (Section 2.2.1). Subsequent modifications to the NRCS Alternative have been considered and incorporated since the 1982 EIS/EIR, in response to the changing physical environment, and to changes in environmental regulations (Section 2.2.4). The NRCS Alternative evaluated in this EIR is based on all subsequent modifications to Alternative F, as presented in the SCVWDs' Map and Construction Plan 65

percent Design Submittal (RMC 2013). The current NRCS Alternative consists of the following main components:

> Acquisition of fee title and easements of adjacent land needed for Project construction and maintenance;

> Channel improvements including deepening and widening, some limited planform re-alignment;

> Excavation and construction of a diversion channel for flows from West Little Llagas Creek to Llagas Creek which would bypass flows from entering East Little Llagas Creek;

> Construction of permanent access roads on both banks within permanent easements for construction and maintenance access;

> Construction of reinforced concrete boxes (RCB) of rectangular cross sections, which are sized to pass the design flood flow under roadways and at tributary junctions;

> Installation of a stream gage near the Church Avenue Ponds

> Relocation of homes, farm structures, and all wells where they are within the ROW;

> Relocation of utility and other public service facilities within the ROW;

> Instream aquatic habitat enhancements to provide cover and rearing for fish in Reaches 4, 5, 6, and 7A; and,

> Stream operation and maintenance activities.

This alternative would provide an increased level of flood management for urban areas, specifically: a 1-percent flood in Morgan Hill (Reaches 8, 7A, and 7B); 10-percent flood management for the semi-urban area around East Little Llagas Creek (Reach 14); and, avoid induced flooding elsewhere on Llagas Creek (Reaches 6, 5, and 4) due to upstream improvements. The extent of floodplain inundation associated with a 1-percent flood event is shown on Figure 2.4-1.

Descriptions of the various components of the NRCS Alternative are provided in the following subsections on a reach-by-reach basis, starting with the most downstream Reach 4 and going upstream to Reach 8, and last, Reach 14.

2.5.1 NRCS Alternative Features

Reach 4 (East Little Llagas Creek to Buena Vista Avenue)

Reach 4 (Figure 2.1-7) is typically dry in the summer and fall months, and has the smallest existing conveyance capacity in the Project watershed. The design flow objective for Reach 4 is to increase capacity to avoid any additional flooding that, potentially, could be caused by upstream improvements. Design capacity would be 7,120 cfs at Buena Vista Avenue.

Modifications to Llagas Creek in Reach 4, would consist of widening and deepening the channel (Figure 2.4-2). Channel bottom width is 30 feet, with a bankfull channel width approximately 40 to 50 feet and 3 feet deep. The existing channel alignment would generally be preserved, except in the most downstream portion of the reach where the alignment would be shifted slightly to the south to avoid loss of structures on the north bank of the creek. Some native shrubs and hardwood trees would be removed to allow for channel widening. These areas would be revegetated using site specific native species consistent with a mitigation plan discussed under Section 3.4, Botanical Resources.

Two maintenance roads would be provided along Reach 4, one on each side of the creek. Access to the maintenance roads would be at Masten Avenue, Rucker Avenue, Buena Vista Avenue, and Denio Avenue. Three drainages (Rucker Creek, an unnamed local drainage south of Masten Avenue, and an unnamed local drainage channel upstream of Buena Vista Avenue) would be culverted at their confluence

with Reach 4 to allow continuous maintenance access. To allow excavation to deepen the channel, underpinning or some other structural modification to shore up the stability of the footings of the existing bridge at Masten Avenue and Llagas Avenue would be needed.

Three grade control structures, constructed of natural boulder materials and in a manner that contributes to habitat where feasible, would be installed in the channel. The grade control structures are mostly buried, except where exposed at the surface of the channel bed. Rock slope and toe armoring would be needed at only two key locations along the outside of meander bends to protect against erosion. The grade control structures ensure that there would be no channel down-cutting. There are two residential homes within the construction footprint (see Table 2.4-1).

The channel downstream of Buena Vista Avenue, approximately 800 feet, will be widened and deepened through the location of an existing fish ladder. The antiquated denil style fish ladder does not properly function (Martin, Pers. Comm., 2013) and would be removed along with the grouted concrete rock just downstream of Buena Vista Avenue so as to not induce flooding associated with upstream improvements. The channel will be evaluated at the fish ladder so that a new design which will meet NMFS depth and velocity criteria for steelhead fish passage can be implemented. The new design will take into account the hydrologic and hydraulic conditions with the Project in-place.

Instream complexity features are included in this reach to assist with migration of anadromous fish during moderate to high flows: approximately 12 clusters of log-root wad structures, 19 stream boulders, and 20 triangular boulder clusters. All of these habitat features provide steelhead and other fish species with cover and velocity breaks to improve rearing and passage. Examples of these instream habitat features are provided in Appendix D. Gravel and cobble excavated to deepen the channel would be returned to the channel bed.

Reach 5

The design flow objective for Reach 5 (Figure 2.1-6) is to increase capacity to avoid any additional flooding caused by upstream flow conveyance modifications. Design capacity would be 3,280 cfs. Reach 5 is typically dry in the summer and fall months.

Channel modifications would be similar to Reach 4, with a cross-section that includes a sinuous low-flow channel, a bankfull channel with benches approximately 30 feet in total width and engineered banks that are 3H:1V slope on either side of the channel (Figure 2.4-2). Channel widening for hydraulic improvement would be limited to one bank, where possible, to preserve existing stands of mature vegetation. Channel dimensions would be similar to those in Reach 4.

Reach 5 would be realigned to split flow around a new mid-channel bar, about 60 feet wide, immediately upstream of the confluence with East Little Llagas Creek. The majority of the flow would travel to the north of the bar, increasing overall channel length. The remaining flow would travel in the existing Reach 5 alignment, south of the bar. The expanded bankfull channel width and bar configuration would be a focal point for sediment deposition and thereby reduce downstream maintenance. The accumulated sediment could be naturally removed during high flows to reduce downstream erosion and incision, or would be removed by the SCVWD as part of its maintenance activities, should it be necessary to do so. This area would also collect various types of debris (e.g. woody or trash) and thus reduce maintenance and potential hazards in the downstream channel.

Maintenance roads 18 feet in width, would be constructed on both sides of the creek in the same manner as for Reach 4. As maintenance access from U.S. 101 would not be feasible due to traffic and permitting issues, connecting roads would be constructed to Kannely Lane and Lena Avenue.

Two grade control structures constructed of natural boulder materials (and in a manner that contributes to habitat where feasible), would be installed in the channel. Instream complexity features (Appendix D) would be installed for aquatic habitat including approximately two clusters of log-root wad structures, 23

stream boulders, two wing deflectors, and three groupings of large woody debris, most of which would be placed around the upstream and downstream end of the mid-channel bar near the confluence with East Little Llagas Creek. Gravel and cobble would be left in the channel bed.

The improved slopes of the channel would be revegetated, consistent with requirements for maintaining hydraulic capacity. Revegetation is discussed as part of a mitigation plan, under Section 3.4, Botanical Resources.

Reach 6

The flow objective for Reach 6 (Figure 2.5-1) is to increase capacity to avoid any additional flooding caused by upstream flow conveyance improvements. The existing channel alignment would generally be followed throughout the reach, except for shifts to avoid structure loss, high quality vegetation, and imposition on local industry. Design capacity would be 3,280 cfs at the Church Percolation Ponds. A 6,600-foot segment of Reach 6, from Lake Silveira to about San Martin Avenue is a perennially flowing stream, continuously supported by releases from Chesbro Reservoir. Downstream from approximately San Martin Avenue, Reach 6 returns to an intermittently flowing channel as water percolates through the streambed to groundwater.

Channel improvements would be similar to Reaches 4 and 5, with a cross-section that includes a sinuous low-flow channel, a bankfull channel with benches approximately 30 feet in total width where they occur on both sides of the channel and engineered banks that are 3H:1V slope on one side of the channel (Figure 2.4-2). Channel widening for hydraulic improvement would be limited to one bank, where possible, to preserve existing stands of higher quality mature vegetation.

Reach 6 would include a widened section at the first bend downstream of Llagas Avenue. The expanded bankfull channel width and benches (40 feet to 80 feet wide on both sides of the bankfull channel) would be designed to induce sediment deposition during high flows. This creates a focused area for sediment and debris accumulation where it can readily be removed by the SCVWD during maintenance activities, thereby reducing maintenance in the downstream channel.

Similar to Reaches 4 and 5, 18-foot-wide all-weather maintenance/access roads typically would be constructed on both sides of the channel. Some portions of the reach provide the opportunity to use existing roads and driveways for maintenance access. Access to top of bank maintenance roads would be constructed at Llagas Avenue, Kimble Court, East San Martin Avenue, Church Avenue, and Murphy Avenue.

There are five existing bridge crossings within Reach 6: Monterey Highway, Union Pacific Railroad (UPRR), Llagas Avenue, San Martin Avenue, and Church Avenue. The existing bridges would not be altered. Two local drainages south of Llagas Avenue would be diverted into culverts at their confluence with Reach 6 to allow continuous maintenance access. Underpinning, or some other structural modification to allow a lower flowline, would be performed at Masten Avenue and Llagas Avenue. Twenty-six grade control structures, constructed primarily of natural materials and in a manner that contributes to habitat where feasible, would be installed at various locations along the channel. There are 11 locations requiring some rock slope protection. There are three residential homes within the Project construction footprint in Reach 6. The inlet pipe to the SCVWD most upstream percolation pond would be reconstructed at a new location to accommodate the channel deepening and widening. This will allow flow in Llagas Creek to continue to be diverted into the pond at the same discharges as under existing operations. A new stream gage would be installed near the new diversion.

The greatest concentration of instream habitat features would be constructed in Reach 6, primarily to improve rearing and passage for steelhead since a portion of this stream reach is perennial. Instream complexity features include approximately 11 clusters of multiple log-root wad structures, 37 stream boulders, 28 wing deflectors, and 61 groupings of large woody debris. Additionally divide logs would be installed in the perennial section of Reach 6.

The improved slopes of the channel would be revegetated, consistent with requirements for maintaining hydraulic capacity. Revegetation is discussed as part of a mitigation plan, under Section 3.4, Botanical Resources.

Reach 7A

The design flow for Reach 7A is to provide capacity for 2,090 cfs. The alignment, shape, and dimensions of the channel are described above in Section 2.4.1.

Upstream of Watsonville Road, the existing diversion channel would need to be widened and deepened. There are three existing fixed points that control channel alignment: the confluence with West Little Llagas Creek; the existing, but buried/inoperable bridge crossing at Watsonville Road; and the existing, but buried bridge crossing at West Middle Avenue. Both bridges are buried to the bottom of their respective superstructures. The new channel would be aligned through both bridges, which would be exhumed during construction. The bridges were constructed by the SCVWD and are sized to carry the 1-percent flood.

In Reach 7A there are no structures within the project footprint requiring relocation.

Similar to other reaches, an 18-foot-wide maintenance/access road would be constructed on both sides of the channel where feasible. Access points would be provided at Middle Avenue, Watsonville Road, La Via Azul Court, and La Crosse Drive. Existing roads would provide shared access for maintenance where possible. Currently, a bike path straddles the top of the channel bank in the most upstream portion of Reach 7A. This bike path would be removed by the Project. A maintenance road will be constructed on the improved bank which would be available for a future trail and/or bike path subject to an agreement between the SCVWD and the City of Morgan Hill. Such a future improvement would require separate environmental review before approval. Additionally, the existing pedestrian bridge over West Little Llagas Creek just upstream from Watsonville Road would be removed.

Some limited instream complexity features would be included at the lower end of Reach 7A including approximately three log-root wad structures, two large woody debris elements, and one triangular boulder cluster. Revegetation is considered and discussed as part of a mitigation plan, under Section 3.4, Botanical Resources. Several pools would also be constructed at the lower end of Reach 7A to improve aquatic habitat.

Seven grade control structures, constructed primarily of natural materials and in a manner that contributes to habitat where feasible, would be installed at various locations along the channel. Armored rock bank slope protection would be needed at one location for erosion control and bank stability. A grade control structure would be constructed below Lake Silveira on Llagas Creek where the Reach 7A channel connects to Llagas Creek. This structure would be comprised of boulder materials, and would be configured as a step-pool sequence. The purpose of this structure is to smoothly transition the channel invert and energy grade on Llagas Creek to the new (lower) channel elevation at the confluence with the Reach 7A channel.

Reach 7B

Reach 7B modifications would provide conveyance for 1,130 cfs at upstream end of Reach 7B and 1,580 cfs at downstream end. Channel design improvements to Reach 7B are similar to Reaches 4, 5, and 6 as described in Section 2.4.1, and would include widening and deepening the existing channel and replacing existing or installing new box culverts. Benches would occur on both sides of the channel along most of the reach. Channel widening would occur on both banks, depending on ROW limitations, with bank slopes between 2H:1V to 3H:1V. Top width would be about 90 to 100 feet, channel bottom would be about 12 feet wide, and channel depth would be approximately 10 to 12 feet.

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FIGURE 2.5-1
NRCS Alternative
Reach 8

Cardno ENTRIX

The general existing channel alignment would be maintained, except near Cosmo Avenue. The channel section near Cosmo Avenue would be realigned approximately 100 feet to the west to stay within SCVWD ROW and to utilize larger culverts that appear to have been included in a previous Cosmo Avenue retrofit or expansion.

A 1,100-foot section of the existing channel, approximately 200 feet downstream and 900 feet upstream of Cosmo Avenue, would be abandoned and a new channel would be constructed.

The creek channel crosses seven roads in culverts between West Dunne Avenue and La Crosse Drive: Ciolino Avenue, Spring Avenue, Cosmo Avenue, Edes Court, West Edmundson Avenue, North La Crosse Drive and South La Crosse Drive. Some of the existing culverts are undersized and are not capable of conveying the 1 percent flood, thereby resulting in the need for modifications as follows:

> The existing triple culverts at Cosmo Avenue and Edes Court would be expanded by adding a fourth RCB (10 feet by 7 feet) to the existing configuration;

> The existing culvert at Spring Avenue would be replaced with a new triple RCB culvert (three boxes, each 10 feet by 9 feet in size); and

> The existing culvert from Ciolino Avenue to West Dunne Avenue would be replaced with a 674-foot long box culvert that is 8 feet wide and 8 feet deep.

Associated with the West Little Llagas Creek channel deepening, a grade control structure would be constructed at the downstream end of Edmundson Creek at the confluence to transition the Edmundson Creek channel to the new, lower elevation of the West Little Llagas Creek channel. Three other grade control structures would be installed in the reach. There is one residential structure in Reach 7B located within the project footprint (Table 2.4-1).

There is a paved pedestrian pathway between Edes Court and La Crosse Drive on the south side of the channel where the planned maintenance road and pathway would overlap at a couple of locations. Where this occurs the path would be removed and the SCVWD maintenance road would be constructed in its place. As discussed above for the trail section in Reach 7A, maintenance road would be available for improvement as a future pedestrian pathway subject to an agreement between the SCVWD and the City of Morgan Hill. Such a future improvement would require separate environmental review before approval.

There would be no instream complexity features installed in Reach 7B. Shallow pools would be constructed to help generate appropriate instream habitat.

The improved slopes of the channel would be revegetated, consistent with requirements for maintaining hydraulic capacity. Revegetation is discussed as part of a mitigation plan discussed in Section 3.4, Botanical Resources.

Reach 8

Channel improvements through the urbanized City of Morgan Hill in Reach 8 begin at Llagas Road and extend downstream to West Dunne Avenue. The improvements would provide flood conveyance capacity for the 1-percent storm flow of 640 cfs at Wright Avenue and 1,130 cfs at West Dunne Avenue. The design for Reach 8 would include the following improvements (Figure 2.5-1):

> Remove the flow constricting plate at the Llagas Road culvert at the upstream boundary of the Project to reduce upstream flooding. The channel will be deepened and widened along a 2,500-foot section of channel downstream from Llagas Road to Hillwood Lane.

> Widen and deepen approximately 600 feet of channel between Wright Avenue and Hillwood Lane with an 8-foot deep trapezoidal channel, with a 20-foot bottom width and 70-foot top width. This channel would be designed to pass the 1-percent flow.

> Widen and deepen approximately 3,000 feet of channel between West Dunne Avenue and Main Avenue to form a trapezoidal vegetated channel, a channel with two vertical walls, or a hybrid section (Figures 2.4-3, 2.4-4, and 2.4-5, respectively), as appropriate depending upon the ROW available.

> Replace approximately 2,200 feet of the existing creek between Main Avenue and Wright Avenue with two 10-foot wide by 7- to 8-foot deep reinforced concrete box culverts following the existing stream alignment, but under Hale Avenue. Replace culverts at West Main Avenue and Wright Avenue (Table 2.5-1). There would be no changes to the culverts at Llagas Creek Drive or at Hillwood Lane.

> Replace five additional existing undersized culverts with new culverts, 10 feet wide by 9 feet deep, at the following locations: 5th Street, 4th Street/Monterey Highway, 3rd Street, 2nd Street/Del Monte Avenue, and Warren Avenue.

Maintenance roads would be constructed downstream from Llagas Road to Hillwood Road. There would be no maintenance roads in the downtown area of Morgan Hill. Equipment and materials would be inserted and removed from the channel at road crossings as necessary. Maintenance would be performed from the channel bottom to reduce the overall footprint.

Grade control is provided by the frequent culvert crossings. One grade control structure would be located just upstream from Llagas Road. The improved slopes of the channel would be revegetated, consistent with requirements for maintaining hydraulic capacity. There are no instream aquatic habitat improvements. There are eight residential structures within the Reach 8 Project footprint (Table 2.4-1).

Table 2.5-1 Proposed and Existing Culverts for Reach 8

Reach 8 Location	Proposed Design			Existing		
	Roadway Width (ft)	Culvert Size # -w(ft) x h(ft)	Type of Crossing	Roadway Width (ft)	Culvert Size w (ft) x h (ft)	Type of Crossing
5th Street	60	2 – 10 x 9	RCB	60	5 x 5	RCB
4th Street/ Monterey Hwy	270	2 – 10 x 9	RCB	270	9 x 6	RCB
3rd Street	14	2 – 10 x 9	RCB	14	14 x 7	RCB
2nd Street/ Del Monte Avenue	250	2 – 10 x 9	RCB	250	10 x 5	RCB
Warren Avenue	40	2 – 10 x 9	RCB	40	10 x 5	RCB
Main to Wright along Hale Ave (Future Santa Teresa Expwy).	2200	2 – 10 x 7-8	RCB	N/A	--	--
Main Street	N/A	--	--	70	9 x 5	RCB
Wright/Hale Avenue	N/A	--	--	110	60”	RCP

RCB = reinforced concrete box culverts

RCP = reinforced concrete pipe

N/A = not applicable

Reach 14

Channel improvements in Reach 14 provide conveyance capacity for the 10-percent flood (1,560 cfs at Corralitos Creek confluence to 3,450 cfs at the Llagas Creek confluence). The proposed design consists of channel widening using a trapezoidal cross-section with a sinuous low-flow channel, a bankfull channel, with narrow-width benches and engineered banks at 3H:1V slope (Figure 2.4-2). Channel widening for hydraulic improvement would predominantly occur on both banks, but where possible would be limited to one bank to preserve existing stands of riparian habitat. Benches would be mostly narrow

width, about 5 feet on one or both sides of the channel. In some areas (e.g., at crossings and confluences), the benches are eliminated to allow for additional capacity and/or to allow natural deposition patterns to form. Channel bottom width is 30 to 40 feet. Excavation depths to the new channel bed would be about 2 feet or less in the upstream half of the reach, up to about 4 feet deep in the downstream half of the reach.

Two tributary streams, Church Creek and San Martin Creek, and an unnamed drainage would be culverted at their confluence with Reach 14 to allow continuous maintenance access. Similar to other reaches, an 18-foot-wide maintenance road would be constructed on both sides of the channel. The maintenance road on the east side of Reach 14 already exists but would be replaced. The existing maintenance road on the west side of Reach 14 would need to be relocated due to channel expansion. Access to the top of bank maintenance roads would be provided at Sycamore Avenue, East San Martin Avenue, and Church Avenue.

Twenty-one grade control structures, constructed primarily of natural materials would be installed along the channel. There are four existing culverts within Reach 14, Church Avenue, San Martin Avenue, Sycamore Avenue, and Middle Avenue. The existing culverts are capable of conveying the 10-percent flood, so no modifications to these culverts are needed.

There are no instream aquatic habitat improvements planned for Reach 14. The improved slopes of the channel would be revegetated as appropriate for soil conditions, and consistent with requirements for maintaining hydraulic capacity. Revegetation is discussed as part of a mitigation plan, under Section 3.4, Botanical Resources.

2.5.2 NRCS Alternative Construction

Table 2.4-2 shows the construction schedule by reach for the NRCS Alternative. Construction is estimated to last for a total duration of 5.5 years. The construction activities are described under Section 2.4.3.2.

Preliminary estimates of earthwork quantities for the NRCS Alternative are shown in Table 2.4-3. About 1,355,500 bank cubic yards[18] (bcy) of spoil would require disposal, which would require approximately 223,800 round truck trips[19] primarily to Anderson Dam (111,900 trips to the Dam and 111,900 trips returning from the Dam) over 5.5 year construction period (with 12 CY truck capacity). Some of the excavated material will also go to filling Lake Silveira to create wetland habitat, and some material may be reused on-site where fill or soil materials are needed. The number of truck trips will be roughly equal between Phase 1 and Phase 2 of construction. Construction materials and disposal are described in Section 2.4.3.3. Table 2.4-4 shows the types of equipment and construction crew size needed. Staging areas for construction work are described in Section 2.4.3.5 and shown on Figure 2.4-6. Construction BMPs are discussed in Section 2.4.3.6.

2.5.3 Easements and Land Requirements

The NRCS Alternative encompasses 263 acres of easements needed in order to construct the Project. The Project ROW would require the SCVWD to acquire private residential properties, agricultural lands, and some lands used for commercial/industrial businesses. Details on the types of land-uses and associated acreages within the project footprint are addressed in Section 3.8, Land Use and Planning.

[18] One Bank Cubic Yard (BCY) equals 27 cubic feet (3'x3'x3') of earth in situ. When excavated and loaded loosely into a truck, the original one BCY of material is less compacted, expanding to approximately 1.2 Cubic Yards (CY).

[19] See section 3.10 Traffic and Circulation for definition of a “truck trip”.

There are a total of 12 residential homes, 11 greenhouses, 21 outbuildings (e.g., sheds, storage buildings), and 5 miscellaneous/unknown structures with the construction footprint (see Table 2.4-1) all of which may need to be relocated. One of the residential properties is owned by the SCVWD. One property at the upstream end of Reach 6 is a food processing company where Llagas Creek would be widened, requiring infrastructure to be relocated including a pipe bridge and some facility parking spaces to accommodate the additional cross-sectional area. There are no structures within the construction footprint of Reach 7A.

2.5.4 Utilities

Utilities include underground and overhead utility lines that provide water, gas, electricity, sewer, storm drains, cable, phone, fiber optics, and other utility services throughout the Project area. There are also miscellaneous features, such as fences, that would need to be removed and potentially relocated. Utilities located within the Project easement footprint would be either protected in place, rebuilt in place, abandoned, or demolished and relocated prior to construction. Sewer lines and storm drains may be relocated at the beginning of construction. Utilities are located in all reaches of the NRCS Alternative; however, most of the utilities that would need to be relocated are in the urbanized Reaches 7B and 8. All utilities that are within the Project easements will be identified and their disposition will be determined during preparation of the final engineering design plans.

2.5.5 Operations and Maintenance

SCVWD would be responsible for maintaining all Project features, such as the channel, culverts, roads, fences, and grade control structures consistent with SCVWD and USACE guidelines. Adequate vegetation and sediment maintenance are key factors to maintaining the flow capacity of the channel and culverts. Additionally, maintenance is required for the access roads, for the structural integrity and functioning of the culverts and grade control structures, and for installed aquatic habitat enhancements. The maintenance methods and activities are described in Section 2.4.5. Tables 2.4-6, 2.4-7, 2.4-8, and 2.4-9. Each table provides a reach-by-reach description of the expected frequency, method, and target hydraulic roughness characteristics for different portions of the channel under maintained conditions.

2.6 Tunnel Alternative (Preferred Alternative)

The SCVWD considered and developed the Tunnel Alternative because there was an opportunity to reduce the Project footprint associated with the NRCS Alternative in Reach 8. The Tunnel Alternative would require a smaller ROW, reduce the amount of vegetation to be removed and excavation needed along the existing West Little Llagas channel, reduce the extent of utilities to be relocated, and reduce the culvert replacements required, which would result in less construction related interference with commercial and residential areas. The Tunnel Alternative is designated the Preferred Alternative.

2.6.1 Preferred Alternative Features

The Preferred Alternative would provide the same 1-percent flood management as the NRCS Alternative in Reach 8 protecting downtown Morgan Hill. All other Project reaches would have the same level of protection, and the same Project features would be constructed as described for the NRCS Alternative. The key feature of the Preferred Alternative is to use an underground concrete tunnel instead of channel widening and deepening proposed through downtown Morgan Hill under the NRCS design. The main components of the Preferred Alternative (Figure 2.6-1) would include:

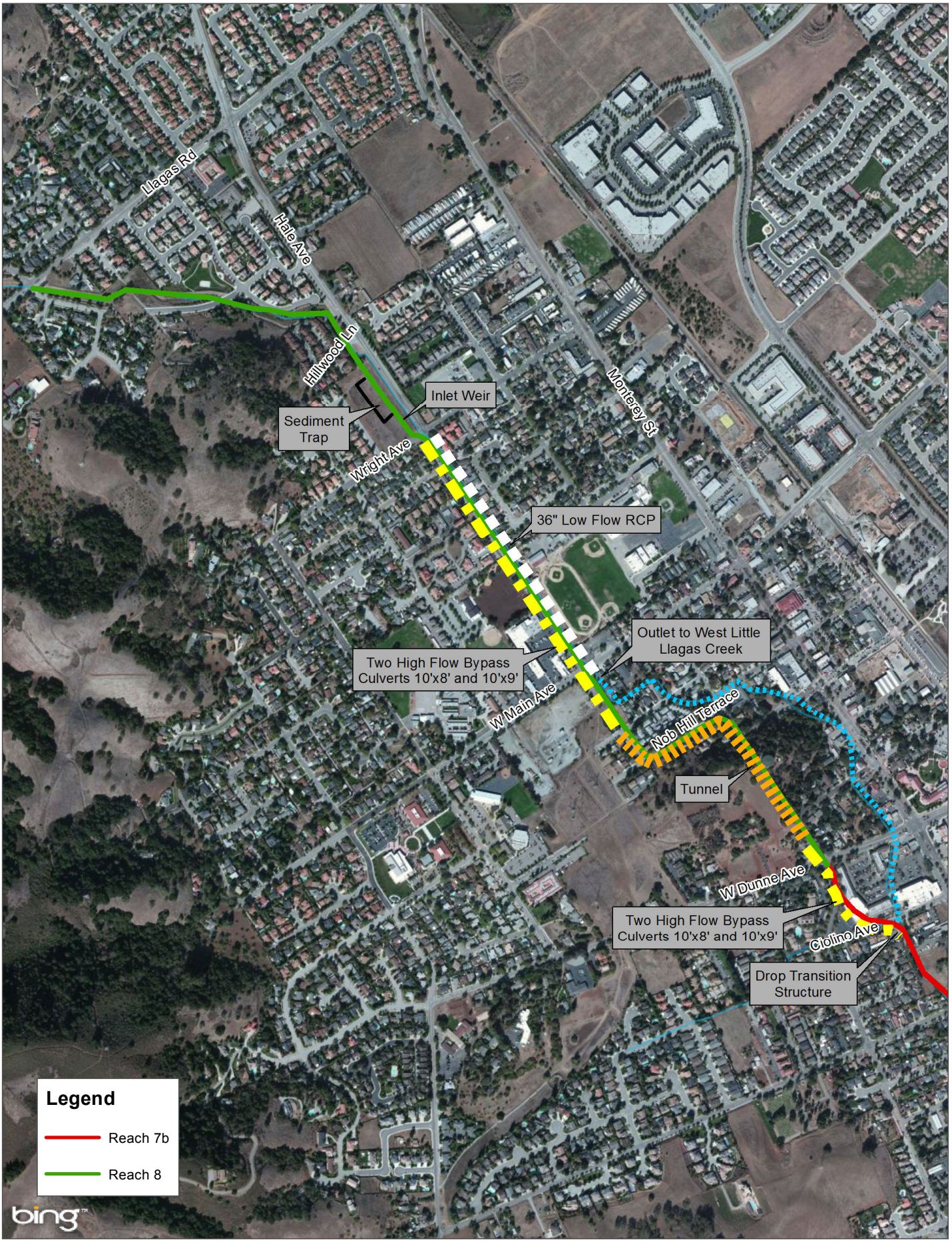

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FIGURE 2.6-1
Tunnel Alternative
Reach 8

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> A 250-foot-long sediment trap and an inlet weir (diversion) structure would be constructed in the 600 feet of channel between Wright Avenue and Hillwood Lane. A new 18-foot-wide maintenance/access road would be installed along the sediment detention basin at the top of the south bank of the channel between Hillwood Lane and Wright Avenue.

> A 36-inch-diameter reinforced concrete pipe (RCP) culvert would be constructed paralleling Hale Avenue, stretching from the weir structure 2,400 feet downstream and discharging into the existing West Little Llagas Creek channel south of West Main Avenue. The 2,400-foot-long earthen channel section of West Little Llagas Creek between Wright Ave and West Main Ave would be replaced with the RCP culvert. The RCP culvert would maintain low flows up to 50 cfs in the existing creek through the downtown area without exceeding the channel capacity.

> Two high flow bypass culverts would be constructed. One would be 10 feet by 8 feet in size, while the other would be 10 feet by 9 feet in size. Both culverts would extend from the weir structure parallel to Hale Avenue and stretch 2,750 feet to Warren Avenue where they would convey high flows to the tunnel.

> A 2,100-foot-long tunnel would be constructed, extending under Nob Hill between Warren Avenue and Del Monte Avenue, continuing under Nob Hill Terrace. This modification also includes using open cut box culverts for transition to and from the tunnel, and construction of a tunnel portal at the upstream end.

There would be no change to the existing culverts at 5th Street, 4th Street/Monterey Highway, 3rd Street, 2nd Street / Del Monte Avenue, and Warren Avenue, nor would the channel be widened and deepened in this section of Reach 8 as proposed under the NRCS Alternative. The flow constricting plate at the Llagas Road culvert at the upstream boundary of the Project would be removed to reduce upstream flooding. The channel would be deepened and widened downstream from the bridge to the inlet of the sediment detention basin near Hillwood Lane.

Also as part of this alternative, Reach 7B would be modified as follows:

> Double box culverts would be constructed; one 10 feet by 8 feet in size, and the other 10 feet by 9 feet in size, from the tunnel outlet at West Dunne Avenue to downstream of Ciolino Avenue. The Preferred Alternative differs from the proposed NRCS design, which would replace the existing culvert along the current alignment of West Little Llagas Creek.

Aquatic habitat enhancement features identified in Section 2.5.1 under the NRCS Alternative would be the same for the Preferred Alternative. Examples of the habitat enhancement features are provided in Appendix D.

2.6.2 Preferred Alternative Construction

The construction approach for the Preferred Alternative would be the same throughout the entire Project reaches as previously described in Section 2.4.3 and as described for the NRCS Alternative. The key difference would be that a tunnel and a sediment detention basin would be constructed, and much of the channel widening, deepening, and culvert replacement construction in Reach 8 through downtown Morgan Hill (Section 2.5.1) would be avoided.

2.6.2.1 Construction Schedule

Construction duration for the Preferred Alternative would be 5.5 years, with the construction lasting for about 36 months in Reach 8, which is the same duration to construct Reach 8 and total Project duration under the NRCS Alternative (Tables 2.4-2 and 2.4-4).

2.6.2.2 Construction Activities, Equipment, and Crews

Construction activities would be the same as those described under Section 2.4.3.2 and for the NRCS Alternative, except that in Reach 8 several thousand feet of RCP and RCB culverts would be buried adjacent to Hale Avenue, the tunnel would be constructed under the Nob Hill Terrace neighborhood, and a sediment detention basin would be constructed near Hale Avenue and Wright Avenue.

The tunnel would be excavated toward the south from the Hale Avenue Portal work area toward Del Monte Avenue near Dunne Avenue. The Project would use conventional mining equipment and methods to excavate the tunnel, namely roadheaders, excavators, and controlled detonations. A roadheader is a boom-mounted cutting head, mounted on a crawler that cuts through the rock face (Figures 2.6-2 and 2.6-3). As the roadheader tunnels forward, the excavated material would be transported from the tunnel face back to the tunnel entrance or shaft using electric-powered muck trains on a temporary railway in the tunnel and/or diesel-powered load-haul-dumps (LHD), also called muck trucks (Figure 2.6-4). The LHD scoops up muck from the tunnel bottom and transports it to the tunnel portal where it is loaded onto dump trucks for disposal. In very soft zones, a bucket excavator may be used.

Figure 2.6-2 Typical Roadheader Used for Tunnel Excavation in Soft to Medium Strength Rock

Figure 2.6-3 Roadheader Excavation with Steel Sets at the Face of a Tunnel

Figure 2.6-4 Load, Haul, Dump (LHD) Unit

In sections of harder rock, controlled detonations would be used to fracture the rock in advance of the roadheader or bucket excavator. Controlled detonation is performed by drilling small holes in a specified pattern in the rock face (Figure 2.6-5), packing them with small amounts of explosive and primer (Figure 2.6-6 a, b, and c), and detonating the explosives using a specified time delay between successive detonations. The detonations would sound like a short succession of thunder generally lasting a few seconds. Controlled detonation methods would adhere to stringent state and federal safety requirements and would also be conducted in accordance with local noise ordinances. Typically, less than 20 pounds of explosives per delay would be used. If explosives are stored at any of the work areas, they would be kept in specially designed and secured containers or magazines in accordance with state regulations (California Code of Regulations, Title 8, Division 1, Chapter 4).

Figure 2.6-5 Drill Jumbo for Drilling Holes

Figure 2.6-6 a, b, and c—Photographs of Controlled Detonation Preparation

Tunneling is anticipated to advance at a rate of approximately 15 to 25 feet per day; however, the advancement rate would vary depending on geological conditions encountered and other factors. In addition, the Project would implement a two-stage lining system. The first stage or initial tunnel support may be provided by steel sets and lagging, rock bolts or dowels, wire mesh, shotcrete, lattice girders, or some combination of these methods (Figure 2.6-7). The purpose of the initial support is to provide a stable and safe work environment and help control groundwater inflow.

Figure 2.6-7 Tunnel with Steel Rib and Wood Lagging Initial Support

The second stage involves installing a final liner of concrete throughout the tunnel intended to provide long-term structural support, to provide a relative smooth surface to enhance flow capacity, and to reduce maintenance and enhance safety. For the project tunnel, the final lining would likely consist of eight to twelve inches of shotcrete.

Portions of the tunnel would have a small amount of cover between the top of the tunnel and the street. At these locations, it would be necessary to inject grout into the loose soil to bind the soil together, which would allow the tunnel to be excavated without causing surface settlement. The three areas to be pre-grouted are Hale Avenue southeast of Warren Avenue (250 feet), the intersection of Nob Hill Terrace and Del Monte Avenue (180 feet on Nob Hill Terrace and 70 feet on Warren Avenue), and Del Monte Avenue (approximately 150 feet north of Dunne Avenue for a length of 70 feet). The equipment used for pre-grouting is a drill rig truck and a grouting truck.

Before the tunnel can be constructed, a tunnel portal would need to be constructed. In general, a tunnel portal is a vertical shaft from which the tunnel is constructed. The size of the portal would be approximately 40 feet long by 30 feet wide. It would be approximately 30 feet deep. It would be located in

a vacant parcel just north of the intersection of Warren Avenue and Hale Avenue. The portal excavation would be supported by steel sheet piles. It would take approximately three weeks to construct the portal. The steel sheet piles would be installed using vibratory pile drivers and/or impact pile drivers. Soil within the portal would be removed using a large excavator. The material would probably be temporarily stockpiled on site then loaded into dump trucks using a wheeled loader for disposal. Power (electricity) is needed in the tunnel and around the portal site. Power may be brought to the site from existing power lines. Power may also be generated on-site using a temporary diesel generator.

Due to the intensity, duration, and proximity of construction activities to the nearby residences, two temporary sound barriers (e.g., walls, sound-absorbing blankets) would be installed along some of the work area boundaries. These sound barriers would be designed to provide a minimum 10 A-weighted decibel (dBA) reduction in noise. The final design of the sound barrier would be determined by the contractor to achieve the Project's noise performance standards. For the purposes of this Project description, the barrier is assumed approximately 20 feet high.

2.6.2.3 Construction Materials and Disposal

The construction fill and disposal material volumes for the Preferred Alternative are provided in Table 2.4-3. The material excavated from the tunnel would vary from highly weathered rock at either end to unweathered rock in the middle of the hill. When it is removed, the rock would be in small pieces ranging from gravel-sized pieces to approximately four inches in diameter. Some of the rock may be taken to a SCVWD maintenance yard and temporarily stored and then used later as construction material in maintenance projects. The remaining material would be disposed of in the same manner as the material from the non-tunnel segments, which is expected to be end-hauled predominantly to Anderson Dam for stockpiling and later use, with some material also going to the Lake Silveira element.

2.6.2.4 Staging Areas and Access Routes

The staging areas and access routes would be the same as described under Section 2.4.3.5 and shown in Figure 2.4-6.

2.6.2.5 Construction BMPs

The construction BMPs will be the same as that described in Section 2.4.3.6. Additional BMPs are prescribed specific to the construction of the tunnel (Preferred Alternative and Reach 6 Bypass Alternative) primarily to address potential noise effects. Those BMPs include specific limits on construction hours for spoils hauling, delivery trucks, and use of air supply fans, in addition to other types of BMPs to address potential noise issues. The type of construction with the greatest noise contributions proposed for the Preferred Alternative is the tunnel, which would be constructed using conventional mining equipment and methods to excavate, specifically roadheaders, excavators, and controlled detonations. Controlled detonations would be used in sections of harder rock, to fracture the rock for the roadheader or excavator. Controlled detonation would be performed by drilling small holes in a specified pattern in the rock face, packing them with small amounts of explosive and primer and detonating the explosives using a specified time delay between successive detonations. The detonations would sound like a short succession of thunder generally lasting a few seconds. Controlled detonation methods would adhere to stringent state and federal safety requirements and would also be conducted in accordance with local noise ordinances. Typically, less than 20 pounds of explosives per delay would be used. A Blasting Plan would be prepared for the Project to provide guidelines for the safe use and storage of blasting materials that may be used during construction and would also provide measures to reduce noise, including the following:

> Drill multiple, small charge holes rather than fewer larger holes;

> Retain soil 3 to 4 feet above blasting material before detonation;

> Use blast mats and timing delays;

> Blast small horizontal and vertical areas rather than large areas;

> Stem blast holes with dense sand;

> Direct charges away from the direction of sensitive receptors; and

> Place physical barriers between the detonation site and the nearest receptors.

BMPs have been prescribed specific to the tunnel construction in order to reduce noise associated with the tunneling activity. Some BMPs designed to reduce noise also reduce vibrations. The BMPs specific to tunnel construction are listed below:

> **Fan Noise:** Tunneling will not be allowed at night. The air supply fans will be shut off between 7:30 p.m. and 7:00 a.m.

> **Generator Noise:** Power will be supplied to the site using PG&E facilities. Power will not be generated using portable power generators.

> **Tunnel Access:** The tunnel will have a gate and this gate will be closed and locked when the air fans are not supplying air to the tunnel.

> **Controlled Detonations:** Controlled detonations would be limited to daytime hours between 7:00 a.m. and 8:00 p.m. Monday through Friday and 9:00 a.m. to 6:00 p.m. on Saturdays unless it can be demonstrated by the qualified vibration consultant that nighttime controlled detonations would not exceed the applicable threshold of 0.130 in/sec PPV for transient sources.

  Controlled detonation methods would adhere to stringent state and federal requirements.

> **Storage of Explosives:** Explosives would not be stored at the tunnel portal work area.

> **Neighborhood Notice:** The SCVWD will provide reasonable advance notification to the businesses, owners, and residents of adjacent areas potentially affected by the tunneling about the nature, extent, and duration of the tunnel construction activities. Interim updates should be provided to such neighbors to inform them of the status of the construction.

> **Noise and Vibration Control Plan:** The contractor shall submit a Noise and Vibration Control Plan prepared by a qualified noise consultant. A qualified noise and vibration consultant is defined as a Board Certified Institute of Noise Control Engineering member or other qualified consultant or engineer approved by SCVWD.

> **Noise Monitoring Plan:** The contractor shall submit a Noise Monitoring Plan, which shall at a minimum, include the following:

  – Schedule for tests to confirm the construction noise levels and effectiveness of noise control measures prior to commencement of substantial noise-generating activities, such as grading, earthmoving, demolition.

  – The number and location of monitoring locations and relation to stationary noise controls.

  – Schedule for ongoing monitoring and reporting of construction noise levels to meet performance standards. Monitoring shall occur at least weekly, or more often if needed in response to complaints.

  – Neighborhood notification procedure for controlled detonation activities.

> **Best Available Noise Control Techniques:** Best available noise control techniques (including mufflers, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds)

shall be used for all equipment and trucks in order to minimize construction noise impacts, as necessary, to maintain noise levels below the applicable thresholds.

> **Impact Equipment:** If impact equipment (e.g., jack hammers, pavement breakers, and rock drills) is used during project construction, hydraulically or electric-powered equipment shall be used wherever possible to avoid the noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatically powered tools is unavoidable, an exhaust muffler on the compressed-air exhaust shall be used. The contractor shall use external jackets on the tools themselves and quieter procedures, such as drilling rather than using impact equipment as needed to comply with the established Noise Performance Standards.

> **Stationary Noise Sources:** Stationary noise sources shall be located as far from sensitive receptors as possible. If they must be located near receptors, adequate muffling and/or enclosures shall be used, as needed, to comply with the established Noise Performance Standards. Enclosure opening or venting shall face away from sensitive receptors. If any stationary equipment (e.g., ventilation fans, generators, dewatering pumps) is operated beyond the time limits specified by the pertinent noise ordinance, this equipment shall conform to the affected jurisdictions pertinent day and night noise limits.

> **Material Stockpiles and Maintenance/Equipment Staging and Parking Areas:** Material stockpiles, as well as maintenance/equipment staging and parking areas, shall be located as far as practicable from residential and school receptors. If such areas cannot be feasibly located 200 feet or more from residential receptors, then a temporary sound barrier shall be constructed to block the line of sight between construction equipment and nearby homes.

> **Sound Barriers:** Sound barrier material shall have a minimum surface density of 1 pound per square foot and a minimum sound transmission class rating of 25. Any noise-generating activities associated with initial site preparation and/or building the sound barriers that exceed applicable thresholds shall be restricted to daytime hours and the duration of the activities that exceed applicable thresholds shall not exceed 2 weeks at any one location.

> **Equipment Maintenance and Repair Work:** All construction equipment maintenance and repair work shall be performed during the daytime hours, when feasible. If nighttime repair is necessary to maintain operations during the nighttime hours, hammering, and other high level noise activities shall be performed in such a way that a sound barrier shields the repair activity from the line of sight to the nearby residence.

> **Backup Alarms:** Subject to site safety priorities and consistent with state and federal worker safety laws, the contractor may use administrative controls instead of audible backup alarms to meet the L_{max} Noise Performance Standards. Such administrative control shall provide backup warning on all vehicles that operate in areas where their backward movement would constitute a hazard to employees working in the area on foot, and where the operator's vision is obstructed to the rear of the vehicle (earth moving equipment) (Title 8 CCR, §1592). Administrative controls may include procedures that require a spotter or flagger in clear view of the operator to direct the backing operation, that require the operator to dismount and circle the vehicle immediately prior to starting a back-up operation, and the design of traffic patterns to minimize the need for backward movement. California Occupational Safety and Health Administration (Cal/OSHA) will be consulted to determine whether additional noise reductions may be achieved through Cal/OSHA-approved alternatives to backup alarms without compromising site safety. If Cal/OSHA indicates that such alternatives are a viable option and SCVWD, in consultation with the contractor, determines that site safety would not be compromised, then the contractor shall apply for a variance from Cal/OSHA and use such alternatives consistent with Cal/OSHA requirements. Such alternatives could include, but not limited to:

- "Smart" alarms with an audible range of 77 to 97 dBA, which limit the warning signal to 5 dBA over ambient noise levels.
- Radar presence-sensing alarms, which identify objects in the reversing path of a truck; or the "bbs-tek" broadband backup alarm system, which uses a broadband sound instead of a more noticeable single-frequency sound.
- Strobe lights instead of audible alarms (which are particularly effective at night).

If any of the alternatives described above can be implemented, the use of backup alarms would be avoided (e.g., by routing trucks and equipment to eliminate the need to back up, or by eliminating truck and heavy equipment use at night).

> **Trucks:** The contract specifications shall contain the following requirements to mitigate noise from trucks:

- Offsite truck operations (haul trucks and concrete delivery trucks) shall not occur during nighttime hours and be restricted during evening and daytime hours, as needed, to comply with the established Noise Performance Standards.
- Haul and delivery truck routes shall avoid local residential streets and shall follow local designated truck routes. Total project-related haul and delivery truck volumes on any particular haul truck route shall be limited to 80 trucks per hour.
- Spoils hauling shall occur only between 7:00 a.m. and 8:00 p.m., Monday through Friday and 9:00 a.m. to 6:00 p.m. Saturday, at the tunnel portal work area.
- Delivery trucks shall be prohibited from operating within 200 feet of any residential uses during the nighttime hours (10:00 p.m. to 7:00 a.m.). If there are receptors, but they are beyond 200 feet from the truck route, limited truck operations shall be allowed during the more sensitive nighttime hours, but noise generated by these operations cannot exceed the 50-dBA sleep interference criterion at the closest receptors. If trucks must operate during these hours and residential uses are located within 200 feet of the truck route, deliveries shall be made to staging areas outside residential areas, then transferred to the construction site during daytime hours (7:00 a.m. to 8:00 p.m.).
- A truck route plan for muck truck movements that minimizes backward movement of trucks.
- In the event that the Noise Performance Standards are exceeded, the contractor shall immediately inform SCVWD and provide information to SCVWD within 24 hours of the exceedance, identifying the source of the exceedance (e.g., unusually noisy method, broken muffler, emergency repair) and identifying the corrective actions that are being taken to reduce the noise.
- In the event that complaints are received regarding noise, the contractor shall immediately inform SCVWD and evaluate whether the noise-generating activity that is the subject of the complaint exceeds applicable thresholds. If determined to exceed the applicable thresholds, the noise-generating activity shall be immediately stopped and/or corrective measures implemented so that the thresholds are no longer exceeded. Subsequently, the contractor shall provide information to SCVWD within 24 hours regarding the noise levels measured and activities that correspond to the complaints. The effectiveness of implemented noise control measures shall be verified and/or corrective actions shall be taken by the contractor to ensure that future exceedances are minimized.

> **Preconstruction Crack Survey:** Prior to construction, SCVWD shall conduct a preconstruction crack survey at homes (where permission is granted) within 225 feet (slant distance) of planned controlled detonations to document existing cosmetic and structural cracks. If complaints of new cracking are made to SCVWD by nearby property owners, SCVWD shall evaluate the claim(s) relative to the baseline crack survey and vibration monitoring data collected during construction. If the claim is verified, then SCVWD shall repair the project-related damage at no cost to the property owner.

> **Blast Overpressure:** Blast overpressure shall be limited to 0.0145 psi or 134 decibels (dB) at nearby residences. The contract specifications shall require the contractor to notify neighbors at the portals within 500 feet of near-surface detonation activity of the construction activity schedule and to advise residents to remove precious and fragile items from walls and shelves. The contract specifications shall require the contractor to notify neighbors within 500 feet slant distance of underground detonation activity (away from the portals) of construction activity schedules.

2.6.3 Easements and Land Requirements

The easement acreage of the Preferred Project encompasses 262 acres. This includes permanent easements for operations and maintenance and a temporary construction easement, which is needed in order to construct the Project.

The number of structures located within the project footprint that may need to be relocated in each reach are the same as that described for the NRCS Alternative (Table 2.4-1), with the exception of 6 residential structures in Reach 8 that will not be within the Preferred Alternative ROW. As such, there are a total of 6 residential structures, 11 greenhouses, 21 outbuildings, and 5 miscellaneous structures within the construction footprint under the Preferred Alternative. Details on the types of land-uses and associated acreages within the Project footprint are addressed in the Land Use and Planning section in Chapter 3.

2.6.4 Utilities

Utilities include underground and overhead utility lines that provide water, gas, electricity, sewer, storm drains, cable, phone, fiber optics, and other utility services throughout the Project area. There are also miscellaneous features, such as fences, that would need to be removed and potentially relocated. Utilities located within the Project easement footprint would be either protected in place, rebuilt in place, abandoned, or demolished and relocated prior to construction. Sewer lines and storm drains may be relocated at the beginning of construction. Utilities are located in all reaches of the Preferred Alternative; however, most of the utilities that would need to be relocated are in the urbanized Reaches 7B and 8. Utilities would be protected in place during construction if they were not to be abandoned or replaced. All utilities that are within the Project easements will be identified and their disposition will be determined during preparation of the final engineering design plans.

2.6.5 Operations and Maintenance

Operations and maintenance would be the same as described in Section 2.4.5, and is the same as that expected for the NRCS Alternative in all Project reaches, with a few differences in Reach 8. The Preferred Alternative would include a sediment detention basin near the upstream boundary of the Project in Reach 8. The detention basin would function to capture sediments transported from the West Little Llagas Creek drainage upstream of the Project, thereby reducing the need to conduct sediment maintenance in downstream reaches, including the culverts and tunnel sections in Reach 8. To maintain the detention basin function it would periodically need to be excavated with the removed sediments end-hauled off-site. The detention basin would have a maintenance road along its south side. The section of West Little Llagas Creek, past the portal intake just downstream from W. Main Avenue through downtown Morgan Hill, would not be within the construction footprint; and there are no SCVWD maintenance easements in this section of channel. Therefore, there would be no maintenance activities by SCVWD in association with this channel segment under the Preferred Alternative.

There would be three types of access to the box culverts and tunnel in Reach 8. First, there would be major access points where panels can be removed to lower equipment into the culverts and tunnel such as bobcats to remove debris and sediment. Second, smaller hatches would be constructed for personnel and small equipment access. Third, manways would be included along the culvert length for inspections.

2.7 Culvert/Channel Alternative

The SCVWD developed the Culvert/Channel Alternative to reduce the Project footprint associated with the NRCS Alternative in Reach 8. This alternative would require a smaller ROW, reduce the amount of vegetation to be removed along the existing West Little Llagas channel, and would allow easier maintenance access, relative to the NRCS Alternative.

2.7.1 Culvert/Channel Alternative Features

The Culvert/Channel Alternative would provide management for a 1-percent flood exceedance in Reach 8, protecting downtown Morgan Hill. All reaches would have the same level of protection, and the same features would be constructed as described for the NRCS Alternative, with a few differences in Reach 8. The key feature of the Culvert/Channel Alternative is elimination of the need for channel deepening and widening through residential properties, as proposed for the NRCS Alternative between West Main Avenue and West 2nd Street in Reach 8. The main components of the Culvert/Channel Alternative that are different from those previously described for the NRCS Alternative include the following (all focused in Reach 8 (Figure 2.7-1).

> Realign an 800-foot segment of the double 10-foot-wide box culverts that, in the NRCS design, would be parallel to Hale Avenue through the Britton School athletic fields up to Del Monte Avenue;

> Continue the double box culvert under Del Monte Avenue approximately 900 feet to West 2nd Street; and

> From West 2nd Street to West Dunne Avenue perform the same channel widening and deepening, along with culvert replacements at 2nd, 3rd, 4th, and 5th Streets as described for the NRCS Alternative for Reach 8. The upstream most portion of the Culvert/Channel Alternative from Llagas Road to Hillwood Lane, thence along Hale Avenue up to the Britton School athletic field would remain the same as the NRCS Alternative. All other reaches would have the same design as previously described for the NRCS Alternative.

Aquatic habitat enhancement features identified in Section 2.5.1 under the NRCS Alternative would be the same for the Culvert/Channel Alternative. Examples of the habitat enhancement features to be installed are provided in Appendix D.

2.7.2 Culvert/Channel Alternative Construction

The construction approach for the Culvert/Channel Alternative would be the same throughout all of the Project reaches as previously described for the NRCS Alternative.

2.7.2.1 Construction Schedule

Construction duration for the Culvert/Channel Alternative would be 5.5 years, with the construction lasting for about 36 months in Reach 8, same as the NRCS Alternative (Tables 2.4-2 and 2.4-4).

2.7.2.2 Construction Activities, Equipment and Crews

Construction activities, equipment, and crew size would be the same as that described for the NRCS Alternative (Table 2.4-4), except that in a segment of Reach 8 construction would occur through athletic fields, and along Del Monte Road to West 2nd Street, rather than through a section of residential homes between West Main Avenue and West 2nd Street.

2.7.2.3 Construction Materials and Disposal

The construction fill and disposal material volumes for the Culvert/Channel Alternative are nearly the same as for the NRCS Alternative, as shown in Table 2.4-3.

0 0.025 0.05 0.1 Miles

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FIGURE 2.7-1

Culvert/Channel Alternative Reach 8

2.7.2.4 Staging Areas and Access Routes

The staging areas and access routes would be the same as for all of the other action alternatives (Figure 2.4-1).

2.7.2.5 Construction BMPs

The construction BMPs will be the same as that described for all alternatives (Section 2.4.3.5).

2.7.3 Easements and Land Requirements

The Culvert/Channel Alternative would require 261 acres of easement, which includes permanent easements for operations and maintenance and temporary construction easements needed in order to construct the Project.

There are a total of 10 residential homes, 11 greenhouses, 21 outbuildings, and 5 miscellaneous structures within the construction footprint that may need to be relocated (see Table 2.4-1). Details on the types of land-uses and associated acreages within the Project footprint are addressed in Land Use section in Chapter 3.

2.7.4 Utilities

Utilities include underground and overhead utility lines that provide water, gas, electricity, sewer, storm drains, cable, phone, fiber optics, and other utility services throughout the Project area. There are also miscellaneous features, such as fences, that would need to be removed and potentially relocated. Utilities located within the Project easement footprint would be either protected in place, rebuilt in place, abandoned, or demolished and relocated prior to construction. Sewer lines and storm drains may be relocated at the beginning of construction. Utilities are located in all reaches of the Culvert/Channel Alternative; however, most of the utilities that would need to be relocated are in the urbanized Reaches 7B and 8. The Culvert/Channel Alternative would have the same amount of utilities in the ROW as the NRCS Alternative in all Project reaches, except for Reach 8 where the flood management features and Project alignments differ. Utilities would be protected in place during construction if they were not to be abandoned or replaced. All utilities that are within the Project easements will be identified and their disposition will be determined during preparation of the final engineering design plans.

2.7.5 Operations and Maintenance

Operations and maintenance required for this alternative would be the same as those as described for the NRCS Alternative.

2.8 Reach 6 Bypass Alternative

The Reach 6 Bypass Alternative would construct a high flow bypass channel between Reach 6 of Llagas Creek and Reach 14 of East Little Llagas Creek. The bypass would be designed so that no flood capacity improvements would be needed along the remaining section of Reach 6 or Reach 5 of Llagas Creek downstream of the proposed bypass. Flood conveyance improvements for the upstream Project Reaches 8, 7A, and 7B and for the downstream Reach 4 would remain the same as described for the Preferred Project. Reach 14 would be designed similar to the Preferred Alternative, except that the channel dimensions will be larger to accommodate the additional high flow routed from the upstream reaches (8, 7B, 7A) through the Reach 6 bypass, so as not to cause induced flooding.

Under existing conditions, Reach 6 of Llagas Creek has capacity to carry up to approximately the 10-year flow. Flows larger than the 10 percent exceedance flow overtop the channel banks and flood the surrounding areas. The bypass would convey the future extra flow (i.e., new capacity) from Reach 8, 7A, and 7B directly to Reach 14. East Little Llagas Creek downstream of the bypass (Reach 14) would be designed to carry the extra flow from the upstream channel capacity. The design flow for the Reach 6

high flow bypass segment would be 1,200 cfs. The existing flow capacity in Reach 6 downstream from the bypass channel (2,090 cfs which is approximately a 10-percent exceedance flow), would continue to be maintained. The existing flow capacity in Reach 5 would also continue to be maintained. In Reach 14 the design flow would be 2,900 cfs at the confluence with the high flow bypass, which would maintain a 10-percent flow exceedance capacity in this reach.

2.8.1 Reach 6 Bypass Alternative Features

The proposed high flow bypass would start near the top of Reach 6, about 0.5 mile downstream of Monterey Highway. The 0.5-mile section of Reach 6 between Monterey Highway and the bypass would be widened and deepened as proposed for all of the action alternatives; however, no construction would occur downstream from the bypass channel, over a distance of approximately 2.7 miles in Reach 6 and the entire 0.5 mile length of Reach 5. Consequently, there would be no instream aquatic habitat enhancements in Reach 6 downstream from the bypass channel or in Reach 5; however, aquatic habitat enhancements identified under the NRCS Alternative for all other reaches would be the same. Construction in Reach 4 would be the same as previously described for all the action alternatives. The bypass channel would run east through open fields, continue under Murphy Avenue and U.S. 101, and connect to Reach 14. Figure 2.8-1 shows the alignment of the bypass channel situated near the upstream portion of Reach 6. The proposed high flow bypass would be approximately 1,660 feet long and would provide a 1-percent exceedance flood protection through the bypass segment. There are five main flood management features included in this alternative:

> Hydraulic control structure at Reach 6;

> Bypass channel from Reach 6 to Reach 14;

> Three bridge replacements;

> Reach 14 creek improvements; and

> Culverts modifications in Reach 14 at Sycamore Avenue Bridge and East San Martin Avenue Bridge.

2.8.1.1 Hydraulic Control Structure

The hydraulic control structure would include a trapezoidal-shaped weir and five 6-foot by 6-foot individual working sluice gates at the entrance of the high flow bypass channel. The invert elevations of the sluice gates would be set at 290 feet NAVD88. The proposed weir would be 60 feet wide, would have 3H:1V side slopes, and the bottom elevation would be set at elevation of 293 feet (NAVD88).

For the 10-percent exceedance flood event, the five sluice gates would be fully opened. The weir and five gates would be designed to divert 1,200 cfs from Reach 6 of Llagas Creek to Reach 14 of East Little Llagas Creek. Automatic control devices would be installed to operate gates to control the flow into the bypass channel and maintain existing flow condition in Reach 6.

Upper Llagas Creek Project EIR

FIGURE 2.8-1

Reach 6 Bypass Alternative

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2.8.1.2 Reach 6 Bypass Channel

The proposed high flow bypass is 1,660 feet long and connects Llagas Creek to East Little Llagas Creek. The bypass channel has a 60-foot bottom width, is roughly 6 feet deep, and has 3H:1V side slopes. The longitudinal channel slope is 0.2 percent. Maintenance roads would be constructed at the top of bank on both sides of the channel. Figure 2.8-2 provides a typical cross-section for the high flow bypass channel.

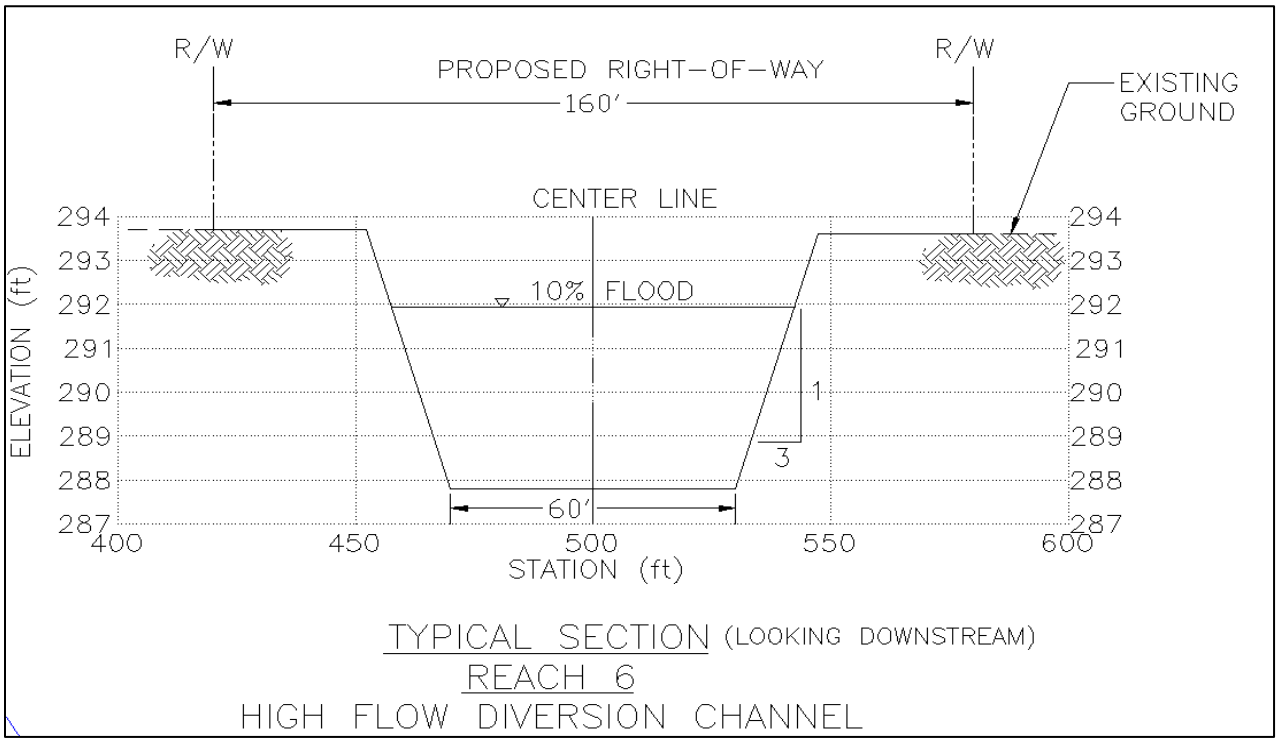

Figure 2.8-2 Bypass Channel Typical Cross-Section Reach 6

2.8.1.3 Bridges

Three bridges are proposed to be constructed at the following locations: Murphy Avenue, U.S. 101 southbound, and U.S. 101 northbound. The bridge dimensions are listed in Table 2.8-1 below.

Table 2.8-1 New Bridges Proposed for Reach 6 Bypass Alternative

Location	Type of Crossing	Roadway Width (feet)	Roadway Span (feet)	Vertical Clearance Depth (feet)
Murphy Avenue	Bridge	42	104	6
U.S. 101-northbound	Bridge	52	140	10
U.S. 101-southbound	Bridge	52	140	10

In order to construct the bypass channel temporary traffic control routes would need to be constructed to accommodate local traffic on Murphy Avenue (Figure 2.8-3). In addition, two construction phases would be needed to divert traffic through temporary traffic routes (Figures 2.8-4 and 2.8-5) on U.S. 101 northbound and southbound.

Phase 1 would include the diversion of traffic in both directions. In this phase construction of the north bound bridge and culvert would take place. The approximate construction time to build the temporary road detours in Phase 1 would be 60 days. After the traffic is diverted through the new temporary roads, the construction of the new bridge and culvert in the northbound direction would be approximately 90 days. In Phase 2, the new north bound bridge would be used to route traffic flow while the temporary road in the south bound direction would still be used. During Phase 2 the south bound bridge and culvert would be constructed, requiring approximately 90 days. The total number of days for the Phase 1 and Phase 2 work along U.S. 101 would be 250 days. Upon completion of the Murphy Road and U.S. 101 bridges, the temporary traffic control routes would be removed.

2.8.1.4 Reach 14 Improvements

The proposed high flow bypass connects directly to the existing Reach 14 (East Little Llagas Creek). To pass the extra flow from the bypass and have 10 percent exceedance flow capacity, the following channel widening work is proposed for Reach 14, starting 500 feet upstream of the confluence with the bypass to 0.5 mile downstream of East San Martin Avenue. The improvements for the rest of Reach 14 (0.5 mile downstream of East San Martin Avenue to the confluence with Llagas Creek Reach 4) are the same as for the NRCS Alternative. No additional improvements beyond those proposed for the NRCS Alternative are needed in this downstream section of Reach 14 because there will be sufficient capacity to carry the 10-percent exceedance flow.

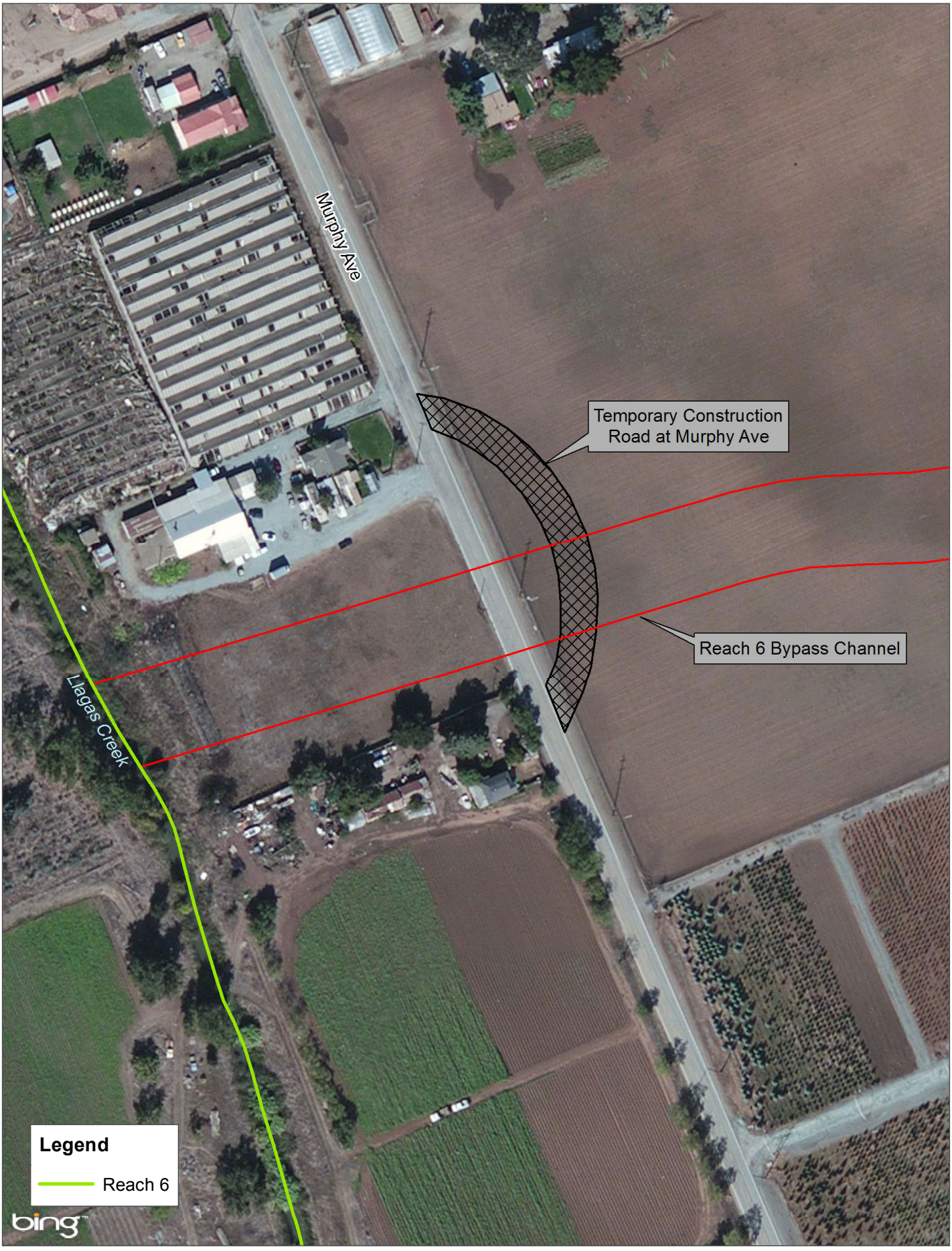

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FIGURE 2.8-3
Temporary Traffic Road at Murphy Avenue

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Upper Llagas Creek Project EIR

FIGURE 2.8-4

Phase 1 - Hwy 101 North Bound Bridge and Culvert Construction and Temporary Traffic Control

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0 50 100 200
Feet

N

Upper Llagas Creek Project EIR

FIGURE 2.8-5

Phase 2 - Hwy 101 South Bound Bridge and Culvert Construction and Temporary Traffic Control

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The proposed trapezoidal cross section has an 80-foot bottom width, 130 foot top-width, 3H:1V side slopes, and an approximately 7- to 10-foot depth (Figure 2.8-6). The longitudinal channel slope is 0.4 percent. The channel widening would not be limited to a single bank. To avoid extra land acquisition, the creek realignment would be designed to stay within the SCVWD's ROW. The creek widening to Sycamore Avenue would be proposed to begin on the north side of the creek and then shift toward the south side.

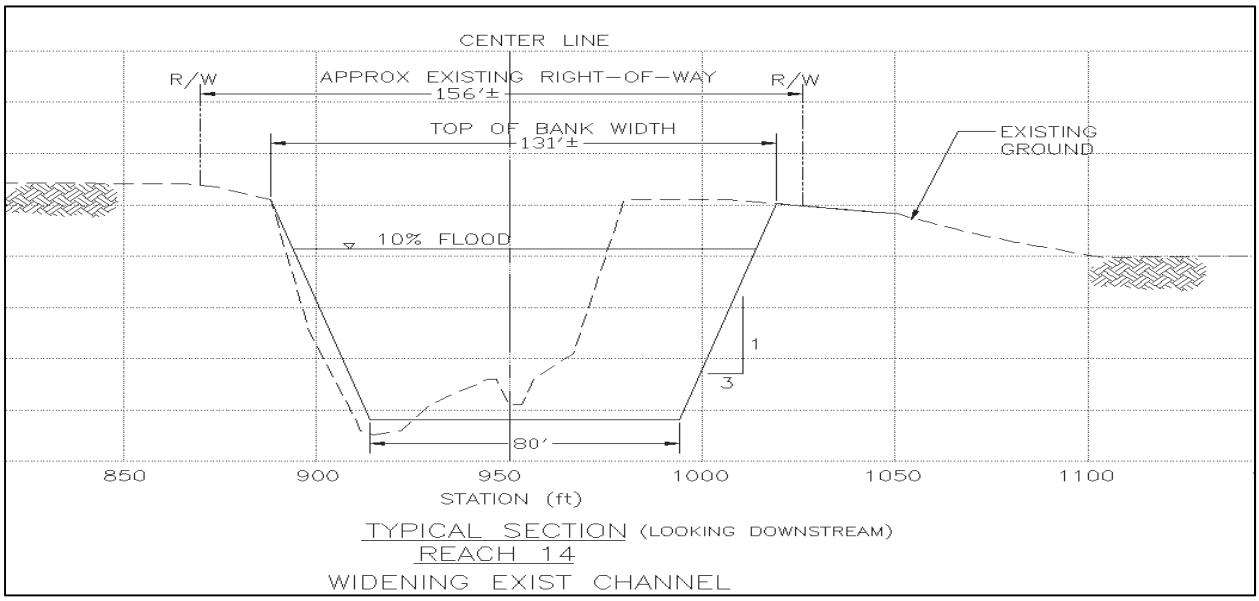


Figure 2.8-6 Reach 14 Typical Cross Section for the Reach 6 Bypass Alternative

2.8.1.5 Culvert Modification

Preliminary hydraulic analyses have indicated that the existing culverts at Sycamore Avenue and East San Martin Avenue are not adequate to convey the 10-year flood event under this alternative. Additional culvert cells are proposed in these two crossings to increase the capacity and are listed in Table 2.8-2.

Table 2.8-2 Proposed Culvert Improvements

Location	Type of Crossing	Existing Roadway Width (feet)	Existing No. of Culvert Cells	Additional No. of Cells are added	Culvert Size per Cell (i.e., Span x depth)
Sycamore Avenue	RCB	60	3	3	11.5'x7'
East San Martin Avenue	RCB	41.5	4	2	12'x7'

2.8.2 Reach 6 Bypass Alternative Construction

The construction approach for the Reach 6 Bypass Alternative would be the same for all of the upstream Project Reaches 8, 7A, and 7B as previously described for the Preferred Alternative. Reach 14 construction would be similar to that in the other alternatives but with a greater amount of channel widening. There would be no construction needed to widen or deepen the channel below the bypass segment in Reach 6 or in Reach 5. Reach 4 flood conveyance improvements would be the same as

described for the Preferred Alternative. Three new bridges and additional culverts would require construction (Section 2.8.1).

2.8.2.1 Construction Schedule

Construction duration for the Reach 6 bypass channel segment along with the Reach 14 segment would be 24 months (Tables 2.4-2 and 2.4-4). The entire Reach 6 Bypass Alternative (all reaches) would require 5.5 years to complete the Project construction.

2.8.2.2 Construction Activities, Equipment and Crews

Construction activities, equipment, and crew size is shown in Table 2.4-4, and is nearly the same as described for the Preferred Alternative, except that the new bypass channel segment would require construction between Reach 6 to Reach 14. This would require temporary roads and traffic detour routing on Murphy Avenue and on both north and southbound lanes of U.S. 101. Construction crews would need to build bridges to accommodate the new bypass channel segment under these roadway sections. An estimated construction time of 250 days would be needed to build the bridges at these three crossings.

2.8.2.3 Construction Materials and Disposal

The construction fill and disposal material volumes are shown in Table 2.4-3. Total disposal volume is less than the other alternatives, approximately 997,000 bcy.

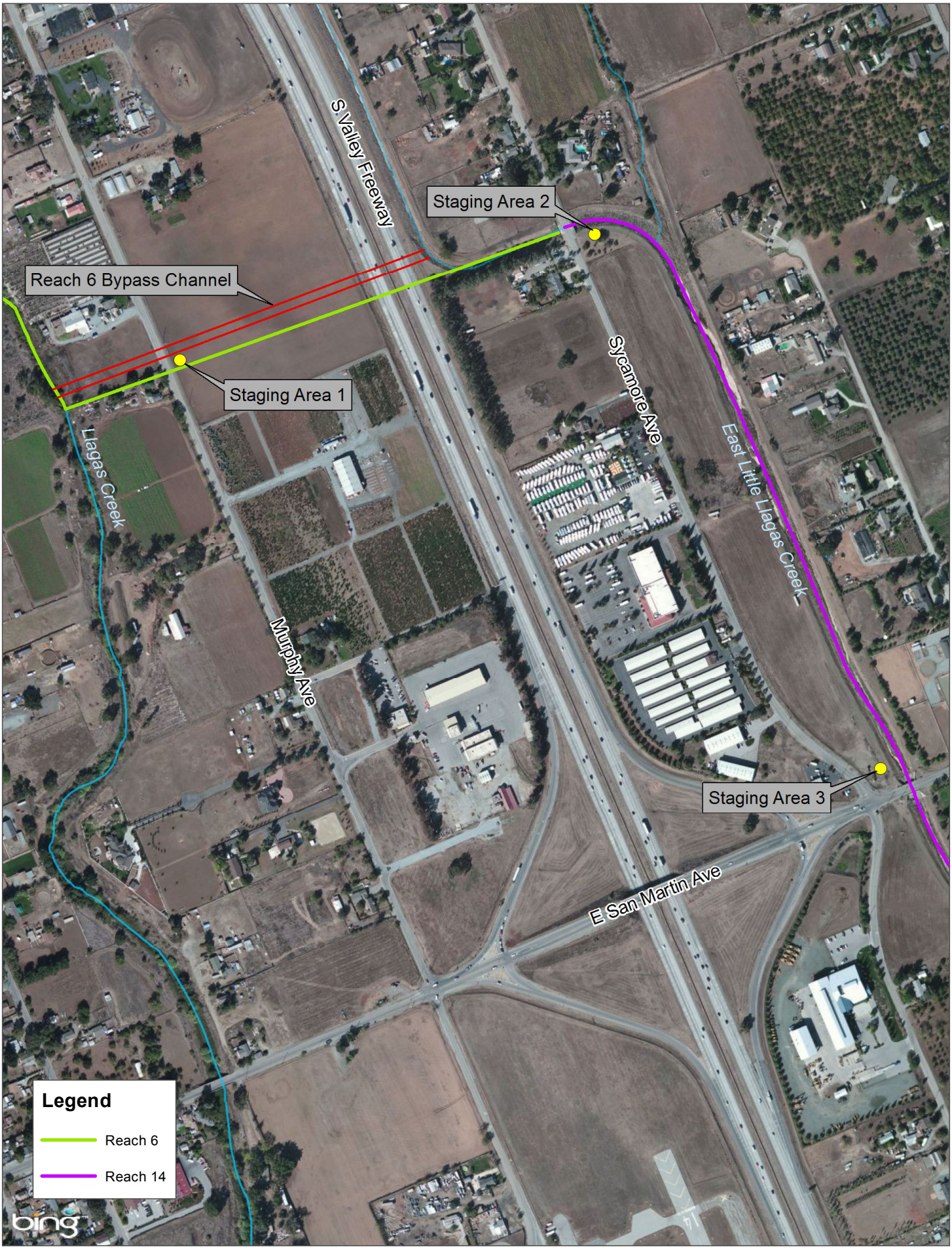
2.8.2.4 Staging Areas and Access Routes

Construction access and staging areas would be the same as previously described for all of the other alternatives except for the two staging areas (F and G) in lower half of Reach 6 (Section 2.4, Figure 2.4-6.) but with an additional two staging areas to cover construction of the bypass channel in Reach 6 to the upstream portion of Reach 14. The two additional staging and storage areas are described in Table 2.8-3 and shown on Figure 2.8-7, below. Staging Area 3 at the corner of East San Martin Avenue and Sycamore Avenue was previously listed and described as staging area E (see Figure 2.4-6).

Table 2.8-3 Summary of Additional Staging Areas for Reach 6 Bypass Alternative

Staging Area	Location	Total Area (acres)	Construction Activity
1	East Side of Murphy Ave. between Reach 6 and Reach 14	0.34	Bypass channel inlet at Reach 6, and channel between Reaches 6 and 14. Also, to construct culverts and bridges at Murphy Ave. and U.S. 101.
2	East side of Sycamore Ave in Reach 14	0.25	To construct the outlet of the bypass channel, culverts and bridges at U.S. 101 and culverts at Sycamore Ave.

Minor vegetation removal and grading could occur at staging areas to provide room for equipment, materials, and construction personnel parking. Work area access would be provided via the existing county roads and maintenance roads. Construction material and equipment haul routes could include Murphy Avenue, U.S. 101 northbound and southbound, Sycamore Avenue, and East San Martin Avenue.



Upper Llagas Creek Project EIR

FIGURE 2.8-7

Reach 6 Bypass Channel Additional Staging Areas for Construction

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2.8.2.5 Construction BMPs

The construction BMPs will be the same as described for all alternatives (Section 2.4.3.5)

2.8.3 Easements and Land Requirements

Easements for the Reach 6 Bypass Alternative encompasses 183 acres, which includes the new bypass channel construction in Reach 6 and permanent easement in Reach 14 for the widening of the channel and maintenance road.

Homes adjacent to the location of proposed channel widening would require relocation, and in some cases residential property and farmland are located within the construction footprint and easement boundaries. There are a total of 3 residential homes, 2 greenhouses, 3 outbuildings, and 4 miscellaneous structures within the construction footprint. (see Table 2.4-1).

2.8.4 Utilities

Utilities include underground and overhead utility lines that provide water, gas, electricity, sewer, storm drains, cable, phone, fiber optics, and other utility services throughout the Project area. There are also miscellaneous features, such as fences, that would need to be removed and potentially relocated. Utilities located within the Project easement footprint would be either protected in place, rebuilt in place, abandoned, or demolished and relocated prior to construction. Sewer lines and storm drains may be relocated at the beginning of construction. Utilities are located in all reaches of the Reach 6 Bypass Alternative, however most of the utilities that would need to be relocated are in the urbanized Reaches 7B and 8. The Reach 6 Bypass Alternative would have the same amount of utilities in the ROW as the Preferred Project in all reaches, except there would be no construction in Reach 6 below the bypass and in Reach 5, so no utilities removal and relocation would be needed at those locations.

2.8.5 Operations and Maintenance

Operations and maintenance would be nearly the same as described for the NRCS Alternative, with the exception of maintenance for the bypass channel and hydraulic control structure in Reach 6. Reaches 5 and 6 downstream from the hydraulic control structure would be maintained according to 2012–2022 SMP wherever SCVWD has maintenance easement responsibilities since these reaches are not part of the Reach 6 Bypass Alternative.

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2.9 Summary of Project Alternatives

Table 2.9-1 Summary of Project Alternatives

Project Feature	No Project Alternative	NRCS Alternative	Preferred Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Flood Capacity					
	Provides 20- to 10-percent flood exceedance event capacity in Morgan Hill and 10-percent flood event capacity in downstream reaches.	Morgan Hill, Reaches 7A, 7B, & 8: 1-percent flood exceedance event 10-percent flood exceedance capacity in semi-rural areas around East Little Llagas Creek (Reach 14) No induced flooding in Reaches 4, 5, and 6 due to upstream channel improvements.	Same flood capacity as the NRCS Alternative	Same flood capacity as the NRCS Alternative	Same flood capacity as NRCS Alternative. Includes a 1-percent flood exceedance capacity in the proposed Reach 6 bypass channel segment.
Land Acquisition/Floodplain Easements and Structures in Project Footprint					
	No new land would be acquired. No structures would be relocated or removed.	263 acres of land for permanent and temporary easements. 49 structures within Project footprint.	262 acres for permanent and temporary easements. 43 structures within Project footprint.	261 acres of land for permanent and temporary easements. 47 structures in Project footprint.	183 acres of land for permanent and temporary easements 12 structures within Project footprint.
Construction					
	No construction would occur. No excavation or disposal needed	Construction over the entire Project area would last an estimated 5.5-year period. Construction related BMPs would guide resource protection activities. Approximately 1.3 million bcy excavated for disposal	Construction duration same as NRCS Alternative. Same BMPs as NRCS, with additional BMPs specific to tunnel construction Approximately same disposal volume as NRCS. Requires blasting and other tunnel construction methods in Reach 8	Construction duration same as NRCS Alt. Same BMPs as NRCS Alternative Approximately same disposal volume as NRCS.	Construction duration is same as NRCS Alternative Same BMPs as NRCS Alternative Approximately 0.99 million bcy for disposal.

Table 2.9-1 Summary of Project Alternatives

Project Feature	No Project Alternative	NRCS Alternative	Preferred Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Recreational Facilities					
	No new recreation facilities. No loss of existing trails.	No new recreation facilities. Existing paved trails along Reach 7B would be converted to maintenance road.	Same as NRCS Alternative	Same as NRCS Alternative	Same as NRCS Alternative
Bridge/Culvert Replacement					
	None. Bridge crossings in Reach 7A at Middle Ave and Watsonville Rd have been constructed but are buried in place.	No bridges or culverts to be added or replaced in Reaches 4 or 5. Reach 6 culverts to be installed at two locations on tributaries to provide continuous maintenance access along Llagas Ck. Five existing bridges will not be modified. Reach 7A two existing bridges that are buried and inoperable at Middle Ave and Watsonville Rd to be exhumed. Reach 7B multiple culverts to be replaced at 7 road crossings (S. and N. La Crosse, Edmundson, Edes Ct, Cosmo Ave, Spring Ave, Ciolino/Dunne Ave). Reach 8 replace culverts at 5 road crossings (5th, 4th/Monterey Hwy, 3rd, 2nd/Del Monte, Warren Ave). Replace 2 culverts at Main St and at Wright/Hale Ave with 2,200 ft long double 10 x 8 ft RCB along Hale Ave. Existing channel to be buried. Remove plate constriction at Llagas Road culvert to expand opening. Reach 14, two tributary streams, Church Ck, San Martin Ck, and	Same as NRCS Alternative except in Reach 8, as follows: Instead of 2200 ft long double 10 x 8 ft RCB along Hale Ave, install a 36-inch RCP culvert for low flows from the weir structure 2,400 ft downstream discharging to West Little Llagas Creek; and two high flow bypass culverts 10 x 8 ft and 10 x 9 ft along Hale Ave to Warren Ave to tunnel portal Construct 2,100-foot long tunnel under Nob Hill between Warren Ave. and up to Del Monte Ave, under Nob Hill Terrace. No change to existing culverts at 5th, 4th St/Monterey Hwy, 3rd St, 2nd St/Del Monte Ave, and Warren Ave. No channel widening or deepening in Reach 8 near downtown Morgan Hill (downstream of tunnel portal). And Reach 7B, as follows: Double box culverts, 10 ft x 8 ft and 10 ft x 9 ft, from tunnel outlet at West Dunne Avenue to downstream of Ciolino Ave, instead of replacing existing	Same as NRCS Alternative except Reach 8, eliminate channel deepening and widening through residential properties between West Main Avenue and West 2nd Street. Realign an 800-foot segment of double 10 ft wide box culverts that, in the NRCS design, would be parallel to Hale Avenue through the Britton School athletic fields up to Del Monte Ave; and, continue the double box culvert under Del Monte Ave 900 ft to West 2nd St. From West 2nd St to West Dunne Ave the same channel widening and deepening, along with culvert replacements at 2nd, 3rd, 4th, and 5th Streets as described for the NRCS Alternative.	Same as Preferred Alternative in Reaches 8, 7B, 7A, 5 and 4. Bridge/culvert improvements in Reaches 6 to accommodate a new bypass channel. Three bridges to be constructed; U.S. 101 northbound, U.S. 101 southbound, and Reach 6 bypass channel at Murphy Ave. Culverts modifications in Reach 14 at Sycamore Ave bridge and East San Martin Ave bridge. Greater channel widening in Reach 14 than Preferred Alternative.

Table 2.9-1 Summary of Project Alternatives

Project Feature	No Project Alternative	NRCS Alternative	Preferred Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
		unnamed drainage to be culverted at confluence with East Little Llagas.	culvert along West Little Llagas Ck as proposed for the NRCS.		
Utility Relocation					
	No utilities are to be relocated.	Water, sanitation, sewer, and gas, pipelines to be either protected in-place, abandoned or replaced. Existing storm drains to be adjusted to outfall into wider channel. Other utilities such as fiber optic, phone, fences to be either abandoned or replaced. Most utilities in Reach 8.	Similar to NRCS Alternative, minor differences in Reach 8.	Similar to NRCS Alternative, minor differences in Reach 8.	Same as Preferred Alternative in all reaches, but no utilities would be replaced in Reaches 5 and 6 downstream from the bypass channel. May have additional utilities in the new bypass channel section of Reach 6.
Operations and Maintenance					
	Vegetation, channel sediment, bank erosion to be managed according to the SCVWD SMP. This would include Arundo removal in Reach 6. Same BMPs for maintenance as NRCS Alternative	Vegetation, and sediment, would be managed. According to Project hydraulic capacity requirements. Channel banks designed for stability, so no erosion or bank stability measures are assumed to be needed. Vegetation maintenance such as grass and weed mowing on benches conducted annually, other vegetation maintenance such as pruning about once every 5 years on all reaches. No maintenance on natural banks with riparian forest. Sediment maintenance at locations where hydraulic capacity is impaired, estimated to occur once every 10 years on average. Minor maintenance to include less than .08 acre wetland/riparian removal per site, sediment removal less than 10	Similar to NRCS Alternative in all reaches, with addition of sediment detention basin and tunnel maintenance in Reach 8. Same BMPs for maintenance as NRCS Alternative	Nearly identical to NRCS Alternative Same BMPs for maintenance as NRCS Alternative	Similar to Preferred Alternative, except for hydraulic gates to be maintained for diversion to bypass channel in Reach 6. Reaches 5 and 6 vegetation, sediment, and bank erosion to be maintained according to 2012-2022 SMP since these reaches are not part of the Alternative. Same BMPs for maintenance as NRCS Alternative

Table 2.9-1 Summary of Project Alternatives

Project Feature	No Project Alternative	NRCS Alternative	Preferred Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
		CY per site Vegetation and sediment maintenance at Lake Silveira as needed to ensure flow split at inlet to wetlands and to historic channel is functioning. Removal of giant reed (Arundo donax) in Reach 6 under the SMP. BMPs for resource protection activities related to maintenance			
Channel Modification					
	No modifications or habitat enhancement features would be made to the channel.	Channel modifications would entail widening and deepening, from just upstream of Llagas Road to just downstream of Buena Vista Ave. Instream complexity features for fish habitat would be installed in Reaches 4, 5, 6, and 7A.	Same as NRCS in Reaches 4, 5, 6, 7A, 7B, and 14. Tunnel replaces channel widening and deepening along a portion of Reach 8, fewer culvert replacements in Reach 8. Sediment detention basin 600-foot long in Reach 8 just downstream of Hillwood Lane.	Same as NRCS except Reach 8 eliminate channel deepening and widening through residential properties between West Main Avenue and West 2nd Street.	Same as Preferred Alternative in Reach 8 and in all other reaches, except no modifications to Reaches 5 or 6 below bypass channel, and for a portion of Reach 14 channel widening is about twice the NRCS Alternative. Construct high flow bypass channel 1660-foot length connecting Reach 6 to Reach 14; to carry 1-percent exceedance flow
Maintenance Roads					
	Maintenance road at the bottom of the channel would be retained. No new maintenance roads would be constructed.	18 ft wide maintenance roads at top-of bank on both sides of the channel; all reaches.	Maintenance roads same as NRCS Alternative, except includes roads to access sediment detention basin.	Maintenance roads same as NRCS Alternative	Maintenance roads same as Preferred Alternative, except no new roads installed in Reaches 5 or Reach 6.

Table 2.9-1 Summary of Project Alternatives

Project Feature	No Project Alternative	NRCS Alternative	Preferred Alternative	Culvert/Channel Alternative	Reach 6 Bypass Alternative
Grade Control Structures					
	No new grade control structures would be installed.	Grade control structures: Reach 4 – 3 Reach 5 – 2 Reach 6 – 26 Reach 7A – 7 Reach 7B – 4 Reach 8 – 1 Reach 14 – 21 One temporary structure each in Reaches 5 and 14.	Same as NRCS	Same as NRCS	Same as Preferred Alternative, except no grade control structures in Reach 5 or Reach 6.
Fish Enhancement					
	No fish habitat enhancements planned.	Habitat enhancement features including a sinuous low-flow channel, pools, large woody debris placements, boulder placements, root wad structures, and wing log deflectors, to be installed in Reaches 4, 5, 6, and 7A. Divide logs to be used only in perennially flowing section of Reach 6 Remove and replace dysfunctional fish ladder downstream of Buena Vista Ave Lake Silveira to include re-water of 1,980 feet of historic abandoned Llagas Creek channel and creation of wetland habitat, Sycamore forest and other forested habitat.	Same as NRCS	Same as NRCS	Same as NRCS, except no habitat enhancement features in Reaches 5 or 6 downstream from bypass channel. Full extent of Lake Silveira mitigation element may not be required.

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